

**Lucent Technologies**  
Bell Labs Innovations



# **SLC<sup>®</sup> -2000 Access System**

Applications, Planning, and  
Ordering Guide

363-208-000  
Issue 6  
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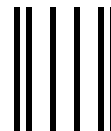
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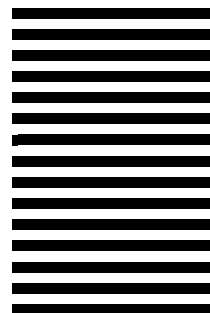
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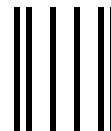
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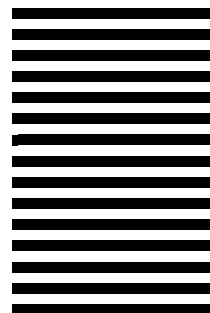
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## About This Document



### Purpose

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This applications, planning, and ordering guide (APOG) provides specific information about the features, applications, operation, engineering, and ordering of the *SLC*<sup>®</sup>-2000 Access System for Releases 3.1, 3.2, 3.3, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6.

### Scope

---

This document provides the information necessary to plan, engineer, and order equipment for a *SLC*-2000 Access System.

### Intended Audience

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The applications, planning, and ordering guide is intended for customers who participate in the application, operation, engineering, and ordering of the system as follows:

- Network planners
- Engineers
- Product evaluators
- Standardization groups
- Ordering personnel.

---

This document is based on an understanding of basic digital transmission principles and familiarity with digital loop carrier systems. Background on digital loop carrier systems may be found in Appendix A of this guide.

## **Reason for Reissue**

---

This document is being reissued to add information on the following *SLC-2000* Access System and Synchronous Optical Network (SONET) Subsystem Software Releases:

- Release R4.5 (RT only)
- Release R4.6 (RT only)
- OC-12 feeder interface
- Maintenance Release 3.3.1 central office terminal (COT)
- 90A cabinet
- 26G2-U optical line interface unit (OLIU)
- AUA293 channel unit.

## **Features of Software Release R4.5 [Remote Terminal (RT) Only]**

---

Software Release 4.5 includes the following features in addition to the features supported in Release 4.4 and all previous RT software releases:

- ***Enhanced FiberReach/MSDT.*** This feature allows the *SLC-2000* host digital terminal (HDT) to host up to 48 24-line optical network units (ONUs) giving the HDT the ability to support up to 1152 POTS or special service lines or 480 integrated services digital network (ISDN) 2B+D lines from a single HDT. To do this, each shelf of a metallic distribution shelf (MDS) assembly provisioned for fiber in the loop (FITL) can now contain any of the following:
  - Up to six 24-line DT Servers (instead of four from the earlier releases)
  - Up to eight 12-line DT Servers and two 24-line DT Servers.
  - Up to ten 12-line DT Servers (this configuration allows the system to support only 960 lines. Slot restrictions prevent the use of the additional 12-line servers to support 1152 lines).
- ***TL1 ISDN Provisioning.*** This feature allows the *SLC-2000* RT to support ISDN provisioning using TL1 messages on all user interfaces including the following:
  - TL1/X.25 interface
  - Front craft interface terminal (CIT) port on the user interface panel (UIP)
  - Rear CIT port.

---

## Features of Software Release R4.6 (RT Only)

---

*SLC-2000* Software Release R4.6 allows the system to support the voice frequency data enhancement (VFDE) feature. This feature is designed to improve the connect rate, or *throughput*, of analog modems served by switched single-party loop-start and ground-start lines.

Software Release R4.6 also allows the use of the *SPQ*®811 DT Server with the enhanced FiberReach/MSDT feature introduced in Software Release R4.5. The *SPQ*811 Server supports all the features of the *SPQ*810 Server. However, when the MDS assembly is provisioned for FITL distribution, the *SPQ*811 server can be installed in slots 11 and 23 when it and the server in slots 9 and 21 are provisioned for 12-line operation. This allows the MDS assembly shelf to host twelve 12-line DTs instead of ten.

## OC-12 Feeder Interface

---

SONET Subsystem Software Release 11 supports all the existing features of SONET Subsystem Release 9.1 and adds an OC-12 feeder interface to the *SLC-2000* system. The system can interface an OC-12 ring using 24G-U optical line interface units (OLIUs) in the MAIN slots of the access resource manager (ARM) shelf.

## Features of Software Maintenance Release 3.3.1 (COT Only)

---

Software Maintenance Release 3.3.1 allows the *SLC-2000* system to support the Tautron *ngRTH*\* test head in the COT.

## 90A Cabinet

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Bell Laboratories has re-engineered the customer premises 90A cabinet to accommodate the *SLC-2000* Access System.

## 26G2-U OLIU

---

When used with the J1C265AA-1, L4 ARM shelf, Function Group C containing DS1 circuit packs and 26G2-U OLIUs can multiplex DSX-1s from the DT Servers onto an OC-1 ring for transport to the ONU. This allows you to eliminate the collocated WBS. For this feature to operate, the SONET subsystem must contain Software Release R13 or later.

---

\* Trademark of Tautron Inc.



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## AUA293 Channel Unit

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The AUA293 ISDN BRIE-III channel unit provides one *ANSI*\* standard digital subscriber line (U-DSL) over an non-loaded 2-wire loop.

## How to Use This Document

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This document has the following organization:

- "About This Document"  
This section defines the purpose, scope, and intended audience for this document; provides introductory and support information on this document; includes contacts for documentation orders; and lists information on how to obtain technical support on the system.
- Chapter 1, "Introduction"  
This chapter introduces the basic *SLC-2000* Access System and how it fits into the network. It also includes basic descriptions of the central office terminal (COT) and the remote terminal (RT) metallic and fiber-in-the-loop (FITL) distribution configurations.
- Chapter 2, "Features and Benefits"  
This chapter describes the features of the *SLC-2000* Access System and the benefits to the customer.
- Chapter 3, "System Configurations and Applications"  
This chapter describes the *SLC-2000* Access System configurations and synchronous optical network (SONET) and DSX-1 feeder topology applications.
- Chapter 4, "Services"  
This chapter describes the metallic and FITL distribution services that are provided by the *SLC-2000* Access System using the channel units currently available. It also provides information about nonswitched and nonlocally switched services, digital data services, ISDN service, and DS1 distribution.
- Chapter 5, "Product Description"  
This chapter describes the hardware and software architecture of metallic and fiber distribution configurations using the *SLC-2000* Access System. It also describes basic signal flow through typical system configurations.
- Chapter 6, "Cabinet and Bay Arrangements"  
This chapter describes the *SLC-2000* Access System cabinets, the attributes and features of the cabinets, and various deployments of the cabinets. A brief description of COT and RT bay arrangements is provided.

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\* Registered trademark of American National Standards Institute, Inc.

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- Chapter 7, "Operations, Administration, Maintenance, and Provisioning (OAM&P) Considerations"

This chapter describes *SLC-2000* Access System features of embedded operations structures and mechanized loop testing (MLT) for local, remote, and centralized users.

- Chapter 8, "System Planning and Engineering"

This chapter is a summary of the information necessary to engineer, order, and deploy *SLC-2000* Access Systems.

- Chapter 9, "Product Support"

This chapter describes the engineering and installation services, technical support, documentation support, and training support provided for customers of the *SLC-2000* Access System.

- Chapter 10, "Technical Specifications"

This chapter summarizes the technical information of the *SLC-2000* Access System and its components.

- Chapter 11, "Ordering"

This chapter provides a guide to ordering the *SLC-2000* Access System and lists the associated equipment and identification.

- Appendix A, "Digital Loop Carrier (DLC) Background"

This appendix provides a brief history of digital loop carrier system evolution.

- Appendix B, "A SONET Overview"

This appendix describes the SONET hierarchy in detail.

- Appendix C, "System Documentation"

This appendix lists the documentation available for the *SLC-2000* Access System.

- Appendix D, "Fiber Services Module (FSM)"

This appendix describes the FSM feature of the *SLC-2000* MSDT and the DDM-2000 FiberReach Narrowband shelf that allows metallic DSX-1 extensions (unprotected) from the ONU.

- Glossary

This section lists the abbreviations and acronyms and spells them out.

- Index.

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## Conventions Used

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Panel stamping on the shelves is highlighted in text by using all uppercase letters in **bold** typeface. Document titles referenced in text are printed in an *italic* typeface. However, *italic* typeface may also be used for highlighting an important word or phrase. Chapter titles referenced in text usually are enclosed in double quotes ("). Special symbols may be used with safety labels and notes.

### Circuit Pack Codes with Empty Parentheses ( )

A circuit pack code shown with a pair of empty parentheses "()" behind the code includes the letter-suffixed versions of that pack. For example, *SPQ440()* represents both/either of the *SPQ440* and/or *SPQ440B* channel units.

### Commands

User input is printed in a constant-width (monospace) font: **boldface** print represents literal input; variable input is printed in *italics*. Display output is printed in constant-width (monospace) font.

In this manual, the CIT commands follow these conventions: SONET subsystem commands are lowercase (example: **set -sync**); DLC subsystem commands are uppercase (example: **SET -SYNC**). UIP commands are uppercase bold-italic font (example: ***RETRIEVE-ALARMS***).

## Hyphenated Terms

Here are some common uses of hyphenated terms in this document.

### Fiber-in-the-Loop Feature

Hyphenated when used as an adjective.

### Fiber in the Loop

No hyphens when used by itself as a noun (for example, as a heading).

### Turn-Up

Hyphenated as a noun or adjective (for example, "system turn-up" or "turn-up procedures").

### Turn Up

No hyphens when used as a verb, as in "turn up the system."

---

## Acronyms and Abbreviations

---

In the text, acronyms will be expanded in lowercase; initial caps are used only when the acronym represents a system [for example, the Mechanized Loop Testing (MLT) system] or when used in a heading. If it is a trademark, it will not be spelled out.

Acronyms will be expanded at first use in text and in headings (for the table of contents); thus, an acronym may be expanded more than once within a chapter. For example, "SONET" may be expanded in the text as synchronous optical network (SONET) and again in a heading as Synchronous Optical Network (SONET).

## Terms Used

---

This section explains terms used in this document that may have a different meaning than general or common use of the term.

- In the *SLC-2000 Access System*, the term *access* means that the system provides the primary service interface for the customer to enter the network.
- The term *pipe* in customer DS1 pipes means to transmit/receive the complete 1.544 Mb/s signal through the network without demultiplexing it to individual (DS0) channels (clear channel DS1 path). DS1 pipes also may be referred to as DS1 distribution.
- *Remote Terminal/Host Digital Terminal (RT/HDT)* acknowledges the dual function of the remote terminal as a digital loop carrier (DLC) system and/or FITL server for *SLC-2000 MSDTs* and *DDM-2000 FiberReach Narrowband Shelves*.
- *DS1 feeder* refers to an internal assignment (within the system) that is equivalent to a DS1 line carrying 24 DS0 channels.
- *DSX-1 metallic feeder* is a system configuration that provides line interface units (LIUs) to interface an external multiplexer or external span protection and repeater shelves for T1 feeder applications.

## Trademarks

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The trademarks used in this document are identified on the back of the title page. Trademarks of Lucent Technologies and other companies are presented in a specific way — they stand out from the rest of the text by using a different font, and they modify a noun. For example, the system name contains a trademark — *SLC<sup>®</sup>-2000 Access System*. A trademark is never used by itself; it must modify a noun (for example, *SPOTS<sup>®</sup> channel units*). A trademark is never treated as an acronym (spelled out or expanded).

---

## Lucent Technologies Trademarks

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## Trademarks of Other Companies

These are identified with a footnote on first use in the text and in figures and tables.

## System Feature Release Supported

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In this document it is assumed that certain feature releases of hardware and software are being used. Otherwise, parts of this document may be inaccurate for your application.

The SLC-2000 Access System Feature Releases covered in this document include Release 3.01.02, Release 3.02.01, Release 3.03.00, Release 3.03.01, Release 4.00.01, Release 4.00.02, Release 4.01.00, Release 4.02.00, Release 4.03.00, Release 4.04.02, Release 4.05.00, and Release 4.06.00. These releases are compatible in SONET and integrated applications as specified in Chapter 8, Table 8-7 on page 8-54.

## Switch Interfaces Supported

---

The term "local digital switch" (LDS) refers to any of the following:

- The 5ESS<sup>®</sup> switch
- The DMS<sup>\*</sup> 100 switch (SLC-2000 Software Release 4.1 and later)
- The GTD-5<sup>†</sup> Digital Switch (SLC-2000 Software Release 4.2 and later)
- The EWSD<sup>‡</sup> Digital Switch<sup>§</sup> (SLC-2000 Software Release 4.2 and later).

These switches are compatible with the SLC-2000 Access System using the appropriate switch hardware (interface unit) and software specified in the description of the features/functions.

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\* Trademark of Northern Telecom, Ltd.

† Registered trademark of GTE Corporation.

‡ Registered trademark of Siemens Aktiengesellschaft.

§ The TR-303 software compatibility testing with the Siemens EWSD Switch was performed and documented by Siemens. Lucent Technologies assumes no responsibility for the software compatibility when the SLC-2000 Access System is used with the EWSD Switch.

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## Customer Assistance and Technical Support

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Lucent Technologies provides customer assistance on the *SLC-2000* Access System including, but not limited to, troubleshooting assistance, technical consultation, operational problem consultation, procedural advice, and emergency recovery assistance from a qualified system support professional from the Regional Technical Assistance Center (RTAC).

Service is provided from the RTAC at 1-800-225-RTAC. This telephone number is monitored 24 hours a day, 7 days a week. During regular business hours, your call will be answered by your local regional RTAC. Outside normal business hours, all calls will be answered at a centralized technical assistance center where service-affecting problems will be dispatched immediately to your local RTAC. All other problems will be referred to your local RTAC on the next regular business day.

## Related Documentation/Training

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Refer to the following sections of this document for *SLC-2000* Access System and related equipment documentation and training:

- **Documentation:** Appendix C
- **Training:** Chapter 9.

## Electronic Documentation

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Documentation for the *SLC-2000* Access System is available in electronic form, on CD-ROM (compact disk, read-only memory). CD-ROM has many advantages over traditional paper documentation, including cost savings, search and retrieve capability, and the assurance of the most current documentation. CD-ROM is available by annual subscription (on standing order).

- To order, call your Technical Information Resource Manager, your Lucent Technologies Account Executive, or the Lucent Technologies Customer Information Center (1-888-LUCENT8).
- For pricing information, contact your Lucent Technologies Network Systems Account Executive or the Lucent Technologies Customer Information Center (1-888-LUCENT8).
- For CD-ROM technical information, call Lucent Technologies Documentation Support (1-888-LTINFO6).

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## Canadian Equipment Attachment Notice

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### General

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For *SLC-2000* Access Systems equipped with the *SPQ443* or *SPQ454* channel units or *SLC* Series 5 Carrier Systems equipped with *AUA43*( ) or *AUA54*( ) channel units deployed in Canada, the following guidelines for attachment to the facilities of the local telecommunications company apply. The guidelines governing the deployment of the *SLC-2000* Access System and the *SLC* Series 5 Carrier System in Canada are contained in the following Equipment Attachment Limitations Notice.

### Equipment Attachment Limitations Notice

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The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.



#### **CAUTION:**

*Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.*



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## **Load Number Notice**

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The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop, which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

---

# Introduction

# 1

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## Introduction

# 1

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### **What Is the *SLC*<sup>®</sup>-2000 Access System**

The *SLC*-2000 Access System is Lucent Technologies' real-world digital loop carrier (DLC) solution that builds upon our proven digital loop carrier system experience. It is based on standard interfaces, network element commonality, and operational ease. This service-ready platform provides cost-effective deployment options and full-service capabilities that dramatically enhance the revenue generating capability and competitive positioning of your company.

The *SLC*-2000 Access System builds upon many of the administrative and operational features of the industry standard *SLC* Series 5 Carrier System and the *SLC* 96 Carrier System. It offers better ways of providing services and supports the standard digital interfaces for universal and integrated systems. It provides a synchronous optical network (SONET) feeder interface and a DSX-1 metallic feeder interface, along with enhanced operations, administration, maintenance, and provisioning (OAM&P) capabilities. The *SLC*-2000 Access System offers increased system flexibility to serve a wide variety of network applications. For a better understanding of DLC and SONET, refer to the following appendices in the back of this document:

- ***Digital Loop Carrier (DLC)*** — Appendix A
- ***SONET*** — Appendix B.

Figure 1-1 and Figure 1-2 show basic *SLC-2000 remote terminals* (RTs) connecting a central office (CO) interface to customer equipment. In these basic applications, the system is fed from the TR-08\* or TR-303† interface of the local digital switch (LDS) in a central office with either SONET or DSX-1 feeders. Table 1-1 gives the maximum number of lines served by a given software release with the RT provisioned for either *metallic* distribution only or *fiber-in-the-loop (FITL)* distribution only

**NOTE:**

For a general definition of TR-08 and TR-303 interfaces, see Chapter 2. For detailed explanations, see the documents referenced below.

**Table 1-1. SLC-2000 RT Distribution**

| <b>SLC®-2000 RT<br/>Software Release</b> | <b>Type of Distribution</b>                           | <b>Maximum Number of Lines<br/>Served by an RT</b> |                                     |
|------------------------------------------|-------------------------------------------------------|----------------------------------------------------|-------------------------------------|
|                                          |                                                       | <b>POTS/<br/>Special<br/>Service Lines</b>         | <b>ISDN Lines<br/>(TR-303 Only)</b> |
| R3.2 or earlier                          | Metallic or FITL Distribution or<br>a Mixture of both | 768                                                | —                                   |
| R4.0 or R4.1                             | Metallic Distribution Only                            | 768                                                | 384                                 |
|                                          | FITL Distribution Only                                | 768                                                | 256                                 |
| R4.2 and R4.3                            | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                          | FITL Distribution Only                                | 768                                                | 256                                 |
| R4.4                                     | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                          | FITL Distribution Only                                | 768                                                | 320                                 |
| R4.5 and Later                           | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                          | FITL Distribution Only                                | 1152                                               | 480                                 |

\* Bellcore Technical Reference TR-TSY-000008, Issue 2 (August 1987) and all Revisions and Supplements, *Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch*.

† Bellcore Technical Reference TR-NWT-000303, Issue 2 (December 1992) and all Revisions and Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*.

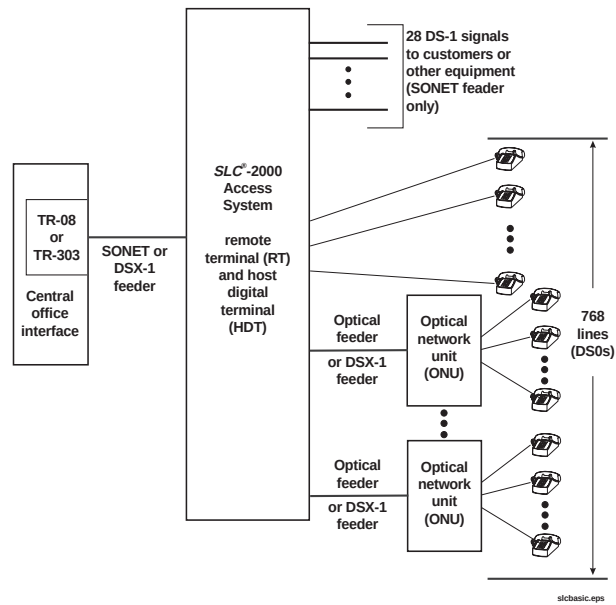


**Figure 1-1. Typical SLC-2000 Access System Connecting a Central Office Interface to Customer Equipment (Software Release 4.4 or Earlier)**

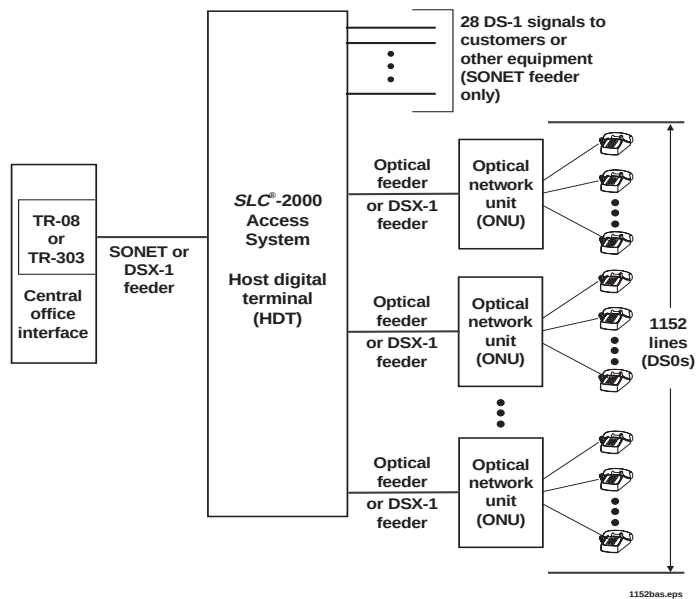


**Figure 1-2. Typical SLC-2000 Access System Connecting a CO Interface to Customer Equipment — FITL Distribution Only (Software Release 4.5 or Later)**

FITL systems host an optical network unit (ONU) such as a *SLC-2000* Multi-Services Distant Terminal (MSDT) or a DDM-2000 FiberReach Narrowband Shelf. If the system is fed by a SONET feeder, it can typically support customer equipment or other equipment with up to 28 DS-1 signals from Function Group C (called *DS1 pipes*). Chapter 3 gives a full range of configurations and applications.

## ***SLC-2000* Access System Basic Description**

---

The *SLC-2000* Access System is a software-driven DLC system with a built-in SONET multiplexer. Table 1-1 on page 1-2 shows the number of subscriber lines supported by each software release for both metallic and FITL distribution. Figure 1-1 and Figure 1-2 on page 1-3 also show that the system can provide 28 subscriber DS1 pipes. If needed, you can equip a *SLC-2000* system connected to a TR-08 interface with an optional built-in loop test system test head [the integral test head (ITH)].

The following list includes the *basic* services and features:

- Basic telephone service
- A full complement of special services
- Integrated Services Digital Network (ISDN) service
- ONUs using both fiber-in-the-loop (FITL) and DSX-1 distribution
- Metallic distribution
- Integrated Network Access (INA) interface (PUB43801)
- TR-08 interface
- TR-303 interface.

## SONET Subsystem

---

The SONET subsystem provides a SONET feeder for point-to-point and linear drop configurations as well as path-switched ring applications as follows:



**NOTE:**

See Chapter 3 for detailed descriptions of SONET feeder applications and configurations.

- **Point-to-Point Applications:** The *SLC-2000* central office terminal (COT) or *DDM-2000* at the central office feeds a single *SLC-2000* remote terminal (RT). A SONET feeder connects these two “points” from the COT to the RT.
- **Linear Drop Applications:** The linear drop arrangement allows synchronous transport signal level 1 (STS-1) or VT1.5 signals to be *dropped off* at intermediate points along a SONET feeder route instead of running feeders from the central office to each separate remote terminal in the route (as with the point-to-point application).
- **Path-Switched Ring Applications:** The path-switched ring arrangement allows several remote sites to share the two-fiber ring facility back to the central office.

The SONET subsystem also provides a ring network connection to a SONET linear network and an OC-3/OC-12 ring connection to another OC-3/OC-12 ring. For detail, see 363-206-200, *DDM-2000 OC-3 and OC-12 Multiplexers, Applications, Planning, and Ordering Guide*.

The SONET subsystem provides access to the following two function groups of the SONET signal, each with a bandwidth of 28 DS1s.

- **Function Group A** — supports DS0 services (for the DLC subsystem)
- **Function Group C** — provides DS1 low-speed interfaces for digital services (DS1 pipes). Function Group C also provides other *DDM-2000* interface features such as DS3, EC-1, OC-1, etc. If the *SLC-2000* system is configured to host a NBS ONU through an OC-1 ring, Function Group C can also provide the multiplexing feature to apply the DSX-1s from the MDS assembly to the OC-1 ring.

The *SLC-2000* ARM shelf may also be used as a SONET multiplexer (no DLC) to transport up to 28 customer DS1 pipes (through the low-speed interface) and grow in DS0 services later.

## DLC Subsystem

---

The DLC subsystem supports all of the transmission, signaling, alarming, and maintenance features for the number of subscriber lines shown in Table 1-1 on page 1-2. You can configure the system into the following virtual remote terminal (VRT) types (see Note):



**NOTE:**

For an explanation of VRTs, see Chapter 2.

- **TR-08 Mode 1 Interface.** This mode provides up to 672 lines organized in up to seven 96-line VRTs.
- **TR-08 Mode 2 Interface.** This mode provides up to 768 lines organized in up to eight 96-line VRTs.
- **TR-303 Interface:**
  - **Release 4.0 and 4.1.** These software releases allow the TR-303 interface to provide one VRT (large line size — up to 768 lines).
  - **Release 4.2 and later.** Software Release 4.2 and later allows up to two TR-303 VRTs. The TR-303 VRTs can be homed or hosted by different LDSs. The total number of lines provided by one SLC-2000 system can not exceed 768 lines even if it is serving two TR-303 interfaces.
  - **Release 4.5 and later.** Software Release 4.5 or later supports an Enhanced FiberReach/MSDT feature. With the entire system configured for FITL, it can support up to 1152 lines configured in up to two TR-303 VRTs.

In addition to the lines assigned to VRTs, other non-switched DS0 services can be assigned to INA DS1s that terminate on non-switched equipment such as DACS, or D4 channel banks.



**NOTE:**

Software Release R4.2 or later allows a mixture of modes (including INA), not to exceed the maximum number of lines the system will support.

## Circuit Maintenance Subsystem

---

The ITH serves as a built-in remote test unit (RTU) that supports on-demand subscriber POTS loop tests. The mechanized loop testing (MLT) system controls the ITH using two dedicated TR08 DS0 channels. For RT applications, if the ITH is not equipped, a DC bypass pair, a digital bypass pair, or an external remote measurement unit (RMU) is required for loop testing. For testing special services loops, you can use an external subsystem such as the *ngRTH*<sup>\*</sup> test head described in Chapter 7.

---

\* Trademark of Tautron, Inc.



## Feeder Configurations

---

The *SLC-2000* Access System allows for two types of feeder configurations:

- ***DSX-1 Feeder.*** The system provides a DSX-1 metallic interface that supports up to 28 DSX-1 metallic feeders.
- ***SONET Feeder.*** The system provides interfaces for the following:
  - ***OC-3.*** This is an optical SONET signal containing the payload of 3 STS-1 electrical signals.
  - ***IS-3.*** This optical signal is a cost-effective optical interface for interconnecting collocated SONET equipment with multimode fiber such as the DDM-2000 OC-12 Multiplexer. Except for differences in the optical specifications, the IS-3 interfaces are functionally equivalent to the OC-3 interfaces.
  - ***EC-1.*** This interface provides the electrical interworkings between the ARM shelf and other SONET equipment.
  - ***OC-12.*** This is an optical SONET signal containing the payload of 12 STS-1 electrical signals. SONET subsystem Software Release R11 or later allows the SONET subsystem to also interface directly with an OC-12 ring using a 24G-U OLIU.

## User Access

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### User Interface Panel (UIP)

The *SLC-2000* Access System has an easy-to-use user interface panel (UIP) that provides a single point in the system for certain turn-up and trouble-reporting activity. This panel contains the system alarm/status indicators and a 24-character display for summary messages on system faults. For more detailed reports, you can connect a craft interface terminal to the system either locally or remotely. Using the craft interface terminal (CIT) along with the UIP, you can set system options and perform provisioning tasks. The UIP also provides basic system turn-up in certain configurations without a craft interface terminal. Local test access for special services alignment is provided by the jacks on the UIP when the following ITH circuit packs are present:

- Test head controller (THC)
- Power converter unit (PCU)
- Craft access unit (CAU).

## **Craft Interface Terminal (CIT)**

To support more advanced applications and maintenance, you can connect a CIT to a port on the UIP. The CIT can be either an American Standard Code for Information Interchange (ASCII) terminal or a personal computer (PC) running software that emulates an ASCII terminal. For software downloads, you must have a PC with the following capabilities:

- *MS-DOS*<sup>\*</sup> Release 3.0 or later operating system
- Serial port (RS-232)
- At least one diskette drive (either a 5-inch 360 kB or a 3-inch 720 kB)
- At least 512 kB of random access memory (RAM).

Higher capacity drives must be read compatible with one of these formats.

Menu-driven and prompt command modes are available as well as extensive help features. The CIT supports local or remote provisioning, maintenance, configuration, administration, inventory, and performance monitoring activities.

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\* Registered trademark of Microsoft Corporation.

## Terminal Applications

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### Remote Terminal or Host Digital Terminal (RT/HDT)

#### General

You can use the *SLC-2000* Access System as a remote terminal (RT) or a host digital terminal (HDT) (Figure 1-1 and Figure 1-2 on page 1-3). The RT or HDT is usually located in a separate facility closer to the customer than the central office. The two applications differ as follows:

- **Remote Terminal:** Access lines from customer equipment terminate *directly* on metallic distribution shelf (MDS) assembly channel units in the RT. This is referred to as *metallic distribution*.
- **Host Digital Terminal:** Access lines from customer equipment terminate on an *optical network unit* (ONU) that is “hosted” by the *SLC-2000* system. In this case, *SLC-2000* HDT “extends” its MDS assembly channel slots to an ONU that is usually located even closer to the customer. This is referred to as *FITL distribution*. The ONU can be one of the following:
  - *SLC-2000* MSDT (Software Release 2.0 and later)
  - DDM-2000 FiberReach Narrowband Shelf (Software Release 4.3 and later).



**NOTE:**

Chapter 2 gives details on the HDT and ONU features for the *SLC-2000* Access System.

As shown in Figure 1-1 on page 1-3, you can have an RT and HDT in the same *SLC-2000* system.

## RT/HDT Configurations

You can configure the RT for either of the following configurations:

- **Universal Configuration:** This configuration is used when the switch distributes DS0 lines (usually analog lines) and requires a COT to multiplex the lines onto a SONET or DSX-1 feeder. The RT interfaces the feeder and demultiplexes the signal back into DS0s for customer use.
- **Integrated Configuration:** This configuration allows the RT to be fed directly from the local digital switch (LDS) without a COT. The LDS usually produces a DS1 signal from an integrated digital carrier unit (IDCU) or similar equipment. The DS1s can then be multiplexed onto a SONET feeder or sent directly to the RT as DSX-1 metallic feeders.

The system architecture is modular and completely connectorized for installation in RT bays (Figure 1-3) and cabinets. System components include the following:

- Access resource manager (ARM) shelf
- Metallic distribution shelf (MDS) assembly
- High density optics shelf (HDOS) (for MSDT FITL applications)
- User interface panel (UIP)
- Fan(s).

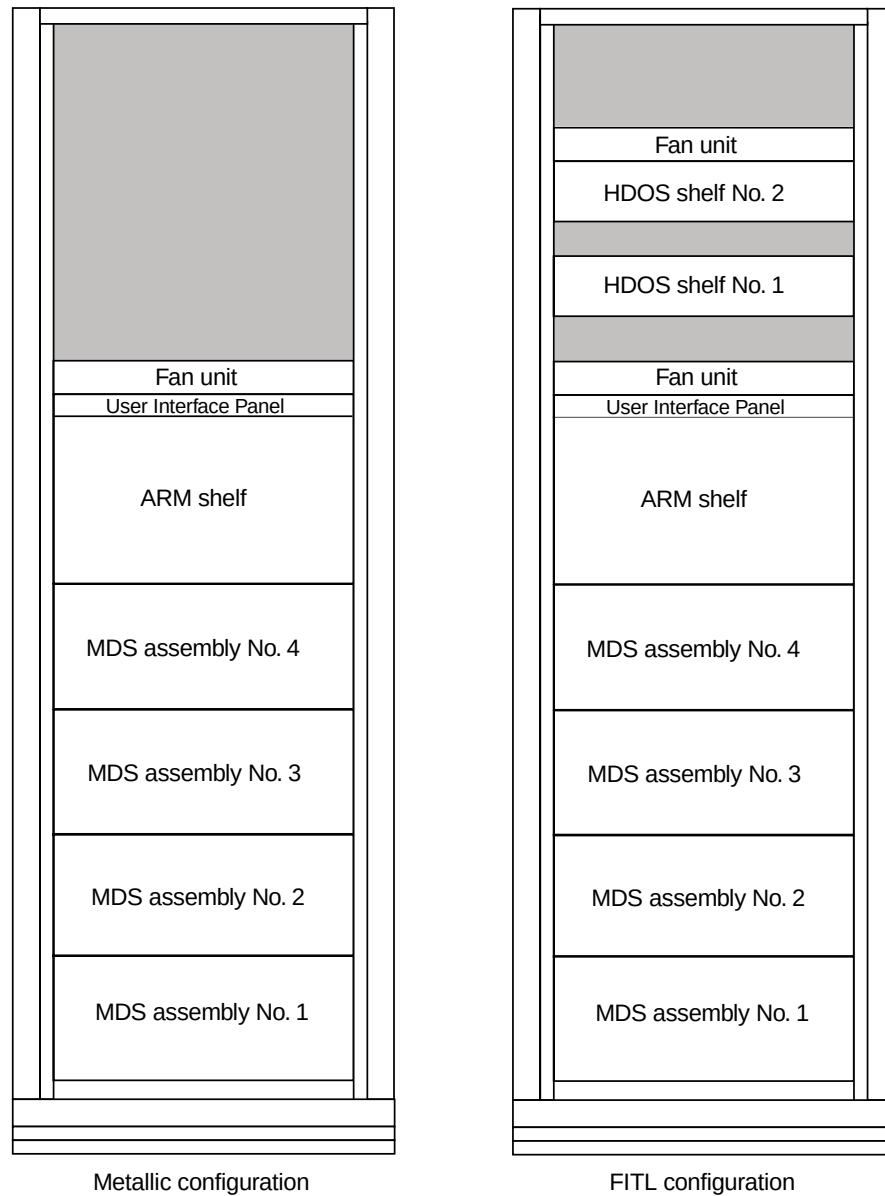


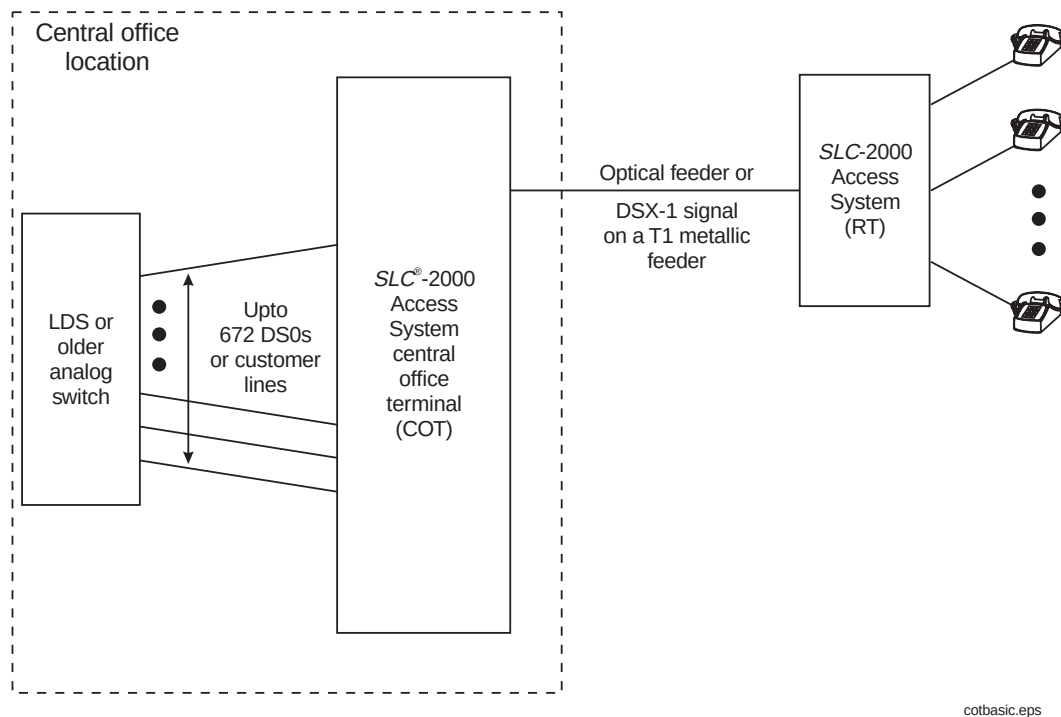
**Figure 1-3. SLC-2000 Access System Remote Terminal Bays**

## Central Office Terminal (COT)

As the name implies, the *SLC-2000* central office terminal (COT) is usually collocated in the central office with the LDS or analog switch. It allows the RT to operate in an *universal* configuration. The COT interfaces analog customer lines from the switch or other central office (CO) equipment to a transmission facility feeder connected to an RT. Figure 1-4 shows a typical configuration.

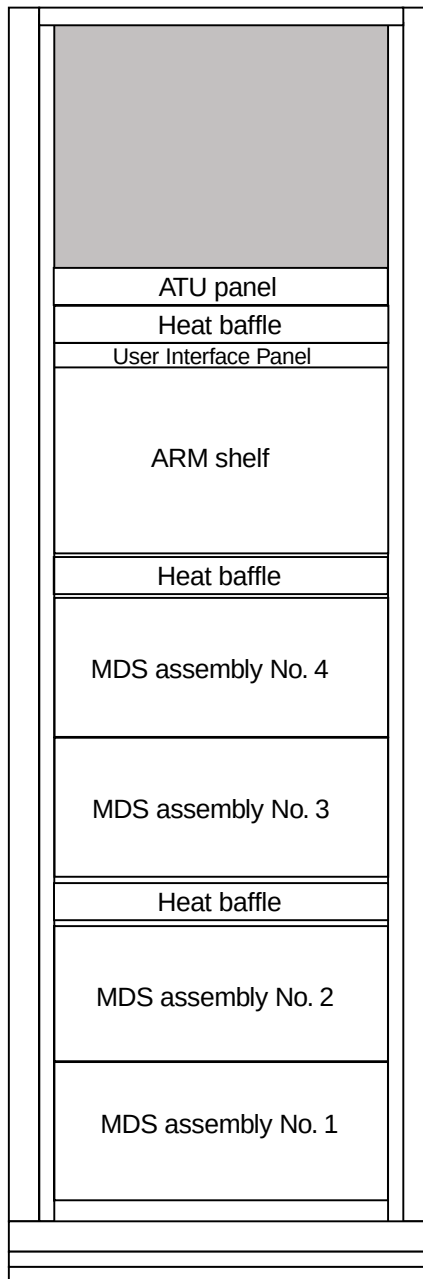
The COT system architecture is also modular and completely connectorized for installation in COT bays (Figure 1-5). System components include the following:

- ARM shelf
- MDS assembly
- Heat baffles
- Alarm and test unit (ATU)
- UIP.



cotbasic.eps

**Figure 1-4. Typical SLC-2000 Central Office Terminal (COT) Configuration**



cotbay02.eps

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**Figure 1-5. The SLC-2000 Access System Equipped for COT Applications**

## **SLC-2000 COT and RT Compatibility**

The *SLC-2000* COT and the *SLC-2000* RT must be running the correct software release as shown in Table 1-2. (The *SLC-2000* Release 2.0 RT is not compatible with the *SLC-2000* Release 3.1/3.2 COT.) See Table 7-3 on page 7-17 for *SLC-2000* and *DDM-2000* software release compatibilities.

**Table 1-2. COT/RT DLC Software Release Compatibility**

| <b>RT Software Release</b> | <b>COT Software Release</b> |
|----------------------------|-----------------------------|
| 2.0 <sup>*</sup>           | <i>SLC</i> ® 96 COT         |
| 3.1                        | 3.1                         |
| 3.2                        | 3.2, 3.3                    |
| 4.0                        | 3.2, 3.3                    |
| 4.1                        | 3.2, 3.3                    |
| 4.2 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.3 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.4 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.5 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.6 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |

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<sup>\*</sup> The *SLC-2000* Release 2.0 RT is not compatible with the *SLC-2000* Software Release 3.1/3.2/3.3 COT.

<sup>†</sup> The *SLC-2000* Release 4.2 RT or later is required to obtain complete end-to-end compatibility with the new channel units supported by Releases 3.3 and 4.2 or later.

<sup>‡</sup> The *SLC-2000* Release 3.3 COT is required to ensure all features are available (for example, full capacity of new channel units) when using Release 4.2 or later at the RT.

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## **Software Feature Releases**

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Lucent Technologies adds new features to the *SLC-2000* system using *software feature releases*. This allows you to economically upgrade your current system by downloading software containing the features you need with a minimum investment in new hardware.

Each software feature release is a set of system features that supports the standard interfaces and various service categories with specific equipment and software. A software release description (SRD) will be available for each future



release of the product, along with updated engineering and ordering information. For SRD numbers covering specific software releases, see Appendix C.

Table 1-3 shows the basic features for each *SLC-2000* software release. Unless otherwise stated, each software release contains all the features for the terminal type (RT/HDT or COT) found in the previous release.

**Table 1-3. Basic Features for Each *SLC-2000* Software Release**

| <b><i>SLC</i><sup>®</sup>-2000<br/>Software<br/>Release</b> | <b>Feature</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1.0                                                        | <p>SONET Networking with DDM-2000 and other <i>SLC-2000</i> systems</p> <ul style="list-style-type: none"> <li>■ OC-3 ring</li> <li>■ OC-3 linear drop/hub</li> <li>■ OC-3 point-to-point</li> <li>■ 21D OLIU connection (IS-3) with collocated DDM-2000 OC-3, DDM-2000 OC-12, <i>SLC-2000</i></li> </ul> <p>Full complement of switched services as follows:</p> <ul style="list-style-type: none"> <li>■ Quad-POTS and Quad-<i>SPOTS</i><sup>®</sup> CUs</li> <li>■ Coin, multi-party, FSR, DID, and ringdown using <i>SLC</i> Series 5 CUs</li> </ul> <p>DS1 services</p> <p>TR-08 Modes 1 and 2 CO interfaces</p> <p>Operational features as follows:</p> <ul style="list-style-type: none"> <li>■ ITH MLT testing</li> <li>■ Basic CIT</li> <li>■ Easy to use UIP</li> </ul>                                                                                                                                                                |
| R2.0                                                        | <p>Full complement of switched and special services as follows:</p> <ul style="list-style-type: none"> <li>■ <i>SPQ</i><sup>®</sup>400/<i>SPQ</i>440 Quad POTS and <i>SPOTS</i> CUs</li> <li>■ <i>SLC</i> Series 5 channel units (except AUA44 and AUA54)</li> <li>■ <i>SLC</i> Series 5 ISDN BRITE channel units</li> </ul> <p>Operational features as follows:</p> <ul style="list-style-type: none"> <li>■ Local provisioning and alignment of special service channel units by CIT</li> <li>■ Local detail alarm reporting by CIT</li> <li>■ Remote CIT operations via modem</li> </ul> <p>Host Digital Terminal (HDT) features as follows:</p> <ul style="list-style-type: none"> <li>■ DS1 feeder using SONET complex</li> <li>■ Terminates <i>SLC-2000</i> MSDT ONU</li> <li>■ 12 or 24 line MSDT Server (<i>SPQ</i>808 Server)</li> <li>■ Provisioning and digital-side access alignment of special service CUs by CIT at HDT</li> </ul> |
| R3.1                                                        | <p>TR-08 Mode 1 DS0 TSI (RT/HDT) as follows:</p> <ul style="list-style-type: none"> <li>■ Any distribution DS0 mapped to any feeder DS0</li> <li>■ Grooming of Special Services</li> <li>■ Support of TR-08 and INA configurations</li> </ul> <p>Remote and local software download (RT/HDT)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

*Continued on next page*

**Table 1-3. Basic Features for Each SLC-2000 Software Release (Continued)**

| <b>SLC®-2000<br/>Software<br/>Release</b> | <b>Feature</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R3.1<br>(Continued)                       | <p>Remote CIT operations via SONET DCC for RT, HDT and MSDT as follows:</p> <ul style="list-style-type: none"> <li>■ Detailed alarms</li> <li>■ Provisioning of special services</li> <li>■ Provisioning of RT/HDT TSI cross-connects</li> <li>■ Change from MML to TL-1 based CIT</li> </ul> <p>TR-08 Mode 2 DS0 TSI for grooming special services out of TR-08 mode 2 systems (RT/HDT)</p> <p>Interworks with R3.1 RT/HDT (COT)</p> <p>CO status alarm closures (COT)</p> <p>PGTC testing capabilities (COT)</p> <p>Full complement of switched and special services (COT) as follows:</p> <ul style="list-style-type: none"> <li>■ Quad POTS and <i>SPOTS</i> CUs (<i>SPQ300</i> and <i>SPQ340</i> CU)</li> <li>■ <i>SLC</i> Series 5 CUs (except AUA34, AUA44, AUA54)</li> <li>■ <i>SLC</i> Series 5 ISDN BRITE CUs</li> <li>■ Dataport</li> </ul> <p>Integrated alarms with DDM-2000 (COT)</p> <p>Remote and local Software download (COT)</p> <p>Remote CIT access</p> |
| R3.2                                      | <p>Compatibility with Bellcore OSs (RT and COT) as follows:</p> <ul style="list-style-type: none"> <li>■ NMA alarms — TL1 interface</li> <li>■ OPS/INE — TL1 interface (including SONET provisioning, DS0 TSI provisioning (RT), special service provisioning</li> <li>■ <i>LEIS</i><sup>*</sup>/LEIM</li> </ul> <p>FNESS OS interface (RT and COT) as follows:</p> <ul style="list-style-type: none"> <li>■ Alarms</li> <li>■ Special service provisioning</li> <li>■ TSI provisioning (RT)</li> <li>■ Inventory</li> </ul> <p><i>RIDES</i><sup>†</sup> OS interface as follows:</p> <ul style="list-style-type: none"> <li>■ Special service</li> <li>■ TSI provisioning (RT)</li> <li>■ Inventory</li> </ul> <p>Integrated Transport Management Subnetwork Controller (ITM SNC)</p> <p>CIT enhancements (RT and COT) as follows:</p> <ul style="list-style-type: none"> <li>■ Local and remote inventory</li> <li>■ Remote alignment</li> </ul>                           |

\* Trademark of Bellcore Communications, Inc.

† Trademark of RAYNET Corporation.

*Continued on next page*

**Table 1-3. Basic Features for Each SLC-2000 Software Release (Continued)**

| <b>SLC®-2000<br/>Software<br/>Release</b> | <b>Feature</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R3.2<br>(Continued)                       | System support for the following (RT and COT): <ul style="list-style-type: none"> <li>■ Quad <i>E SPOTS</i> CU (<i>SPQ442</i> and <i>SPQ443</i> CU)</li> <li>■ 4W CS and E&amp;M CU (<i>SPQ444</i> and <i>SPQ454</i> CU)</li> <li>■ RS-232 (<i>AUA232</i>)</li> <li>■ SW-56 2W (<i>AUA200</i>)</li> <li>■ Tollgrade DC bypass (<i>MCU5405</i> CU)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                           | DSX-1 feeder interface (RT and COT) as follows: <ul style="list-style-type: none"> <li>■ T1 adjunct repeater/protection shelf</li> <li>■ DSX-1 interface to stand-alone multiplexer</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                           | SARTS testing via adjunct RMU shelf (RT — R3.2 and R4.5 only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                           | ALIT-like routine drop testing for integrated <i>5ESS</i> ® switch configurations (RT and COT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                           | Interworks with R3.2 RT/HDT (COT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| R3.3<br>(COT only)                        | Interworks with R4.2 RT/HDT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                           | Software support for the following COT CUs: <ul style="list-style-type: none"> <li>■ Dual coin (<i>SPQ333</i> CU)</li> <li>■ Dual DS0 dataport (<i>SPQ334</i> CU)</li> <li>■ Dual OCU dataport (<i>SPQ452</i> CU)</li> <li>■ Quad DID (<i>SPQ336</i> CU)</li> <li>■ Tollgrade single program CU (5, 8, 15, and 20 kHz) (<i>PGM</i>*2000 CU)</li> <li>■ Quad Coin (<i>SPQ318</i> CU)</li> <li>■ Quad EBS P-Phone (<i>SPQ328</i> CU)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                           | Compatibility with the Tautron <i>ngRTH</i> † test head (R3.3.1 or later only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                           | SARTS testing via adjunct RMU shelf (R3.3.1 or later only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| R4.0<br>(RT only)                         | TR-303 compatibility with the <i>5ESS</i> switch (5E9.1 BWM and 5E9.2 BWM) as follows: <ul style="list-style-type: none"> <li>■ TR-303 system with up to 768 lines and remaining lines on INA digroups</li> <li>■ Up to 28 DS1s at CO</li> <li>■ ISDN service (4:1) TDM served by MDS assembly shelf (with DSL performance monitoring)</li> <li>■ ISDN service (4:1) TDM served by MSDT (allows DSL performance monitoring; <i>AUA94</i> provides no inventory, <i>AUA94B</i> provides inventory)</li> <li>■ ISDN service with BRITE CUs via INA</li> <li>■ SONET and metallic DS1 feeder</li> <li>■ MSDT FITL without expanded EOC messages using <i>SPQ809</i> MSDT Server</li> <li>■ Full TL1 and ASN.1 operations. Split operations between <i>5ESS</i> switch and external OSS</li> <li>■ Software download to MSDT from HDT</li> <li>■ Special services on INA digroups</li> <li>■ Inventory and DS1 performance monitoring for HDT-MSDT link</li> <li>■ Special services served in a TR-303 VRT</li> </ul> |
|                                           | DS1 feeder line loopback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                           | DS1 performance monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                           | Rear access CIT port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                           | Remote inventory of MSDT with CIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

\* Trademark of Tollgrade Communications, Inc.

† Trademark of Tautron, Inc.

*Continued on next page*

**Table 1-3. Basic Features for Each SLC-2000 Software Release (Continued)**

| <b>SLC<sup>®</sup>-2000<br/>Software<br/>Release</b> | <b>Feature</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R4.1<br>(RT only)                                    | TR-303 compatibility with <i>DMS 100</i> <sup>†</sup> switch                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                      | System support for quad ISDN CU — metallic distribution only ( <i>SPQ494</i> CU)                                                                                                                                                                                                                                                                                                                                                                                      |
| R4.2<br>(RT only)                                    | TR-303 compatibility with <i>GTD-5</i> <sup>†</sup> switch                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                      | Two TR-303 large line size VRTs and remaining lines on TR-08 or INA digroups                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                      | Software support for the following new CUs: <ul style="list-style-type: none"> <li>■ Quad DID (<i>SPQ456</i> CU)</li> <li>■ Dual Coin (<i>SPQ453</i> CU)</li> <li>■ Dual OCU dataport (<i>SPQ452</i> CU)</li> <li>■ Quad 1500 Ohms POTS <i>SPOTS</i> ( <i>SPQ440C</i> CU)</li> <li>■ Tollgrade single program CU (5, 8, 15, and 20 kHz) (<i>PGM</i><sup>‡</sup>2000 CU)</li> <li>■ Quad Coin (<i>SPQ419</i> CU)</li> <li>■ Quad P-Phone (<i>SPQ429</i> CU)</li> </ul> |
|                                                      | Interworks with R3.3 COT                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| R4.3<br>(RT only)                                    | Support for DDM-2000 FiberReach R2.0                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                      | DDM-2000 FiberReach Narrowband Shelf (NBS) support as follows: <ul style="list-style-type: none"> <li>■ 48 DS0 NBS</li> <li>■ Up to 8 AUA94 CUs (16 ISDN lines)</li> <li>■ POTS, <i>SPOTS</i>, ISDN, Coin, 4-wire, Dataport and SW56 CUs</li> </ul>                                                                                                                                                                                                                   |
| R4.4<br>(RT only)                                    | Support of the following enhanced DDM-2000 FiberReach software R2.1 features: <ul style="list-style-type: none"> <li>■ Full complement of CUs including the quad ISDN (<i>SPQ494</i> CU) when DSX-1 feeders are provisioned for the octet mode</li> <li>■ Full NBS operations</li> </ul>                                                                                                                                                                              |
| R4.5<br>(RT only)                                    | Enhanced FiberReach/MSDT                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                      | TL1 ISDN Provisioning                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| R4.6<br>(RT only)                                    | Voice Frequency Data Enhancement (VFDE)                                                                                                                                                                                                                                                                                                                                                                                                                               |

\* Trademark of Northern Telecom, Ltd.

† Registered trademark of GTE Corporation.

‡ Trademark of Tollgrade Communications, Inc.

## **Related Systems**

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The *SLC-2000* Access System is a basic element in the Lucent Technologies Network Systems Service Net-2000 integrated SONET architecture. Service Net-2000 is based on standard interfaces and uses common network elements from the 2000 Product Family:

- DDM-2000 Multiplexer (OC-3 and OC-12) and FiberReach Multiplexer
- FT-2000 Lightwave System
- DACS III-2000
- DACS IV-2000
- *DACScan*<sup>®</sup>-2000 Controller
- *5ESS*<sup>®</sup>-2000 Switch
- *SLC-2000* MSDT
- Business Remote Terminal-2000 (BRT-2000)
- Integrated Transport Management Subnetwork Controller (ITM SNC).

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### Introduction

The *SLC*<sup>®</sup>-2000 Access System is designed to work in today's digital loop carrier (DLC) environment, while providing the advanced access network evolution platform for your company to remain in the forefront of the fast-changing telecommunications arena. The *SLC*-2000 Access System provides the following:

- A full complement of telephony services, including integrated services digital network (ISDN)
- Compatibility with today's switches and operations systems in today's outside plant environment
- A platform for TR-08<sup>\*</sup> and TR-303<sup>†</sup> switch interfaces for flexibility in configuring the following number of lines for switch-specific applications depending on the software release:
  - **Release 4.4 or earlier:** Up to 768 lines [both metallic and fiber-in-the-loop (FITL) distribution]
  - **Release 4.5 or later:** Up to 768 lines (metallic distribution only), or up to 1152 lines (FITL distribution only)

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\* Bellcore Technical Reference TR-TSY-000008, Issue 2 (August 1987) and all Revisions and Supplements, *Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch*.

† Bellcore Technical Reference TR-NWT-000303, Issue 2 (December 1992) and all Revisions and Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*.

- 4:1 time-division multiplexing (TDM) of ISDN D-channels (with TR-303)
- Full synchronous optical network (SONET) capability (linear and ring applications)
- DSX-1 metallic feeder interface
- Support of operations, administration, maintenance, and provisioning (OAM&P) commonality among Lucent Technologies' products and industry standard operations systems
- Host digital terminal (HDT) support of optical network units (ONUs) such as the *SLC-2000* Multi-Services Distant Terminal (MSDT) (Release 2.0 and later) or the *DDM-2000* FiberReach Narrowband Shelf (Release 4.3 and later)
- Flexibility to integrate telephony services using metallic or fiber distribution, rings, and multiple *SLC-2000* Access Systems
- Voice frequency data enhancement (VFDE) feature improving the connect rate, or *throughput*, of analog modems served by switched single-party loop-start and ground-start lines (Software Release R4.6 or later).
- Modular service growth up to the following number of lines per system:
  - **Release 4.4 or earlier:** Up to 768 lines [both metallic and fiber-in-the-loop (FITL) distribution]
  - **Release 4.5 or later:** Up to 768 lines (metallic distribution only), or up to 1152 lines (FITL distribution only)
- Full capability and security of Lucent Technologies' premier, field-proven cabinets.

All this is supported by Lucent Technologies' expertise in customer engineering and technical support services including the Bell Laboratories division.

The *SLC-2000* Access System positions your company for the maximum revenue generation potential with the minimum cost, minimum work-around, minimum operations, training, and high reliability for serving business and residential customers needs. It is your complete solution to your telephony service needs.

## **Full Service Platform**

---

The *SLC-2000* Access System delivers plain old telephone service (POTS) efficiently and provides business services. It is compatible with existing *SLC* Series 5 Carrier System channel units, thus preserving the value of your investment. The *SLC-2000* Access System supports single party POTS, all *CLASS*\* services, and business and residence customer services (BRCS). In summary, a full array of services is supported by the *SLC-2000* Access System, including a mix of metallic and fiber distribution in remote terminal/host digital terminal (RT/HDT) configurations. A brief description of the types of services is presented in the following sections. Chapter 4 includes a detailed listing of services and channel units for Releases 3.1, 3.2, 3.3, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6.

## **Switched Services**

---

A new family of channel units, *SPQ*<sup>®</sup>-type circuit packs, has been developed for the *SLC-2000* Access System. These quad channel units provide up to four lines of service for POTS, *SPOTS*<sup>®</sup>, *ESPOTS*, ISDN, and other channel unit applications.

## **POTS and Locally Switched Services**

POTS and locally-switched services are provided by *SPQ300*, *SPQ400*( ), *XSPQ400*, and *SPQ401*( ) POTS and the *SPQ340*, *SPQ440*( ), and *SPQ450* *SPOTS* quad channel units [for example, POTS, *SPOTS* channel units, coin, quad coin, DID, ISDN P-phone, multiparty, frequency selective ringing (FSR), etc.]. These services are also supported by existing *SLC* Series 5 Carrier System channel units [for example, POTS, *SPOTS* channel units, coin, multiparty, frequency selective ringing (FSR), etc.]. A low-power quad POTS channel unit, *SPQ909*( ), is available for use in the Multi-Services Distant Terminal (MSDT) or the DDM-2000 FiberReach Narrowband Shelf (NBS).

---

\*

Service mark of Bellcore.

## Voice Frequency Data Enhancement (VFDE) — Software Release R4.6 or Later

SLC-2000 Software Release R4.6 or later allows the system to support the VFDE feature. This feature is designed to improve the connect rate, or *throughput*, of analog modems served by switched single-party loop-start and ground-start lines. These lines must connect to the TR-303 interface of a local digital switch (LDS) containing the appropriate VFDE software. If the LDS does not contain the appropriate VFDE software, then the feature is not usable with the SLC-2000 system.

The VFDE feature increases the possibility that analog modems will connect closer to their rated speed. For example, if you are using a modem rated at 28.8 kb/s, but normally connect to your internet server or other computer equipment at 21.6 kb/s, this feature could improve the connect rate.



### NOTE:

A lot of different factors combine to decrease the connect rate of a modem. These include line noise, poor physical connections, modem quality, etc. The DS1s interfacing with the SLC-2000 system are only one of many factors. The VFDE feature eliminates the DS1s interfacing with SLC-2000 equipment as one of the factors decreasing the connect rate.

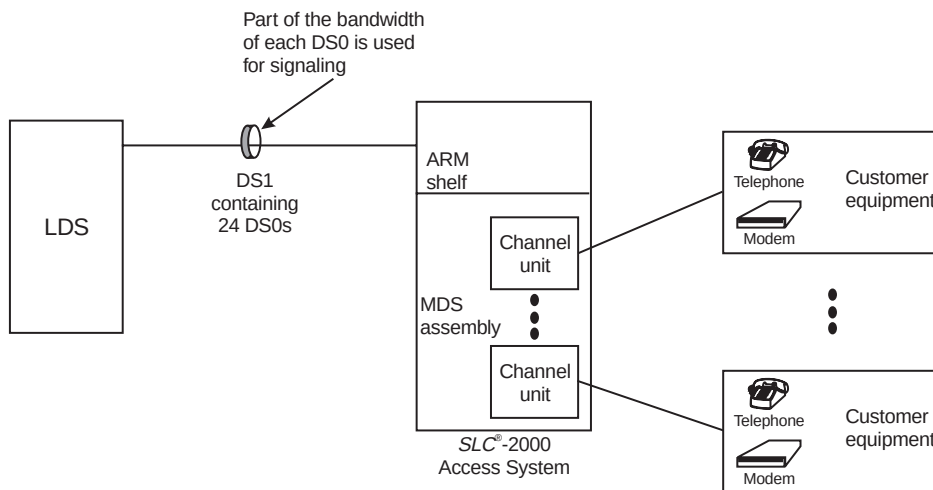
The SLC-2000 system uses a hybrid signaling scheme specified in TR-303. The hybrid signaling scheme requires the use of *robbed-bit signaling*. The VFDE feature allows the system to suspend robbed-bit signaling and convert to a *clear channel* mode. Figure 2-1 and Figure 2-2 compare robbed-bit signaling and clear channel as follows:

- **Robbed-bit Signaling:** This is the standard TR-303 signaling mode used on each DS0 within the DS1 feeder between the LDS and the SLC-2000 ARM shelf. The system also uses this method between the DT Server in the MDS assembly and the optical network unit (ONU). Each DS0 has a bandwidth of 64 kb/s. A small portion of this bandwidth is used for signaling. However, this limits the usable bandwidth for analog modem connections and the reduces the connect rate.
- **Clear Channel Mode:** This is an enhancement of the TR-303 standard and makes the entire 64kb/s bandwidth available for an analog modem connection and is similar to the “B” channel of an ISDN line.

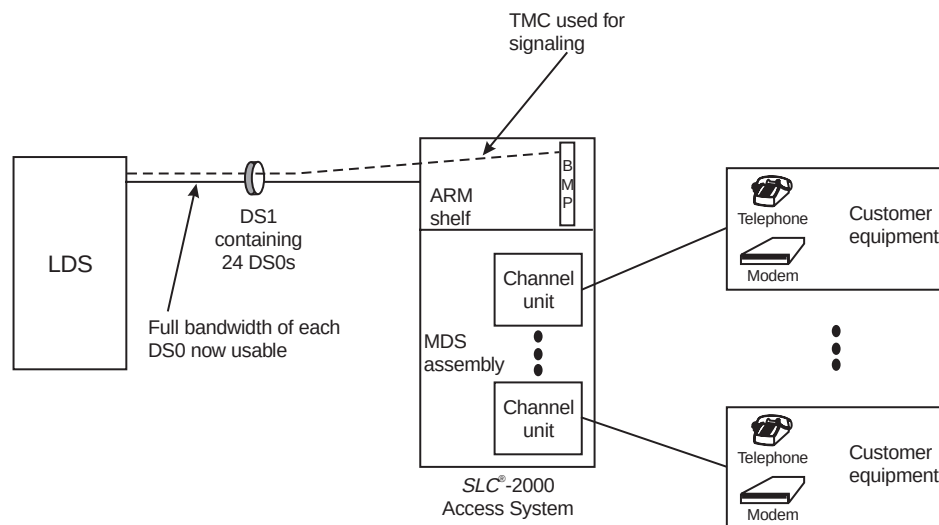
The VFDE feature operates as follows depending on the type of distribution:

- **Metallic Distribution:** Figure 2-1A shows the VFDE feature with switched POTS and special service lines connected directly to channel units in the MDS assembly. You enable the feature by installing Software Release R4.6 or later on your system. With the correct software release installed, the system stays in the robbed-bit signaling mode while a customer's equipment goes off-hook to place an outgoing call or answer an incoming call. After the connection has been made with the far end, the system immediately converts the connection to the clear channel mode as shown

in Figure 2-1B. The connection stays in the clear channel mode until the MDC detects a release or until it detects a *flash* from the customer equipment and passes it to the LDS over the TMC terminating on the BMP circuit pack. The system then reverts back to robbed-bit signaling until the next connection is attempted.



A. Robbed-Bit Signaling



B. Clear Channel

vfdemet.eps

**Figure 2-1. VFDE Feature — Metallic Distribution**

- **FITL Distribution:** Figure 2-2A shows the VFDE feature with switched POTS and special service lines connected through a FITL configuration where the channel units are installed in an ONU. The ONU must be a MSDT or a NBS system. You enable the feature by not only installing Software Release R4.6 or later on your system, but by also installing the following hardware at the HDT and ONU:
  - *SPQ811* or later DT Server in the MDS assembly at the HDT
  - *SPQ401B* or *SPQ440D* channel unit — depending on type of service — in the ONU channel unit slots desiring clear channel service.

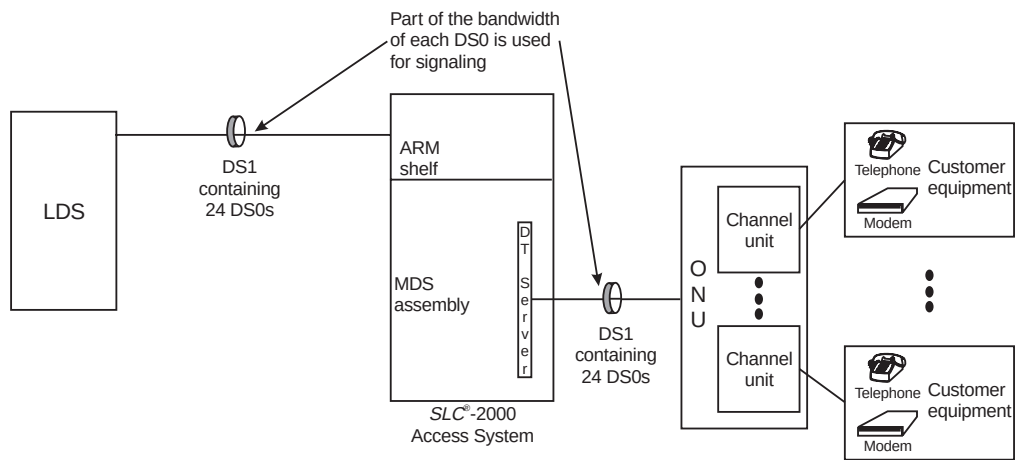


**NOTE:**

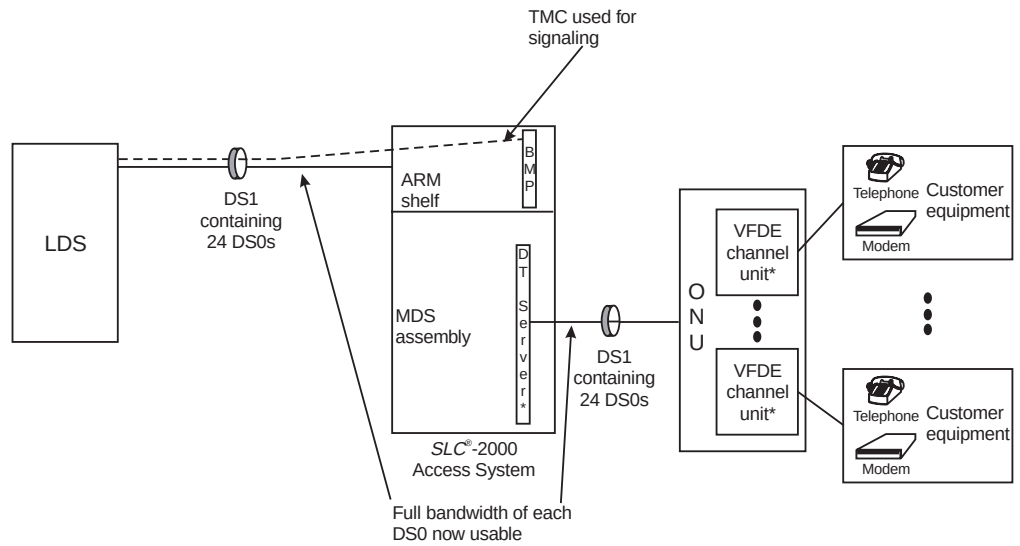
The *SPQ401B* or *SPQ440D* are required at the ONU for VFDE operation in a FITL configuration. However, you can also use both channel units in a metallic configuration in the MDS assembly, but they are not required for VFDE operation in a metallic distribution configuration. VFDE operation in a metallic configuration requires only the correct software loads in the *SLC-2000* system and the LDS.

With the correct software release and hardware installed, the system stays in the robbed-bit signaling mode while a customer's equipment goes off-hook to place an outgoing call or answer an incoming call. After the connection has been made with the far end, the system immediately converts the connection to the clear channel mode as shown in Figure 2-2B. The connection stays in the clear channel mode until the MDC detects a release or until it detects a *flash* from the customer equipment and passes it to the LDS over the TMC terminating on the BMP circuit pack. The system then reverts back to robbed-bit signaling until the next connections is attempted. If the correct FITL hardware is *not* installed, you will still realize some throughput improvement because of the clear channel operation between the ARM shelf and the LDS.

As stated earlier, once in the clear channel mode, the system will keep the connection in clear channel until the MDC detects an on-hook (disconnection) or a switch-hook flash from the customer equipment. It then reverts back to — and stays in — the robbed-bit signaling mode. When a switch-hook flash is detected, the system assumes that the connection is a voice call — with the customer trying to use a voice feature such as 3-way calling or other *5ESS*<sup>®</sup>-type feature initiated by a flash — not requiring clear channel operation.



A. Robbed-Bit Signaling



\*For clear channel operation, the following equipment must be installed:

- DT Server: SPQ®811 Server
- VFDE Channel Unit: SPQ401B or SPQ440D

If the above equipment is not installed, some throughput improvement will be realized on the link between the LDS and the HDT.

B. Clear Channel

vfdefitl.eps

**Figure 2-2. VFDE Feature — FITL Distribution**

## **Integrated Services Digital Network (ISDN) Basic Rate Access**

The *SLC-2000* Access System transports Integrated Services Digital Network (ISDN) basic rate access services to customers remote from an ISDN switch. This service is provided by the basic rate interface transmission extension (BRITE) channel units: the AUA90 T-BRITE or AUA92 U-BRITE in the *SLC-2000* central office terminal (COT) and the AUA90 T-BRITE or AUA93 U-BRITE in the RT or ONU. For the TR-303 interface (to a local digital switch), service is provided by the AUA94 *ANSI*<sup>\*</sup> U-interface channel unit in the *SLC-2000* RT and/or MSDT/NBS. Software Releases 4.1, 4.2, and 4.3 support the use of the *SPQ494* quad ISDN channel unit for these services in the RT only. Release 4.4 or later supports the use of the *SPQ494* quad ISDN channel unit in the RT and in the NBS when provisioned for the octet mode of service.



**NOTE:**

In Software Release 4.4 or later, the DDM-2000 FiberReach NBS will support the *SPQ494* Quad ISDN channel unit. However, Release 4.4 or later — or any *SLC-2000* software release — will *not* support this channel unit in the *SLC-2000* MSDT system. The AUA94 continues to provide ISDN services at the MSDT.

## **Enhanced Business Service (EBS)**

In Software Releases 3.3 (COT) and 4.2 and later (RT), EBS channel units provide enhanced local service using a proprietary protocol of the *Nortel*<sup>†</sup> company. This service is a Centrex-CO feature offered to customers served by a *DMS-100*<sup>†</sup> switch.



**NOTE:**

EBS service is frequently referred to as *P-Phone* service.

EBS channel units are used in pairs at the following locations:

- **Central Office Terminal (COT)** — *SPQ328* quad EBS channel unit
- **Remote Terminal (RT/NBS/MSDT)** — *SPQ429* quad EBS channel unit.

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\* Registered trademark of American National Standards Institute, Inc.

† Trademark of Northern Telecom, Limited.



## Special Services

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Nonlocally switched and nonswitched special services [for example, digital data services provided by DDS, 2- and 4-wire foreign exchange (FX) line/trunk, private line voice/data, 4-wire private branch exchange (PBX) tie trunk, 2-wire *ESLOTS* service, etc.] are supported using existing *SLC* Series 5 channel units. Release 3.2 and later releases feature *SPQ*-type channel units for special services as follows:

- *SPQ442* quad E *SPOTS* channel unit (current sink)
- *SPQ443* quad E *SPOTS* channel unit (current feed)
- *SPQ444* single-channel 4-wire voice frequency (VF) channel unit (current sink) with tandem capability to connect to another DS1 multiplexer such as D4 channel bank
- *SPQ454* single-channel E&M channel unit with tandem capability
- *SPQ334* dual DS0 dataport channel unit (Release 3.3 and later)
- *SPQ452* dual office channel unit (OCU) dataport channel unit (COT Release 3.3 and RT Release 4.2 and later).



**NOTE:**

In Software Releases 4.1 and earlier, the *SPQ452* is *not* supported at either the MSDT or DDM-2000 FiberReach ONUs.

Expanded digital data capability is supported with the AUA200 channel unit for switched 56-kb/s data and the AUA232 channel unit for EIA RS-232 applications.

## High-Speed Services

---

The *SLC*-2000 Access System supports high-speed services (DS1 or higher) from function group C (Chapter 5) in the SONET subsystem. It can be equipped for one DS3 service, one EC-1 (STS-1E), or up to 28 DS1 rate services without using an external multiplexer. DS1 service is provided at the DSX-1 level. These DS1 rate pipes can be used in a variety of applications, such as DS1 rate service and ISDN primary rate access service. The EC-1 interface allows a *SLC*-2000 COT to provide an efficient interconnection to an FT-2000 Lightwave System or the DACS IV-2000.

## **Alarm and Telemetry Services**

---

The *SLC-2000* Access System is compatible with most voiceband alarm and telemetry services. The *MCU*<sup>\*</sup>-5205 channel unit, from Tollgrade Communications, Inc., provides a metallic interface for more than 50 varieties of alarm, signaling, telemetry, and control circuits. The *MCU-5205* channel unit allows transport of DC and DC/AC circuits over *SLC-2000* Access System facilities.

## **Wideband Audio Service for Broadcasters**

---

In COT Software Releases 3.3 and later and RT Software Releases 4.2 and later, the *SLC-2000* Access System supports wideband audio services for broadcasters. The system provides this service over dedicated (nonswitched) circuits using the *PGM*<sup>\*</sup>-2000 channel unit manufactured by Tollgrade Communications, Inc. It can use both the integrated (hairpin) and universal modes to provide these services. The *PGM-2000* channel unit provides the following four bandwidth grades of service:

- 5 kHz
- 8 kHz
- 15 kHz
- 20 kHz.



### **CAUTION:**

*See the PGM-2000 channel unit data sheet (TLGD-2000) for metallic distribution shelf (MDS) assembly slot restrictions when using the 15- and 20-kHz bandwidth grades. Chapter 4 discusses this service in detail.*



### **NOTE:**

The *PGM-2000* channel unit is not supported in an ONU hosted by a *SLC-2000* HDT.

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\* Trademark of Tollgrade Communications, Inc.

## Full Synchronous Optical Network (SONET) Compatibility

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### Integrated SONET Multiplexer

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The *SLC-2000* Access System supports an integrated SONET OC-3 multiplexer similar to the *DDM-2000* OC-3 multiplexer. This capability allows a variety of advanced SONET-based applications, such as point-to-point, taper, linear drop, and ring topologies, without using an external SONET multiplexer. The circuit packs used for the integrated SONET multiplexer, timing, overhead processing, DS1, DS3, or EC-1 interfaces, and control are identical to the ones used in the *DDM-2000* OC-3 multiplexer. The main difference between the SONET subsystem of the *SLC-2000* system and the *DDM-2000* OC-3 multiplexer is that the *SLC-2000* system only provides physical access to function groups A and C to provide STS-1s for the system. The bandwidth of function group B is passed through the OLIU for use on other network elements. The *DDM-2000* OC-3 multiplexer contains function groups A, B, and C.

Table 8-8 on page 8-57 gives a list SONET subsystem Software Release R11 and R13 features commonly used with *the SLC-2000* system.

### Flexible Network Applications

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The *SLC-2000* Access System supports the following direct SONET interfaces:

- **Direct OC-3 Interface.** With any SONET subsystem software release, the *SLC-2000* system includes the necessary equipment to interface directly with an OC-3 feeder.
- **OC-12 Interface using an External *DDM-2000* OC-12 Shelf.** With any SONET subsystem software release, you can make an optional in-service upgrade to an optical carrier level 12 (OC-12) feeder by using an external *DDM-2000* OC-12 multiplexer shelf.
- **Direct OC-12 Interface using OC-12 Optical Line Interface Units (OLIUs) in the SONET Subsystem.** With SONET subsystem Software Release R11 or later, you can insert OC-12 optical line interface units (OLIUs) into the MAIN slots of the ARM shelf. This allows your *SLC-2000* system to interface directly with an OC-12 ring.

Point-to-point, hub, taper, and ring applications are supported.

## **Flexible Central Office Interfaces**

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### **Integrated Network Access (INA) Applications and Description**

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The SLC-2000 Access System supports the INA facility interface on DS1 rate feeders configured with D4 sequential counting format and provisioned as either superframe (SF) or extended superframe (ESF) format. INA applications allow electronic grooming of non-locally-switched and nonswitched special services to INA facilities that can be connected to D-banks or digital cross-connect systems. Up to 28 feeder DS1s may be used for INA applications in either universal or integrated systems.

INA DS1s are supported at the RT and at a COT using Release 3.3 (or later). An INA DS1 is a logical or software-defined DS1 that can be handled much like a virtual remote terminal (VRT). The INA DS1 at an RT must be cross-connected to a physical feeder DS1 to be activated for transporting groomed, nonlocally switched or nonswitched special services to a digital access and cross-connect system (DACS) or D-banks in the central office. INA DS1s can be optioned for superframe (SF)\* or extended superframe (ESF) framing and to sequentially count (map) distribution time slots. The **ED-INA** command is used to set the framing format for INA DS1. With certain limitations (Chapter 3), INA DS1s can be mixed with TR-08 Mode 1 and Mode 2 VRTs and TR-303 VRTs.

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\* Superframe (SF) is the same format as D4.

## Universal Applications

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Universal applications are used when the switch distributes DS0 lines (usually analog lines) and requires a COT to multiplex the lines onto a SONET or DSX-1 feeder. The RT interfaces the feeder and demultiplexes the signal back into DS0s for customer use.

The *SLC-2000* Access System supports universal TR-08 Mode 1 digital loop carrier (DLC) applications with the *SLC-2000* COT or *SLC 96* Carrier System COTs. The *SLC-2000* COT provides service for up to 672 customers in SONET and metallic feeder configurations. With SONET feeder, 28 DS1 pipes also are available for DS1 rate services. In universal applications with the *SLC-2000* COT, full support for central office alarms and a testing interface to the pair gain test controller (PGTC) is provided (testing for universal *SLC-2000* systems also requires PGTC). Each *SLC 96* COT supports up to 96 customers; it provides a standard set of office alarms and also allows testing via the PGTC.

## Integrated Applications

---

Integrated applications allow the RT to be fed directly from the LDS without a COT. The LDS usually produces a DS1 signal from an IDCU or similar equipment. The DS1s can then be multiplexed onto a SONET feeder or sent directly to the RT as DSX-1 metallic feeders over T1 carrier facilities.

In Releases 3.1 and 3.2, integrated DLC applications are provided with the TR-08 Mode 1 or Mode 2 digital switch interfaces to an LDS. The "hairpin" capability of the LDS can be used for grooming special services onto a DS1 (PUB 43801) port. DACS II (with a TR-08 pass-through and special services DS0 grooming) and DACS IV-2000 with either DS1 or EC-1 (SONET applications only) interfaces in the central office can be used as well.

Release R4.0 or later software provides the TR-303 digital switch interface to an LDS.

Twenty-eight feeder DS1s are available to serve the following number of customer lines, depending on the configuration selected and the *SLC-2000* Software Release:

- **Release 4.4 or earlier:** Up to 768 lines [both metallic and fiber-in-the-loop (FITL) distribution]
- **Release 4.5 or later:** Up to 768 lines (metallic distribution only), or up to 1152 lines (FITL distribution only).

## Virtual Remote Terminals (VRTs)

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### Description

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Figure 2-3 shows the VRT concept as seen from the central office (CO) interface. The *virtual remote terminal (VRT)* is a logical or software-defined segment of a *SLC-2000* system remote terminal that appears to the CO interface to be a complete remote terminal. This VRT will have equal or fewer end users **and** equal or fewer feeder facilities than the complete remote terminal. The CO interface is a COT if in a universal configuration, or an integrated digital terminal (IDT) if in an integrated configuration.

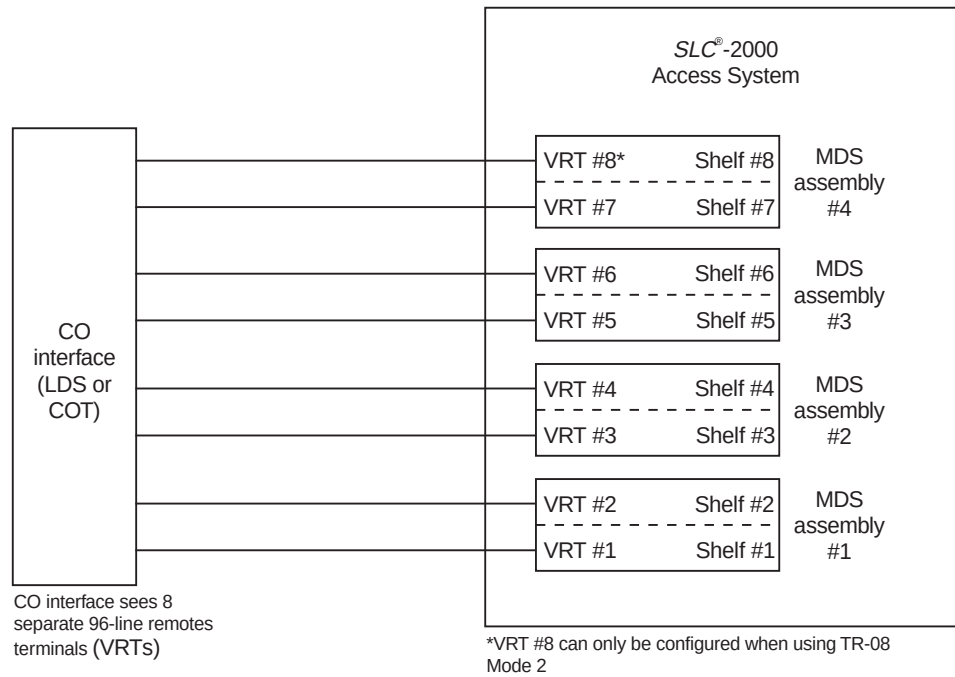
This logical (virtual) definition allows a number of VRTs to be established within a single physical RT/HDT. Each VRT appears to the central office switch interface or COT to be an independent remote terminal that can be administrated separately.

A TR-08 VRT is seen from the CO interface as a remote terminal serving 96 lines or DS0s. You can configure the VRT in one of the following modes depending on whether concentration is needed:

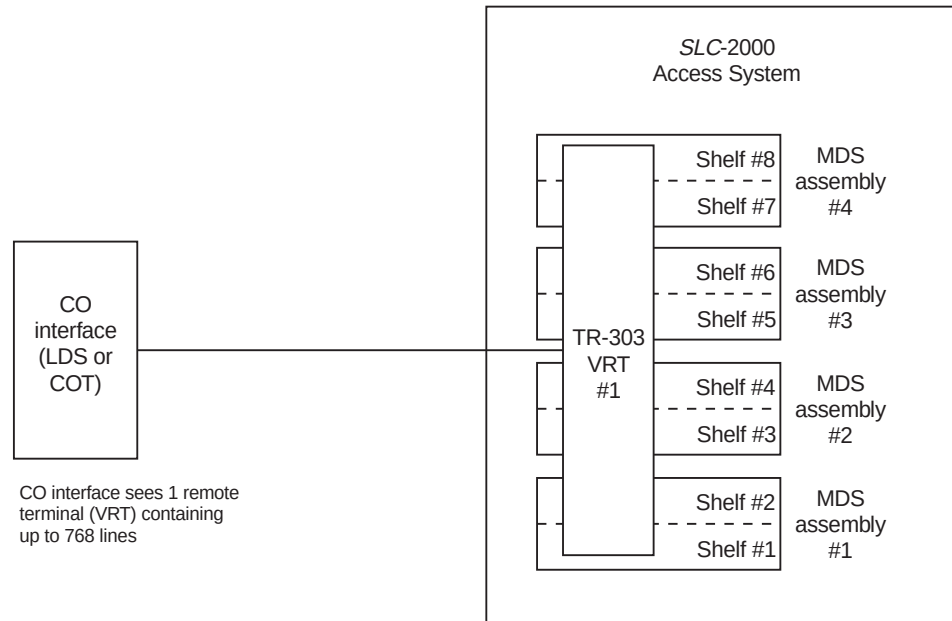
- **Mode 1:** This mode supports 96 customer lines with four DS1 feeders and uses no concentration. Each customer line is mapped to its own channel in one of the DS1 feeders.
- **Mode 2:** This mode supports 96 customer lines with 2 DS1 feeders and uses 2:1 concentration. The system allows only 48 of the 96 lines to be in use at any one time.

In Figure 2-3A, the CO interface sees VRT #1 as a 96-line TR-08 VRT configured as shelf 1 of MDS assembly 1. It sees VRT #2 as a 96-line TR-08 VRT configured as shelf 2 of MDS assembly 1, etc.

A TR-303 VRT is seen from the CO interface as a remote terminal containing a certain number of lines defined by the software. For example, in Figure 2-3B, the CO interface sees VRT #1 as a 768-line TR-303 VRT configured using the complete *SLC-2000* RT.



A. TR-08 VRTs



B. TR-303 VRT

vrtdesc.eps

Figure 2-3. Virtual Remote Terminal (VRT) Concept

## Bandwidth Management

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The *SLC-2000* Access System includes a bandwidth management section that allows you to *build* virtual remote terminals (VRTs) and virtual COTs (VCOTs) as separate segments of the physical RT or COT. The VRT/VCOT capability allows a number of *logical* DLC systems to be established within a single *SLC-2000 physical* RT/COT. In addition to the lines assigned to VRTs, other non-switched DS0 services can be assigned to INA DS1s that terminate on non-switched equipment such as DACS, or D4 channel banks. Virtual remote terminals (VRTs) and virtual COTs (VCOTs) are separate logical or software-defined DLC systems based on the following:

- **TR-08 Mode 1:** Up to seven 96-line VRTs/VCOTs per physical 672-line *SLC-2000* Access System
- **TR-08 Mode 2:** Up to eight 96-line VRTs/VCOTs per physical 768-line *SLC-2000* Access System
- **TR-303:**
  - **Software Release R4.0 and R4.1:** One VRT of up to 768-lines per *SLC-2000* Access System (VRT line size defined in the software).
  - **Software Release R4.2 or Later:** Up to two VRTs whose line size can total up to 768-lines per *SLC-2000* Access System (VRT line size defined in the software).
  - **Software Release R4.5 or Later:** For metallic distribution only, same as Software Release R4.2. For FITL distribution, up to two VRTs whose line size can total up to 1152-lines per *SLC-2000* Access System (VRT line size defined in the software).



**NOTE:**

The *SLC-2000* system can contain a mixture of TR-08 and TR-303 VRTs. However, when using the Enhanced FiberReach/MSDT feature to support up to 1152 lines with Software Release 4.5 and later, at least one VRT must be a TR-303 VRT. See Chapter 3 for cross-connect (checkerboarding) restrictions when using the Enhanced FiberReach/MSDT feature with Release R4.5.

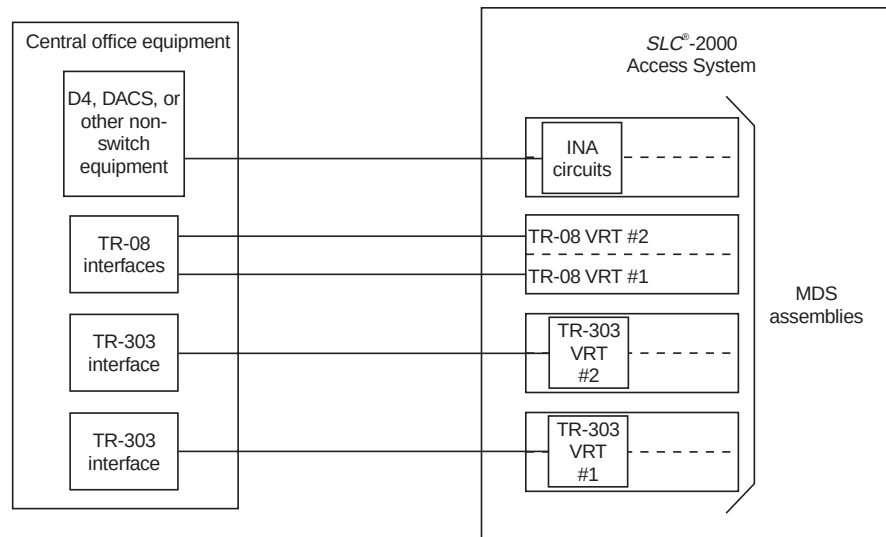
Each VRT appears to the central office switch interface to be a complete DLC system independent of any other VRTs in the physical system/terminal. Similarly, each VCOT appears to the RT interface to be a complete system.



The virtual terminal concept supports grooming of nonlocally switched and nonswitched special services, bandwidth shedding (FITL only), and time slot assignment for efficient use of feeder resources. The *SLC-2000* Access System provides a total bandwidth management capacity of 28 feeder DS1s. This capacity can be allocated differently based on the software release being used.

- **Releases 3.1, 3.2, and 3.3.** The system supports up to eight TR-08 VRTs and/or up to 28 INA DS1 facilities, not to exceed the total system feeder capacity of 28 DS1s.
- **Releases 4.0 and 4.1.** The system supports up to eight TR-08 VRTs, one TR-303 VRT, up to 28 INA DS1 facilities, or any combination of these, not to exceed the system feeder capacity of 28 DS1 feeders.
- **Releases 4.2 and later.** The system supports up to eight TR-08 VRTs, up to two TR-303 VRTs, up to 28 INA DS1 facilities, or any combination of these, not to exceed the system feeder capacity of 28 DS1 feeders.

Figure 2-4 shows a typical mixture of modes supported by a *SLC-2000* system. In the figure, the *SLC-2000* system supports two 192-line TR-303 VRTs, two 96-line TR-08 VRTs, and eight INA DS1s (192 DS0s).



**Notes:**

1. VRTs and INAs are not necessarily associated with specific MDS assembly shelves. Virtually any DS0 interfacing the system can be cross-connected to any VRT or INA.
2. See "T0 Cross-Connect/Checkerboarding Restrictions" in Chapter 3 for cross-connect restrictions.

mixmode.eps

**Figure 2-4. Mixed Mode System**

A TR-08 VRT may be configured for either Mode 1 (nonconcentrated) or Mode 2 (2:1 concentrated) operation; Mode 1 requires 4 feeder DS1s to be assigned for each 96 lines, and Mode 2 VRTs require 2 feeder DS1s to be assigned for each 96 lines. In conformance with the TR-08 specification, the TR-08 VRT line size is limited to 96 lines. The mode of the TR-08 VRT must be set the same for each pair of VRTs associated with an MDS assembly; however, with Release 4.0 and later, any channel on the MDS assembly may be cross-connected (checkerboarded) into the TR-303 VRT. Also, if VRT 7 is set to Mode 1, VRT 8 will not be accessible for TR-08 use (VRTs 7 and 8 must both be set for TR-08 Mode 2).

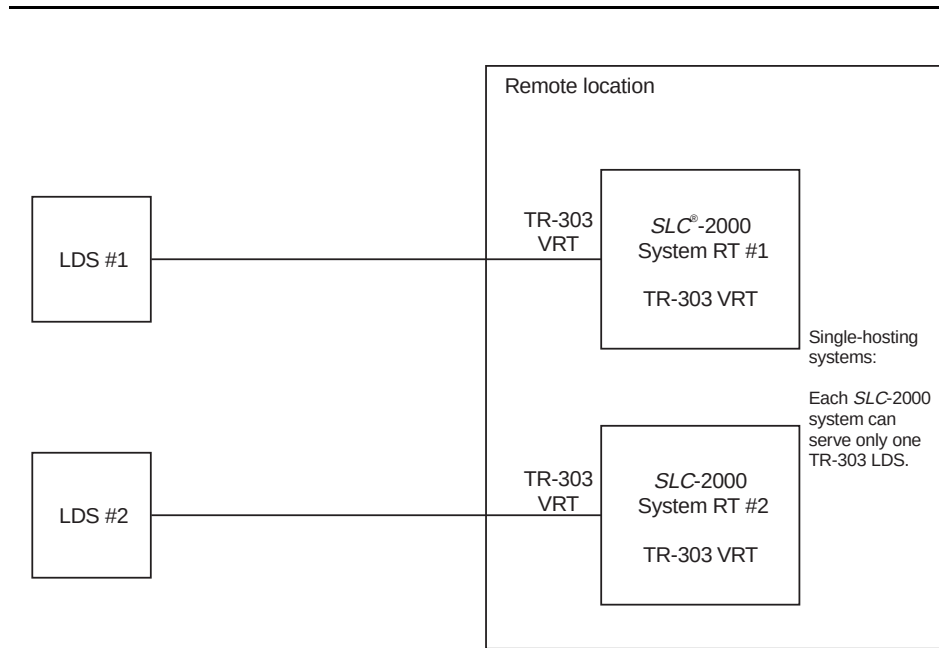
In a Mode 2 TR-08 VRT, a channel is associated with a feeder time slot and a physical switch termination only when there is an active call. Per-call concentration eliminates the need to dedicate feeder time slots to each individual caller on a full-time basis. This provides a 2:1 savings in facility costs over Mode 1. In integrated applications, it also provides a 2:1 savings in switch interfaces.

For Releases 4.0 and 4.1, the *SLC-2000* Access System allows the configuration of one TR-303 virtual remote terminal (VRT). Release 4.2 and later adds the capability to support up to two TR-303 VRTs. Figure 2-5A shows a remote location that must contain two *SLC-2000* systems to serve two TR-303 LDSs. Since each RT contains only one TR-303 VRT, two RTs are required. Software Release R4.2 or later allows you to configure *two* TR-303 VRTs in the same *SLC-2000* RT. The two TR-303 systems interfacing with the two *SLC-2000* VRTs can be configured to provide from 1 to 767 lines each; however, the total number of lines for both systems cannot exceed the 768 line capacity of the *SLC-2000* system. Figure 2-5B shows one *SLC-2000* system serving two TR-303 LDSs by using 2 VRTs. In this example, VRT #1 is configured as a 384-line VRT and VRT #2 is configured as a 384-line VRT. The concentration ratio for the TR-303 VRT must be engineered (see Chapter 8) and varies depending on the number of feeder DS1s supporting the TR-303 VRT. The line size of the TR-303 VRT may range from one subscriber line to the maximum number shown in Table 2-1 on page 2-20 depending on the type of distribution and the software release. Full access concentration with no internal blocking is provided onto available time slots on the feeder DS1s associated with the VRT. In the TR-303 mode, a minimum of 2 feeder DS1s can be engineered to a maximum of 28 feeder DS1s.

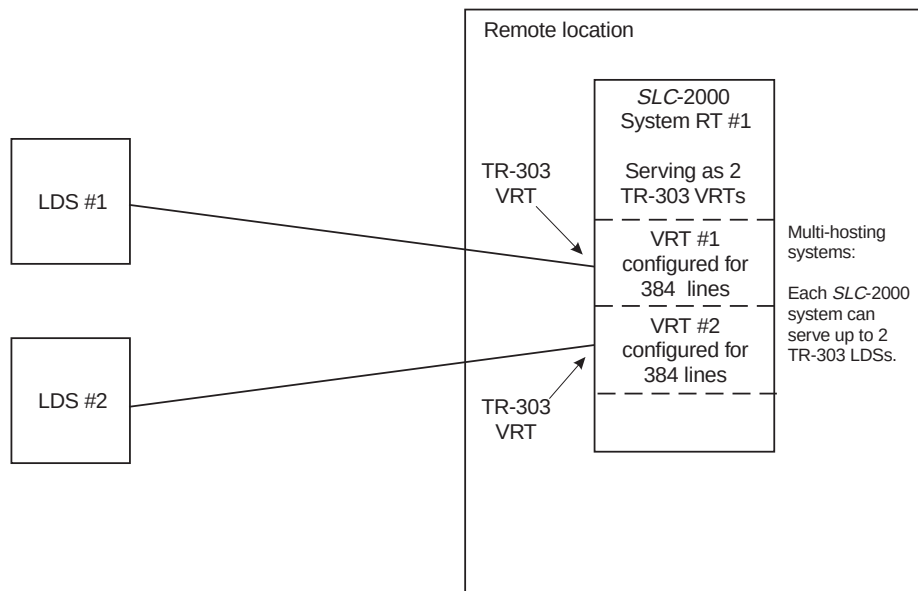


**NOTE:**

Bellcore documentation refers to *multihosting* as *multiple interface groups*.



**A. Release 4.0 and 4.1 Single-Hosting Systems**



**B. Release 4.2 and Later Multi-Hosting Systems**

singmult.eps

**Figure 2-5. Single and Multihosting of TR-303 Configurations**

**Table 2-1. SLC-2000 RT Distribution**

| <b>SLC-2000 RT<br/>Software Release</b> | <b>Type of Distribution<br/>(Note)</b>                | <b>Maximum Number of Lines<br/>Served by an RT</b> |                                     |
|-----------------------------------------|-------------------------------------------------------|----------------------------------------------------|-------------------------------------|
|                                         |                                                       | <b>POTS/Special<br/>Service Lines</b>              | <b>ISDN Lines<br/>(TR-303 Only)</b> |
| R3.2 or earlier                         | Metallic or FITL Distribution or<br>a Mixture of both | 768                                                | —                                   |
| R4.0 or R4.1                            | Metallic Distribution Only                            | 768                                                | 384                                 |
|                                         | FITL Distribution Only                                | 768                                                | 256                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 368*                                |
| R4.2 and R4.3                           | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 768                                                | 256                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 704*                                |
| R4.4                                    | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 768                                                | 320                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 712*                                |
| R4.5 and Later                          | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 1152                                               | 480                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 1104†                                              | 732*                                |

\* Maximum number of ISDN lines is figured with seven shelves provisioned for metallic distribution and one shelf provisioned for FITL distribution.

† Maximum number of POTS or Special Services lines is figured with seven shelves provisioned for FITL distribution and one shelf provisioned for metallic distribution.

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Also, for Release 4.0 or later, the SLC-2000 Access System allows a mixed configuration of TR-08 VRTs and the TR-303 VRT. As an extension of the checkerboarding capability in Releases 3.1 and 3.2, flexibility is provided to assign channel circuits to the desired TR-08 Mode 1 or TR-303 VRT (checkerboarding is not allowed into a TR-08 Mode 2 VRT although it is possible to electronically groom a physical line from a TR-08 Mode 2 VRT logical line to an INA, TR-08 Mode 1, or TR-303 VRT logical line. It is also possible to checkerboard a physical line from a TR-08 Mode 2 VRT logical line to an INA.). The VRTs are defined by the cross-connections established between the channel circuits and the logical VRT. In Release 4.2 or later, this capability has been expanded to support two TR-303 VRTs.

More detailed information about bandwidth management is included in Chapter 3, "System Configurations and Applications."

### **Time Slot Interchange (TSI)**

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The central component of the bandwidth management section is a full access time slot interchange (TSI) function that operates across the full line capacity of the terminal for metallic distribution (and/or fiber distribution at the host digital terminal). Using TSI, bandwidth management applications can be supported as follows:

- Electronic grooming of nonswitched and nonlocally switched special services from any Mode 1 or Mode 2 TR-08 VRT or TR-303 VRT to INA digroups
- Bandwidth shedding of unassigned bandwidth in fiber-in-the-loop (FITL) configurations
- Electronic grooming of any TR-08 Mode 1 or Mode 2 VRT distribution time slot to any other TR-08 Mode 1 VRT facility time slot
- Checkerboarding capability to electronically cross-connect any of the physical subscriber line appearances with any of the logical line terminations on any of the Mode 1 TR-08 VRTs or on the TR-303 VRTs (Release 4.0 or later)
- Support of TR-303 ISDN D-channel quarter time slot packing using 4:1 time-division multiplexing (TDM) (Release 4.0 or later).

### **TR-303 Interface**

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Release 4.0 or later of the SLC-2000 Access System supports the TR-303 interface. It provides the following channels:

- **Time Slot Management Channel (TMC):** The TMC is used for call control. When operating in the TR-303 configuration, the SLC-2000 Access System supports hybrid signaling as defined in the TR-303 standard. The TMC is used to assign DS0s to customer line terminations on a per-call basis, and ABCD channel signaling codes are used for supervision once a call is established (that is, the DS0 is assigned). When a call is to be cleared, the TMC is also used to clear the DS0 assignment.
- **Embedded Operations Channel (EOC):** The EOC is used for transporting operations messages. It supports the provisioning, maintenance, and administration functions of the TR-303 VRT.

Both the EOC and TMC require two DS0s each to provide an active path and a standby path.

The TR-303 capabilities of Release 4.0 or later support TMC and EOC data link protocol and messages for the large-line size RT as defined in 235-900-308<sup>\*</sup>. Release 4.0 or later supports remote operations service element/common management information service element (ROSE<sup>†</sup>/CMISE<sup>‡</sup>) operations encoded in abstract syntax notation (ASN.1<sup>§</sup>) basic encoding rules over the EOC data link. ROSE/CMISE messages are supported as necessary also over the TMC data link.

The SLC-2000 Access System supports CMISE message service for defined system objects<sup>¶</sup> from a database in memory. ROSE and CMISE service messages, using ASN.1, provide the following application message types: M-CREATE, M-DELETE, M-SET, M-GET, M-ACTION, and M-EVENT REPORT. The capabilities supported over the EOC data link are as follows:

- Provisioning of analog and ISDN line terminations
- Semipermanent time slot assignment of ISDN D channels
- Semipermanent time slot assignment for special services
- Circuit testing primitives:
  - Connect loop-around access
  - Connect split out access
  - Connect test response circuit
  - Operate termination
  - Release test response circuit
  - Disconnect test access
  - Reset timer
  - Loop around to diagnose the test access path (TAP)
  - Release loop-around.
- Path switching of TMC and EOC data links, initiated by LDS request, by the SLC-2000 RT when a problem with the active data link is detected, or by the user via the CIT

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\* Issue 3.00, January 1993, **5ESS** Switch Integrated Digital Carrier Unit TR-TSY-000303 Interface Specification.

† International Organization for Standardization ISO/IEC/DIS 9072-1.2, 1989, *Draft International Standard - Information Processing Systems - Text Communication - Remote Operations - Part 1: Model, Notation and Service Definition*.

‡ International Organization for Standardization ISO/IEC 9595, 1991, *International Standard - Information Processing Systems - Open Systems - Interconnection - Common Management Information Service Definition - ISO/IEC 9595*.

§ CCITT Recommendation X.208, 1988, *Specification of Abstract Syntax Notation (ASN.1)*.

¶ Bell Communications Research, Inc., "IDLC System Generic Requirements, Objectives, and Interface: Operations (ROS/CMIS/ASN.1) Messages Release 1.0", TR-TSY-000303, Supplement 3, Issue 1, March 1990, Revision 1, August 1992.

- Autonomous reporting of equipment, environmental, memory, data link, and feeder alarms
- Autonomous reporting of service state changes of analog and ISDN line terminations when problems are detected within the *SLC-2000* RT
- Retrieval of DS1 and ISDN performance monitoring counts
- Provisioning of DS1 and ISDN performance monitoring alert thresholds
- Autonomous reporting of DS1 and ISDN alert threshold crossings
- ISDN line maintenance [loopbacks and corrupted cyclic redundancy code (CRC)].

As stated earlier, Release 4.2 or later software allows the system to support up to two TR-303 VRTs. The systems with two TR-303 VRTs differ from the earlier single TR-303 system as follows:

- ***Autonomous Corrupt Memory Alarm.*** The autonomous corrupt memory alarm has been changed to an event report with a warning.
- ***RT Time-of-Day Clock.*** The RT time-of-day clock can only be set from the VRT #1 EOC interface to the LDS (Figure 2-5). The system will reject requests to set the time-of-day clock from the LDS hosting VRT #2. This means that in a single TR-303 VRT configuration, VRT #1 must be turned up to ensure synchronization of the RT clock with the LDS.
- ***Data Link and DS1 Alarms.*** As with a single TR-303 VRT, all alarms in the system are sent to both LDSs using the EOC channels except the TR-303 data link and DS1 alarms. These alarms are only sent to the host associated with the alarmed DS1 or data link.

## **Flexible RT Metallic and FITL Distribution Options**

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### **Modular Architecture for Metallic and Fiber Distribution**

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The *SLC-2000* Access System architecture is highly modular, allowing for economical start-up and growth configurations, thus minimizing the initial system cost. The *SLC-2000* Access System supports up to four MDS assemblies and, at the RT, one or two high-density optics shelves (HDOS) (one HDOS per two MDS assemblies) within a single system. This allows the system to support the number of lines shown in Table 2-1 on page 2-20 depending on the software release and the type of distribution. When fed by a SONET feeder, it also supports up to 28 DS1 rate pipes, one DS3 pipe, or one EC-1 (STS1E) interface in the maximum configuration.

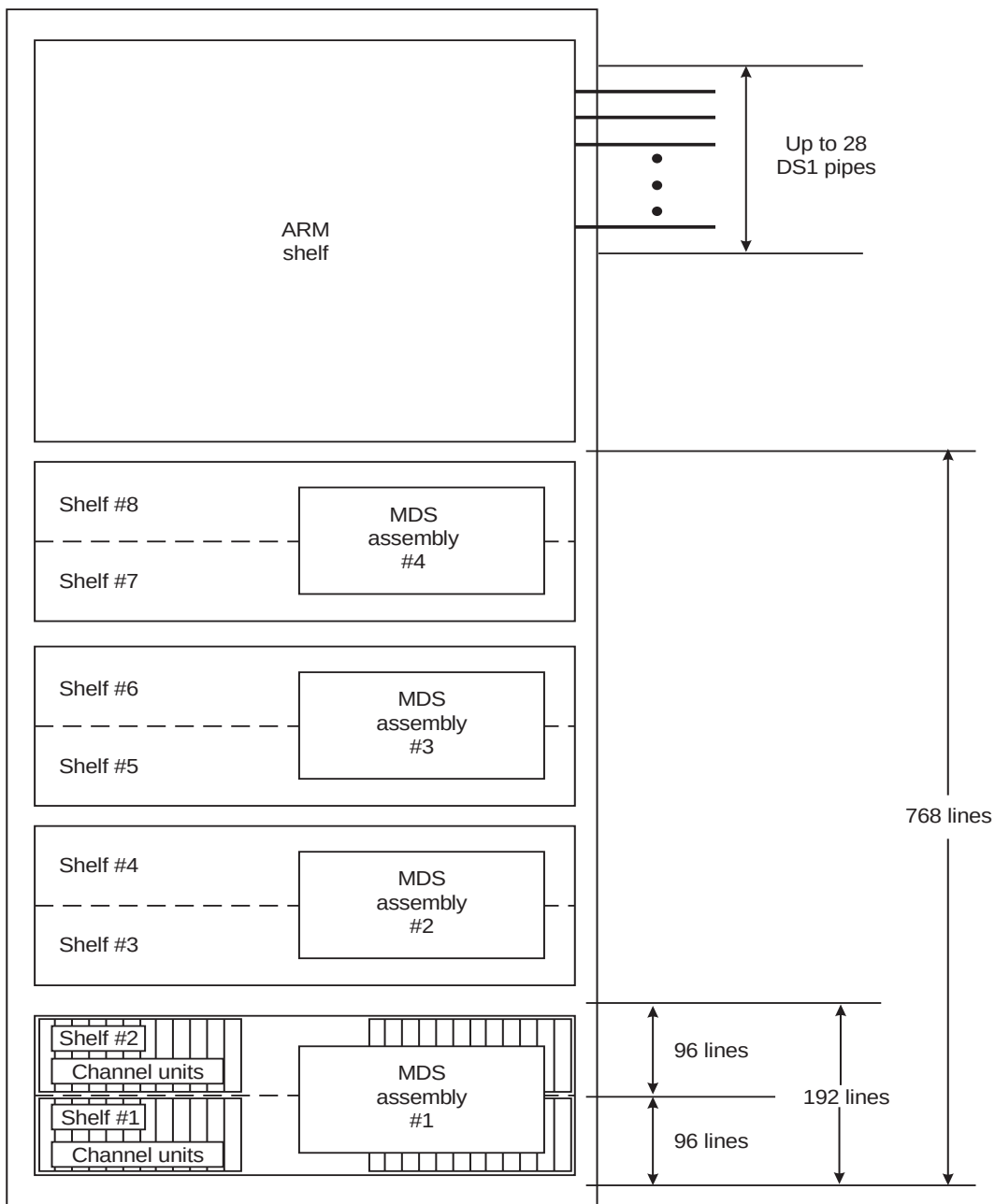
Depending on the software release and the type of distribution, you can configure the *SLC-2000* equipment to support the following customer lines:

- **Release 4.4 or Earlier with Metallic and/or FITL Distribution.** Figure 2-6 on page 2-26 shows the *SLC-2000* system distribution to the customer for Software Release 4.4 or earlier. The maximum line size is 768 lines for metallic and fiber distribution. Each MDS assembly supports up to 192 lines with each shelf of the assembly supporting 96 lines. Each 96-line shelf is further divided into two 48-line quadrants. Each 48-line quadrant contains a metallic distribution controller (MDC) that controls the quadrant and interfaces the customer lines to the ARM shelf. A flexible slot architecture (any service/any physical slot) is supported, avoiding channel unit slot equipment restrictions for most services.



- **Release 4.5 or Later with Metallic Distribution Only.** Figure 2-6 shows the *SLC-2000* metallic *only* distribution to the customer for Software Release 4.5 or later. The maximum line size is 768 lines. Each MDS assembly supports up to 192 lines with each shelf of the assembly supporting 96 lines. Each 96-line shelf is further divided into two 48-line quadrants. Each 48-line quadrant contains a metallic distribution controller (MDC) that controls the quadrant and interfaces the customer lines to the ARM shelf. A flexible slot architecture (any service/any physical slot) is supported, avoiding channel unit slot equipment restrictions for most services.
- **Release 4.5 or Later with the Enhanced FiberReach/MSDT Feature.** Figure 2-7 shows the *SLC-2000* system distribution to the customer with the Enhanced FiberReach/MSDT feature (Release 4.5 or later). This feature requires TR-303 switch interface. The maximum line size is 1152 lines for FITL distribution. Each MDS assembly supports up to 288 lines with each shelf of the assembly supporting 144 lines. Each 144-line shelf is further divided into two 72-line quadrants that can contain DT-Servers configured as follows:
  - Up to three 24-line DT servers
  - Up to four 12-line DT Servers and a 24-line DT Server
  - Up to five 12-line DT Servers (*SPQ809* or *SPQ810* Server with Software Release R4.5 or later)
  - Up to six 12-line DT Servers (requires *SPQ811* DT Server and Software Release R4.6 or later).

Each 72-line quadrant contains a metallic distribution controller (MDC) that controls the quadrant and interfaces the customer lines to the ARM shelf.



dist.eps

**Figure 2-6. SLC-2000 System Distribution to the Customer**

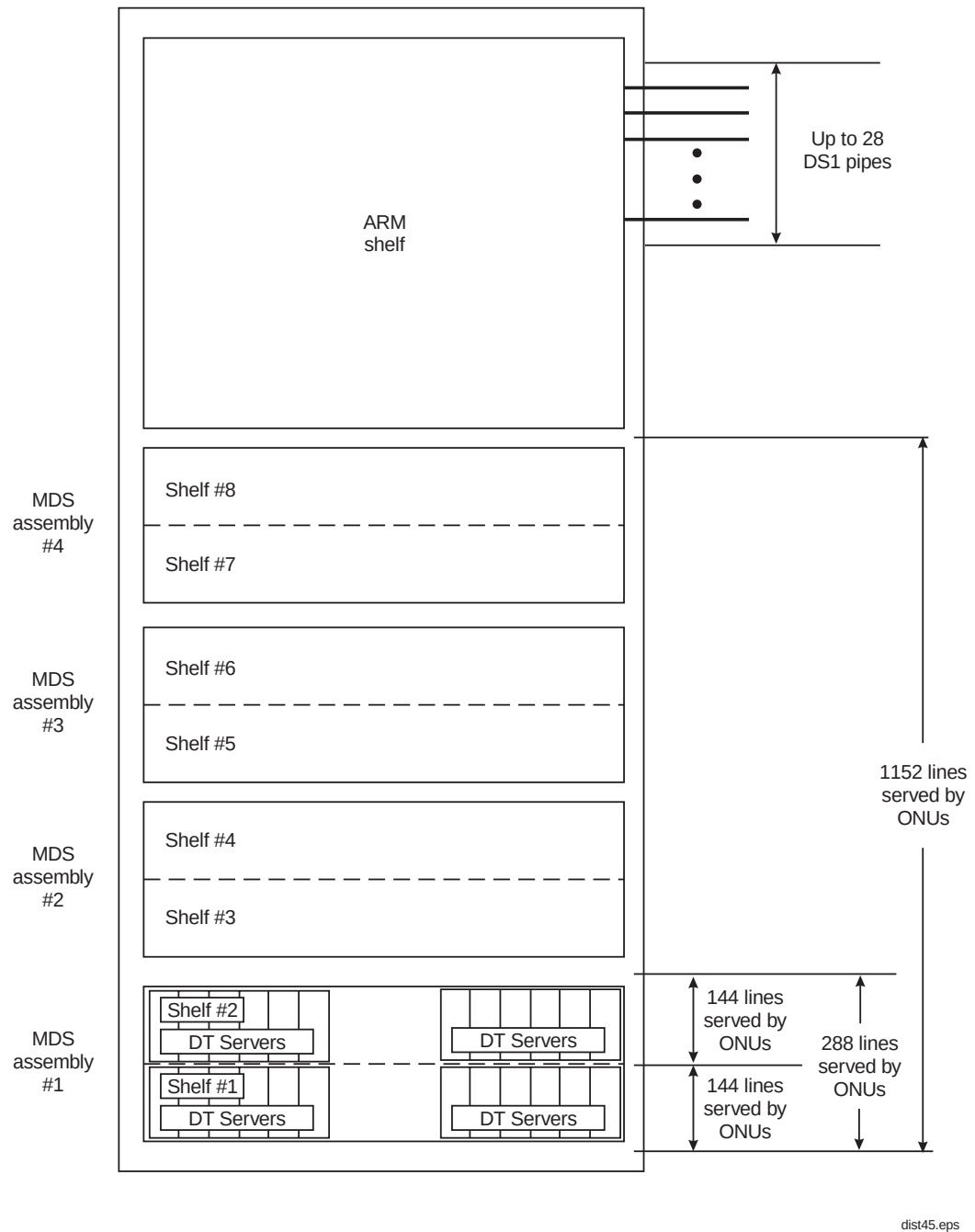


**Figure 2-7. SLC-2000 System Distribution to the Customer with Enhanced FiberReach/MSDT Feature (Release 4.5 or Later with FITL Distribution)**

## FITL Distribution

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You can configure the *SLC-2000* Access System RT as a *host digital terminal* (HDT). The HDT can “extend” its metallic distribution capabilities to one or more *optical network units* (ONUs) at a different location closer to the customer. Depending on the software release, the *SLC-2000* system can support two types of ONUs:

- **Release 2.0 and later** — *SLC-2000 Multi-Services Distant Terminal* (MSDT)
- **Release 4.3 and later** — DDM-2000 FiberReach Narrowband Shelf (NBS) and the *SLC-2000* MSDT.



**NOTE:**

ONUs are usually hosted by HDTs using *optical* feeders. But for the purposes of this document, an ONU can occasionally be hosted by an HDT connected to the ONU over a metallic feeder such as a T1 facility.

Figure 2-8, Figure 2-9, and Figure 2-10 show some basic configurations of the *SLC-2000* HDT “feeding” an ONU. The HDT “extends” its metallic distribution capabilities to the ONU with special circuit packs called *MSDT or DT Servers*. These circuit packs replace the channel units in an MDS assembly shelf configured to serve an ONU. However, each quadrant, or MDC, of an MDS assembly can still serve or extend a maximum of 48 lines in systems using Software Release 4.4 or earlier. In systems using the Enhanced FiberReach/MSDT feature (Release 4.5 or later), it can serve or extend 72 lines. Chapter 8 gives the MDS assembly slot restrictions for the MSDT or DT Servers.

## Software Release 2.0 or Later

Software Release 2.0 or later supports a point-to-point fiber-in-the-loop (FITL) architecture. When configured for FITL, the *SLC-2000* RT serves as the HDT and is connected to a *SLC-2000* MSDT which serves as the ONU. An HDT can “feed” an ONU using single-mode fiber links or metallic feeders. A *SLC-2000* HDT can support up to thirty-two 24-line MSDTs or sixty-four 12-line MSDTs or a combination of 12- and 24-line MSDTs.

The *SLC-2000* FITL feature supports the telephony services to subscribers that are available with metallic distribution, including special services. The *SLC-2000* MSDT is compatible with existing *SLC* Series 5 channel units, as well as most of the new *SLC-2000* Access System *SPQ-type* channel units.



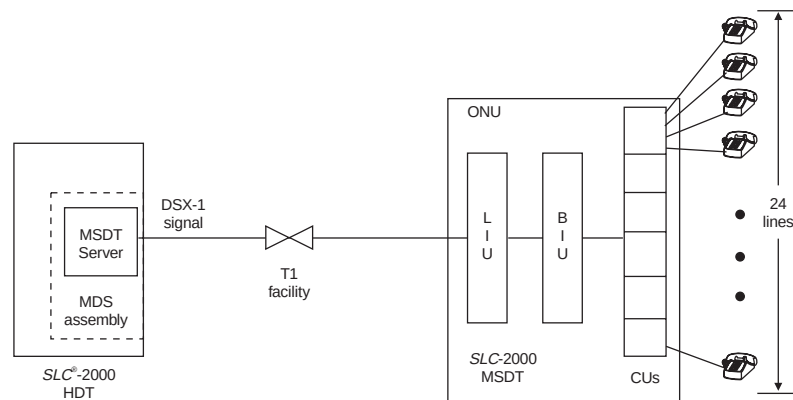
**NOTE:**

The following examples explain the basic signal paths starting at the *SLC-2000* HDT and ending at the channel unit slots in the ONU.

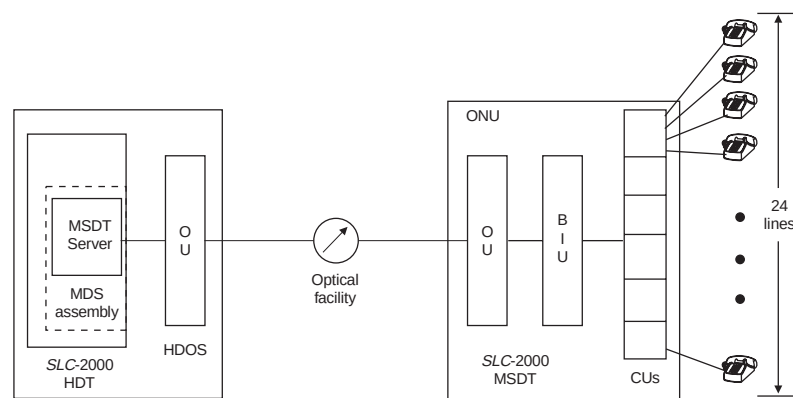
Figure 2-8A shows an HDT “feeding” a basic 24-line MSDT ONU over a T1 facility with a DSX-1 signal. The MSDT Server in the HDT is configured to send a DSX-1 signal to the MSDT. At the ONU, the DSX-1 signal interfaces the MSDT using a

line interface unit (LIU) circuit pack. The signal then goes to the bank interface unit (BIU) where it is broken down for the individual channel slots. Each of the six channel slots can contain a *quad* channel unit serving four individual customer lines.

Figure 2-8B shows an HDT “feeding” a basic 24-line MSDT ONU over an optical facility. The MSDT Server in the HDT is configured to send an optically-compatible RS-422 electrical signal to the optical unit (OU) in the HDOS. The OU converts the electrical signal to an optical signal and sends it to the MSDT. At the the MSDT, an OU receives the optical signal and converts it back into an electrical signal. The signal then goes to the BIU where it is broken down for the individual channel slots. Each of the six channel slots can contain a *quad* channel unit serving four individual customer lines.



A. Basic 24-Line MSDT Configuration With Metallic Feeder



B. Basic 24-Line MSDT FITL Configuration

msdt.eps

**Figure 2-8. Basic SLC-2000 HDT-to-MSDT ONU Configurations**

### Software Release 3.2 or Later

For Release 3.2 or later, the *SLC-2000* FITL feature with the MSDT includes the following:

- A low-power quad POTS channel unit (*SPQ909*) that is TR-909\* compliant
- Compatibility with most *SPQ-type* channel units for special services
- Expanded data applications with the AUA200 [switched 2-wire 56-kb/s data services unit (DSU)] and AUA232 (EIA RS-232 interface) channel units
- DC alarm applications via Tollgrade's *MCU-5205* channel unit
- Software download capability from the HDT and compatibility with future RT/HDT upgrades (requires the *SPQ809* MSDT Server in the HDT).

### Software Release 4.0 or Later

For Release 4.0 or later, capabilities added to the MSDT include the following:

- The use of the AUA94 channel unit that uses 4:1 time-division multiplexing (TDM) of the D-channels for ISDN BRI (2B+D channel) service (MSDTs operating in TR-303 mode only)
- DSX-1 feeder interface (via the fiber services module)
- *SPQ809* MSDT Server for remote inventory.

Benefits to your company include reduced maintenance, administration, and rearrangement costs, and the availability of special services using FITL.

### Software Release 4.3 (DDM-2000 FiberReach Narrowband Shelf)

Software Release 4.3 allows the *SLC-2000* system to host the DDM-2000 FiberReach Narrowband Shelf (NBS) as an ONU. The *SLC-2000* RT/HDT continues to provide all the features and services supported in Release 4.2 and earlier. This also includes support of the *SLC-2000* MSDT.

When hosting the NBS as an ONU, the system uses the *virtual-MSDT* (V-MSDT) concept. For Release 4.3, the V-MSDTs in the NBS support two DSX-1 feeder signals and a limited number of channel units and services (described later in this part).

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\* Bellcore Technical Reference TR-NWT-000909, Issue 1, December 1991, *Generic Requirements and Objectives for Fiber in the Loop Systems*.

### Virtual-MSDT (V-MSDT) Concept

In Software Release 4.3, the *SLC-2000* system can host a 48-line DDM-2000 FiberReach Narrowband Shelf (NBS) as the ONU. By using the *virtual MSDT* (V-MSDT) concept, the user notices very few changes when the HDT is hosting an NBS instead of a *SLC-2000* MSDT of earlier software releases.

⇒ **NOTE:**  
The *SLC-2000* HDT continues to host the *SLC-2000* MSDT as in earlier software releases.

Figure 2-9 and Figure 2-10 show the V-MSDT concept. The 48-line NBS is actually divided into two 24-line shelves (Shelf #1 and Shelf #2 in the figure). Each 24-line shelf has its own dedicated MSDT Server at the HDT just as each *SLC-2000* MSDT has its own dedicated Server. In the figure, Server A hosts V-MSDT A and Server B hosts V-MSDT B. Thus, the *SLC-2000* HDT thinks it is actually hosting two 24-line MSDTs. All alarms and reports sent to the HDT actually show information about the 24-line V-MSDT.

⇒ **NOTE:**  
The V-MSDT concept also supports 12-line V-MSDTs if you have its MSDT Server configured for 12-line service.

⇒ **NOTE:**  
Release 4.3 does not support DS1 performance monitoring for the NBS.

### Narrowband Shelf Channel Units (Release 4.3)

*SLC-2000* Software Release 4.3 supports a limited number of channel units at the DDM-2000 FiberReach NBS. These channel units include the following:

- AUA53B Coin CF channel unit
- AUA41B 4W VF CF channel unit
- AUA52B OCU Dataport, all-rate channel unit
- AUA94 Dual ISDN, ANSI U TDM channel unit
- AUA200 2-wire Switched 56 kb/s DPX channel unit
- SPQ909 Quad ALC POTS CS + OHT + CLASS CF channel unit
- SPQ400 Quad *SLC-2000* System ALC POTS CF + OHT/CLASS channel unit
- SPQ440C Quad *SLC-2000* System ALC POTS/SPOTS CF + OHT + CLSS channel unit.

See Chapter 4 for details of each service supported by the channel units.

## **Basic 48-Line NBS ONU Fed Through a DDM-2000 FiberReach Wideband Shelf**



**NOTE:**

The following examples explain the basic signal paths starting at the *SLC*-2000 HDT and ending at the channel unit slots in the ONU.

Figure 2-9 shows an HDT hosting a 48-line DDM-2000 FiberReach NBS ONU. This configuration uses the DDM-2000 FiberReach Wideband Shelf (WBS) to transmit the signal between the HDT and the ONU. As stated earlier, the NBS can contain two V-MSDTs. Therefore, to configure a complete 48-line system, the HDT MDS assemblies must contain at least two Servers to support this ONU.

In a typical configuration, each MSDT Server sends a DSX-1 signal to the WBS collocated with the *SLC*-2000 HDT. The WBS multiplexes the DSX-1 electrical signals onto an OC-1 optical ring and transmits it to the ONU. At the ONU, another WBS receives the OC-1 signal and demultiplexes it back into two DSX-1 signals and sends them to the DSXBIU in the NBS. The DSXBIU then conditions the signals to be received by the six channel unit slots being fed by the specific DSX-1 signal. Using this method, V-MSDT A (the six slots in Shelf #1) is hosted by Server A at the HDT. V-MSDT B (the six slots in Shelf #2) is hosted by Server B at the HDT. Each of the two V-MSDTs will serve up to 24 lines for a total ONU capacity of 48 lines.

In a typical configuration, the WBSs are part of an OC-1 ring. At least one WBS in the OC-1 ring must be hosted by a DDM-2000 OC-3 multiplexer or the ARM shelf of a *SLC*-2000 SONET subsystem to maintain the single ended operation capability of the SONET network.



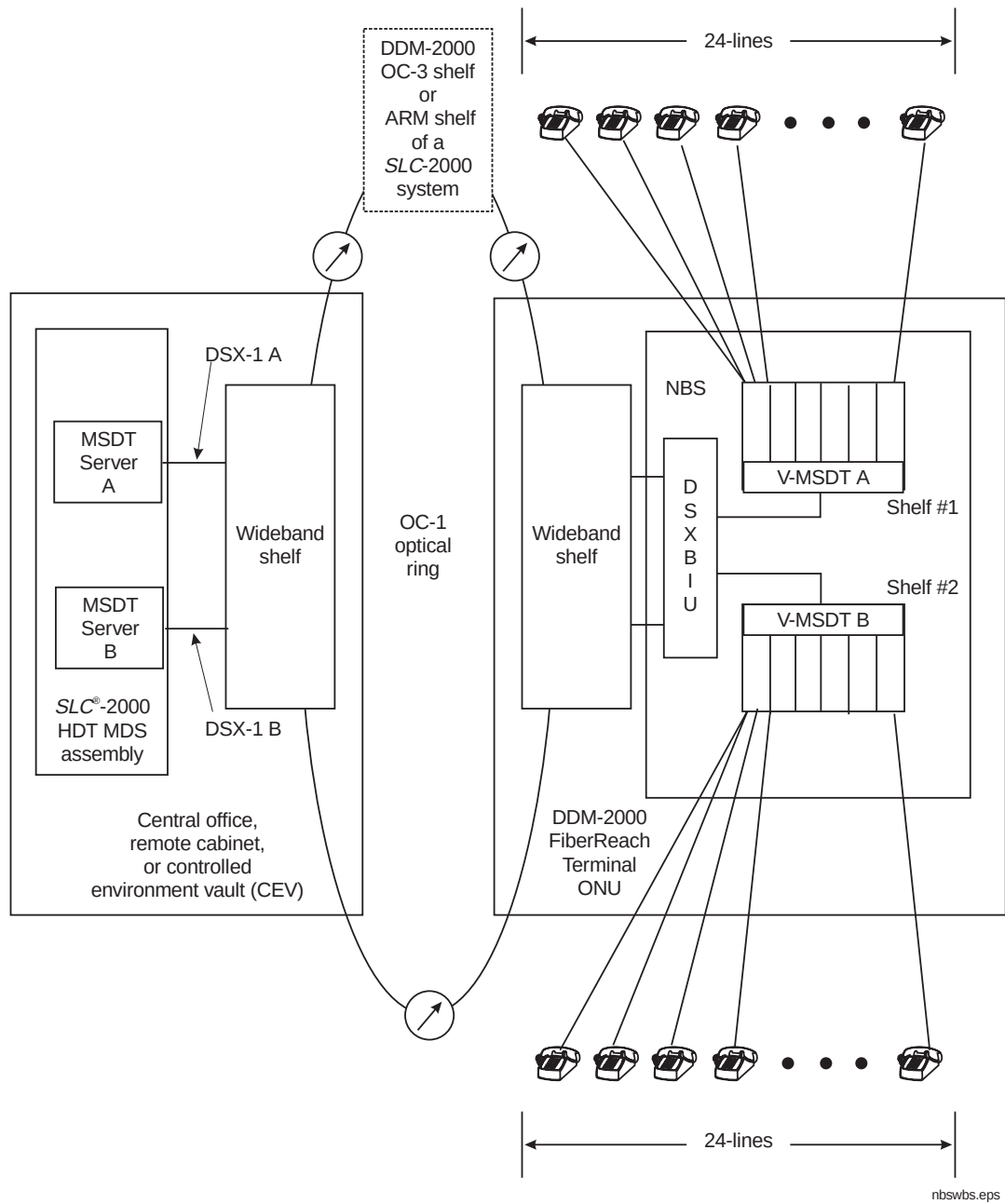


**Figure 2-9. 48-Line NBS ONU Fed Through a DDM-2000 FiberReach Wideband Shelf (Release 4.3)**

## 48-Line NBS ONU Fed Through a T1 Facility



**NOTE:**

The following examples explain the basic signal paths starting at the *SLC-2000* HDT and ending at the channel unit slots in the ONU.

Occasionally, a customer requests that the NBS be fed using metallic facilities such as an existing metallic cable pair. Figure 2-10 shows an HDT hosting a 48-line DDM-2000 FiberReach NBS ONU using a T1 facility to transmit the signal between the HDT and the ONU. As stated earlier, the NBS can contain two V-MSDTs. Therefore, to configure a complete 48-line system, the HDT MDS assemblies must contain at least two MSDT Servers to support this ONU.

Each Server sends a DSX-1 signal to a DSX cross-connect collocated with the *SLC-2000* HDT. From the DSX cross-connect, the DSX-1 signals are sent to the ONU using a T1 facility. At the ONU, the DSX-1 signals leave the T1 facility and usually terminate on a DSX connector where they are connected to the DSXBIU. The DSXBIU then conditions the signals to be received by the six channel unit slots being fed by the specific DSX-1 signal. Using this method, V-MSDT A (the six slots in Shelf #1) is hosted by Server A at the HDT. V-MSDT B (the six slots in Shelf #2) is hosted by Server B at the HDT. Each of the two V-MSDTs will serve up to 24 lines for a total ONU capacity of 48 lines.

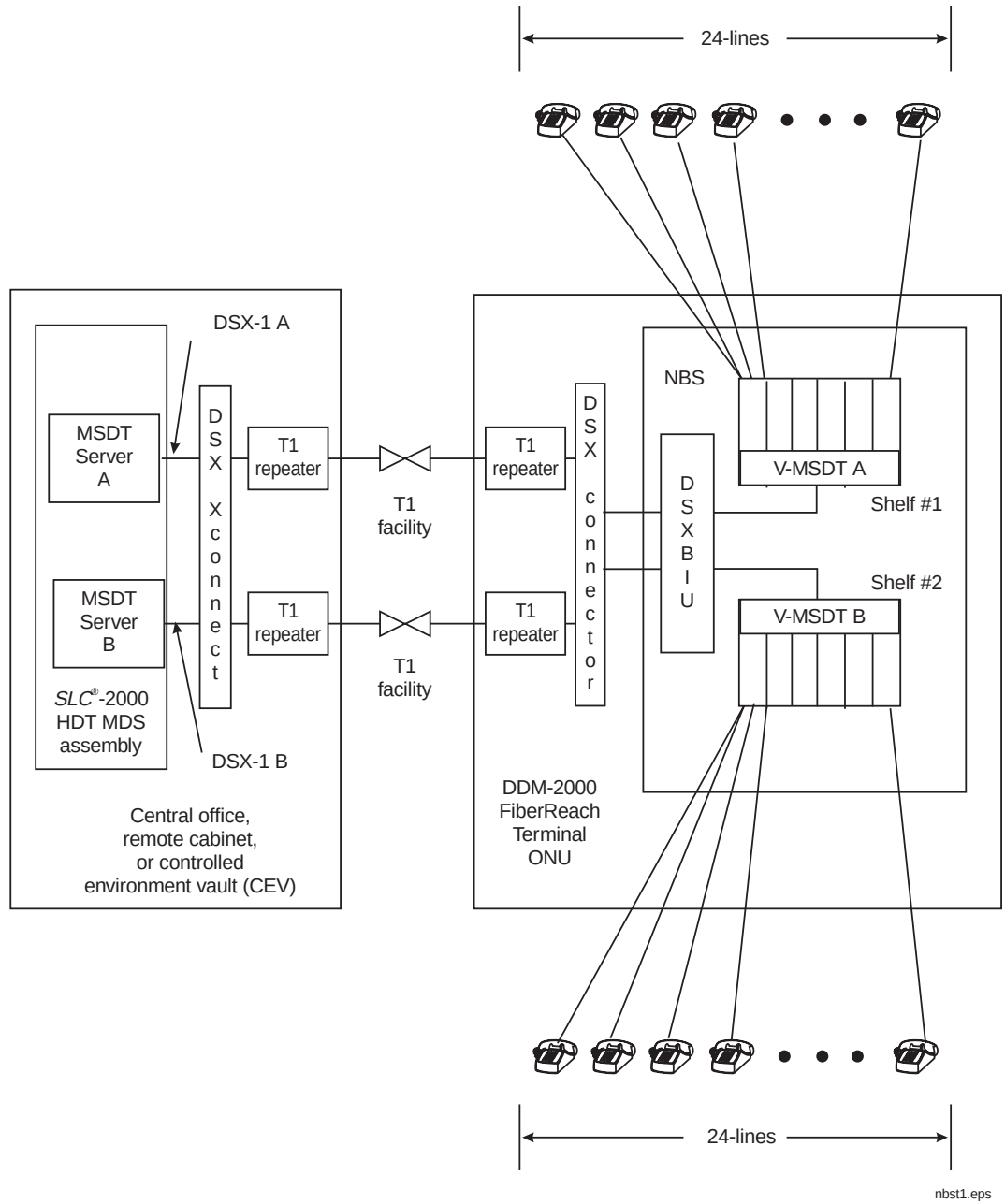


**Figure 2-10. 48-Line NBS ONU Fed Through a T1 Facility (Release 4.3)**

## Software Release 4.4 or Later

Software Release 4.4 allows the *SLC-2000* HDT to support updated features at the *DDM-2000 FiberReach* NBS plus all the features available in Release 4.3. Release 4.4 allows you to provision the *DSX-1* signals terminating on the NBS to one of the following two Modes:

- **Quad Mode:** This mode is similar to the service provided with Release 4.3 where a single server can feed a 6-slot V-MSDT for 24-line service. This configuration is optimized for supporting up to 24 POTS or special service lines per V-DT. However, as shown in Figure 2-11, the Servers at the HDT are now DT Servers and the shelves in the NBS are divided into two V-DTs. The HDT can host the NBS through either an optical feeder (Figure 2-11, Figure 2-12, or Figure 2-13) or a metallic feeder.
- **Octet Mode:** This mode allows you to further divide each shelf of the NBS in half to form four 3-slot quadrants. These three slots can support up to 24 DS0s. The octet mode is optimized for supporting up to 10 ISDN lines per V-DT. Figure 2-14, Figure 2-15, and Figure 2-16 show typical NBS configurations in the octet mode.



### NOTE:

**Virtual-Distant Terminal (V-DT) Concept.** For Software Release 4.4 and later, the system uses the *V-DT* concept instead of the V-MSDT concept of Release 4.3. A V-DT configured for the quad mode of operation will permit up to 24 POTS or special service lines, or up to 8 ISDN lines along with 6 POTS or special service lines for each of the two 6-slot V-DTs. A V-DT configured for the octet mode of operation will permit up to 12 POTS or special service lines or up to 10 ISDN lines for each of the four 3-slot V-DTs.

Whether using the quad mode or the octet mode, the *SLC-2000* system can interface the NBS by either of the following methods:

- ***Metallic Method.*** This method is shown in Figure 2-10 on page 2-35.
- ***Optical Method.*** There are a number of different ways to optically interface the NBS to the *SLC-2000* host depending upon your needs and the vintage of the *SLC-2000* equipment in your network:
  - ***SLC-2000 HDT with DSX-1 Metallic or SONET CO Interface Feeders (Collocated WBS or DDM-2000 OC-3 shelf):*** Figure 2-11 and Figure 2-14 show a *SLC-2000* system using a collocated WBS interfacing with a NBS through an OC-1 ring. The collocated WBS could also be replaced by a DDM-2000 OC-3 shelf. The WBSs in the ring must be hosted by a DDM-2000 OC-3 shelf (whether collocated or at a different location) or the ARM shelf of a *SLC-2000* system to maintain the single ended operation capability of the SONET network. If the WBSs are hosted by the ARM shelf of a *SLC-2000* system, Function Group C contains 27G2-U OLIUs to interface the OC-1 ring.
  - ***SLC-2000 HDT with DSX-1 CO Interface Metallic Feeders Only (27G2-U OLIUs in MAIN Slots):*** Figure 2-12 and Figure 2-15 show a *SLC-2000* system with DSX-1 feeders from the CO interface. This configuration requires 27G2-U OC-1 OLIUs in the MAIN slots and MXRV0s in Function Group C. DS1 low-speed circuit packs are also required in the low-speed slots. The ARM shelf must also contain SONET subsystem software release R9.1 or later. This configuration allows the system to host 2 OC-1 rings and eliminate the need for a collocated WBS. It also allows the ARM shelf to host the WBSs in the OC-1 rings eliminating the need for a separate DDM-2000 OC-3 multiplexer.
  - ***SLC-2000 HDT with SONET CO Interface Feeders (26G2-U OLIUs in Function Group C):*** As shown in Figure 2-13 and Figure 2-16, if the SONET subsystem contains Software Release R13 or later, and the ARM shelf is the J1C265AA-1, L4, you can replace the collocated WBS with 26G2-U OLIUs in Function Group C and DS1 low-speed circuit packs of the ARM shelf. This eliminates the expense of the collocated wideband shelf and also the need of a DDM-2000 OC-3 shelf to host the WBSs in the circuit. You can use this application with both DSX-1 and SONET feeders for the CO interface.



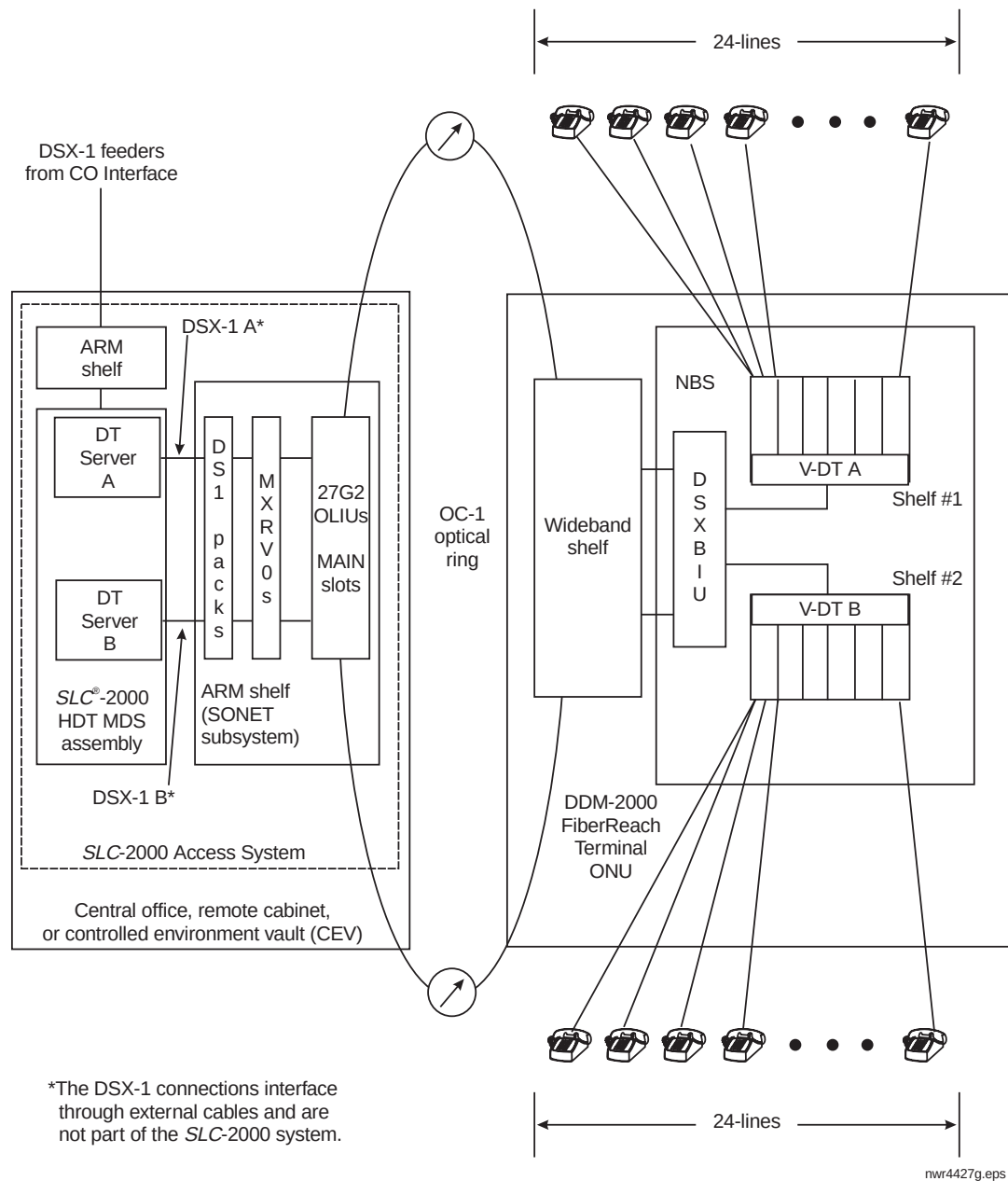
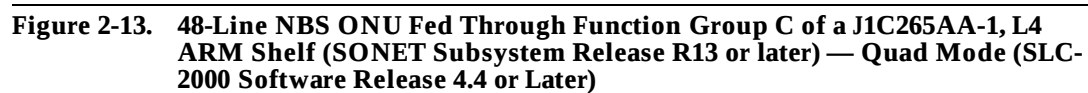


**Figure 2-12. 48-Line NBS ONU Fed Through Function Group C and 27G2-U OLIUs in the MAIN Slots — Quad Mode (Release 4.4 or Later)**





As the mode definitions show, Release 4.4 adds an *octet* mode of service. This allows the NBS ONU the capacity for 48 POTS-type lines or 40 ISDN lines with each line offering 2B+D service. However, the octet mode uses the V-DT concept. As shown in Figure 2-14, Figure 2-15, and Figure 2-16, each six-slot shelf in the NBS can be divided into two octet V-DTs to allow the NBS to contain four octet V-DTs. In the octet mode, each channel unit slot has access to eight DS0s instead of the four DS0s accessible in the quad mode. This allows the octet V-DT to contain an *SPQ494* Quad ISDN channel unit in each of the first two slots and an *AUA94* Dual ISDN unit in the third slot. A fully equipped NBS with four DSX-1 feeders provisioned for the octet mode can provide 40 ISDN lines with each line capable of 2B+D service. If the first two slots contain *SPQ494* channel units, the third slot can also contain any other channel unit compatible with the NBS.



**NOTE:**

The *SPQ494* ISDN channel unit cannot be used in the *SLC-2000* MSDT. For 2B+D ISDN service with the MSDT, use the *AUA94* channel unit.

Each three-slot 24 DS0 V-DT in the octet mode still has its own specific server at the *SLC-2000* HDT. Figure 2-14, Figure 2-15, and Figure 2-16 show the NBS provisioned for the octet mode.

## Signal Path Using ARM Shelf and Collocated WBS



### NOTE:

The following example explains the basic signal paths starting at the *SLC-2000* HDT and ending at the channel unit slots in the ONU.

Figure 2-14 shows an HDT hosting a DDM-2000 FiberReach NBS ONU with four DSX-1 feeders. This configuration uses a collocated DDM-2000 FiberReach WBS to transmit the signals on an OC-1 ring between the HDT and the ONU. As stated earlier, the NBS operating in the octet mode can contain four V-DTs. Therefore, to configure a complete system with 40 ISDN lines, the HDT MDS assemblies must contain at least four Servers to support this ONU.

In a typical configuration, each Server sends a DSX-1 signal to the WBS collocated with the *SLC-2000* HDT. The WBS multiplexes the DSX-1 electrical signals onto an OC-1 optical ring and transmits it to the ONU. At the ONU, another WBS receives the OC-1 signal and demultiplexes it back into four DSX-1 signals and sends them to the DSXBIU. The DSXBIU then conditions the signals to be received by the three channel unit slots being hosted by the specific DSX-1 signal. Using this method, V-DT A (the first three slots in Shelf #1) is hosted by Server A at the HDT. V-DT B (the first three slots in Shelf #2) is hosted by Server B at the HDT. V-DT C (the last three slots in Shelf #1) is hosted by Server C at the HDT. V-DT D (the last three slots in Shelf #2) is hosted by Server D at the HDT.

As shown in Figure 2-14, the WBSs are part of an OC-1 ring. At least one node in the OC-1 ring must be a DDM-2000 OC-3 multiplexer or function group C of the ARM shelf in a *SLC-2000* SONET subsystem to maintain the single ended operation capability of the SONET network.

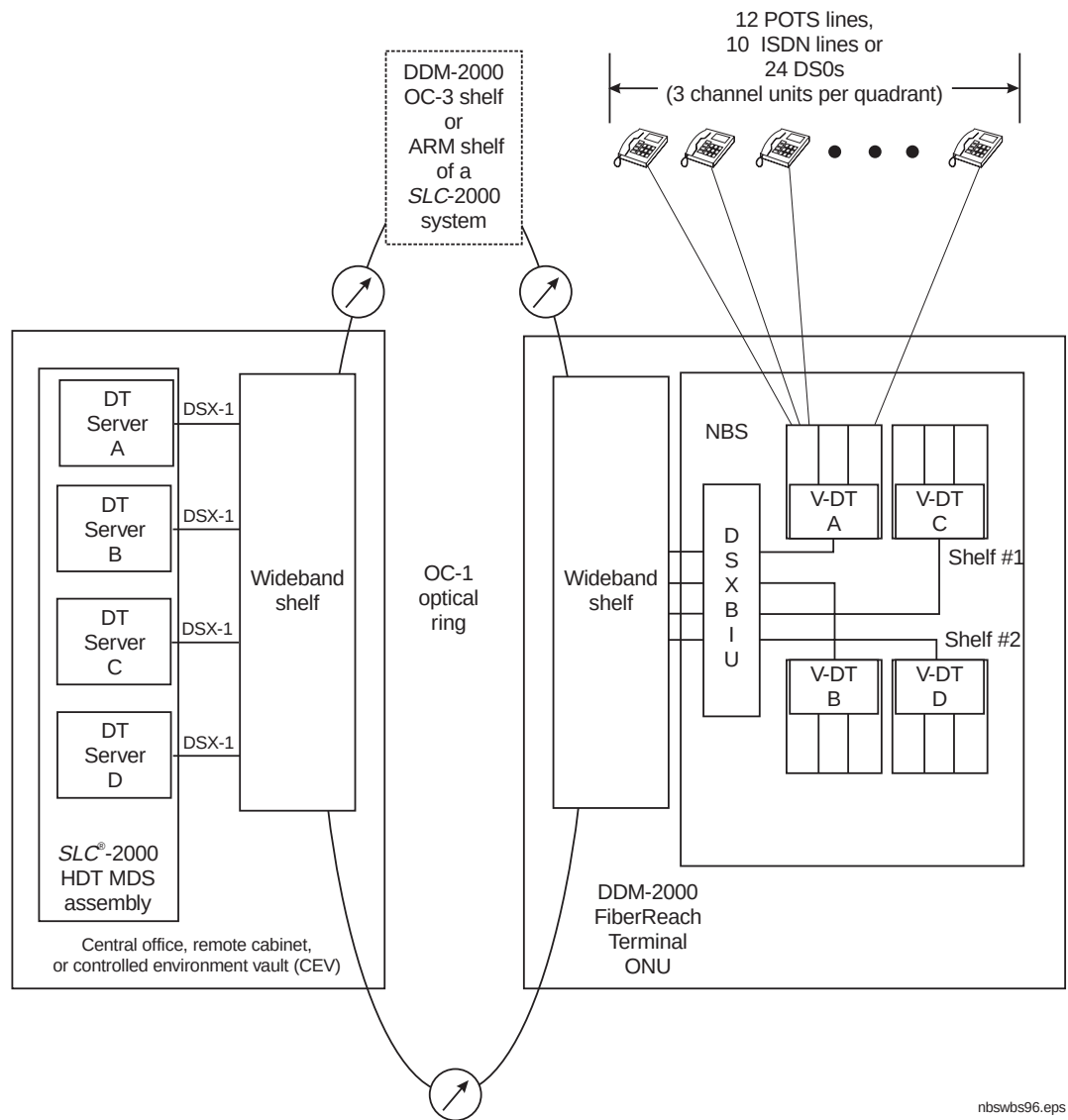


**Figure 2-14. Basic DDM-2000 FiberReach NBS ONU Configuration Operating in the Octet Mode — Collocated WBS**

### **Signal Path Using Function Group C and 27G2-U OLIUs in the MAIN Slots of the ARM Shelf**



**NOTE:**

The following example explains the basic signal paths starting at the *SLC-2000* HDT and ending at the channel unit slots in the ONU.

Figure 2-15 shows a *SLC-2000* HDT hosting a *DDM-2000* FiberReach NBS ONU with four *DSX-1* feeders. This configuration uses the *DS1* circuit packs in the low-speed slots and *MXRV0*s in Function group C along with *27G2-U* OLIUs in the MAIN slots of the ARM shelf to transmit the signal between the HDT and the ONU. You can use this configuration only when the *SLC-2000* HDT contains LIUs and is fed by *DSX-1* metallic feeders. The ARM shelf must contain SONET subsystem software R9.1 or later.



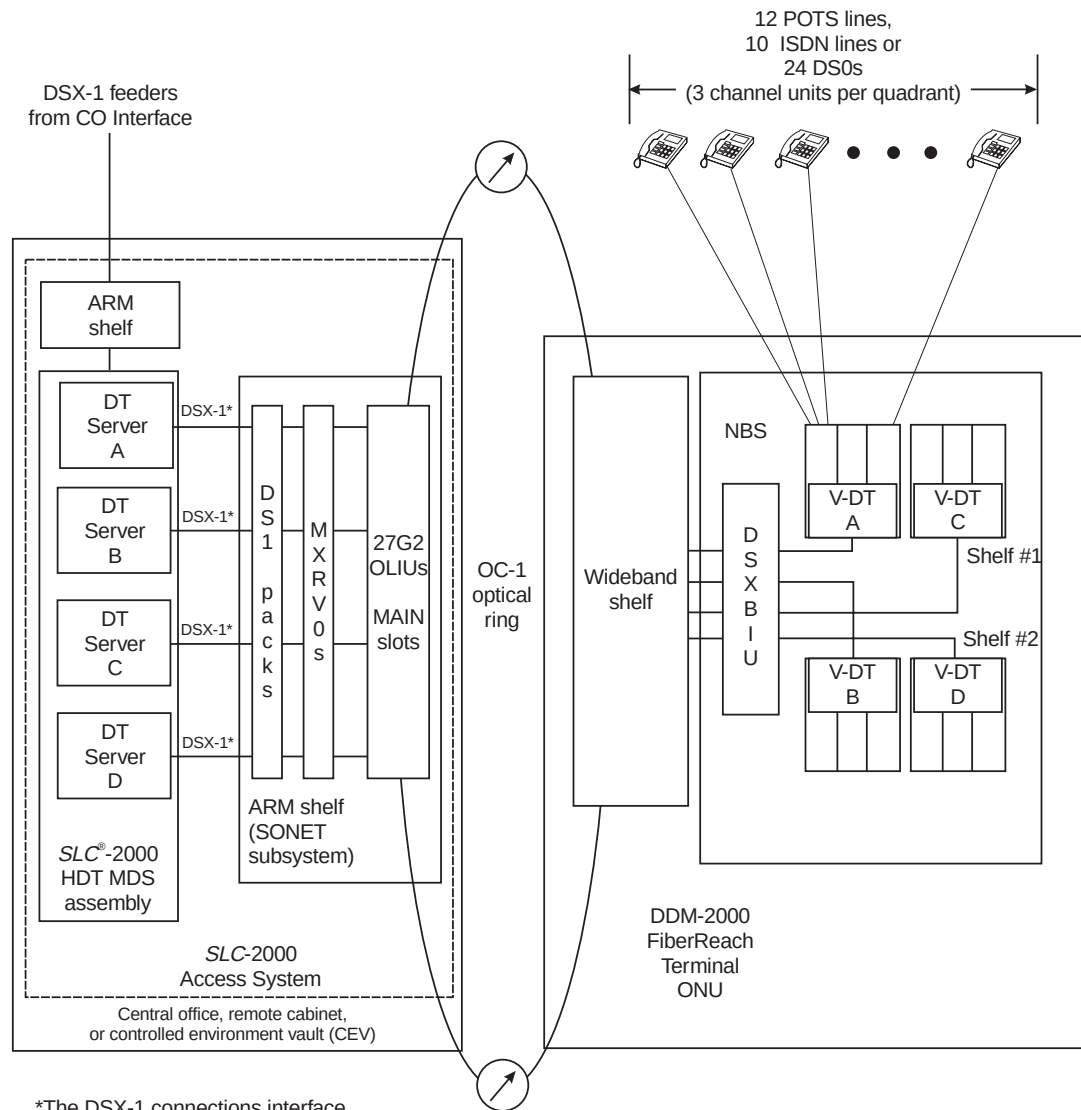
**NOTE:**

The *27G2-U* OLIUs can support two OC-1 FiberReach rings from the ARM shelf (Figure 2-15 only shows one ring).

As stated earlier, the NBS operating in the octet mode can contain up to four V-DTs. Therefore, to configure a complete NBS with 40 ISDN lines, the HDT MDS assemblies must provide at least four Servers.

In a typical configuration, each Server sends a *DSX-1* signal to the *DS1* circuit packs in Function Group C of the ARM shelf in the HDT. The *DS1* circuit packs multiplex the signals into a VT-G and pass them to the *MXRV0*s in Function Group C, then to the *27G2-U* OLIUs. The OLIUs multiplex the electrical signals into an OC-1 optical signal that is inserted onto the OC-1 ring. The OC-1 ring carries the signal to the ONU. At the ONU, a WBS receives the OC-1 signal and demultiplexes it back into four *DSX-1* signals and sends them to the *DSXBIU* in the NBS. The *DSXBIU* then conditions the signals to be received by the three channel unit slots being hosted by the specific *DSX-1* signal. Using this method, V-DT A (the first three slots in Shelf #1) is hosted by Server A at the HDT. V-DT B (the first three slots in Shelf #2) is hosted by Server B at the HDT. V-DT C (the last three slots in Shelf #1) is hosted by Server C at the HDT. V-DT D (the last three slots in Shelf #2) is hosted by Server D at the HDT.

As shown in Figure 2-15, the *27G2-U* OLIUs in MAIN slots and the WBS are part of an OC-1 ring. The ARM shelf serves as a host for the WBSs in the ring.



\*The DSX-1 connections interface through external cables and are not part of the SLC-2000 system.

nwoct27g.eps

**Figure 2-15. Basic DDM-2000 FiberReach NBS ONU Configuration Operating in the Octet Mode — 27G2-U OLIUs in the MAIN Slots of the ARM Shelf**

### **Signal Path Using Function Group C of a J1C265AA-1, L4 ARM Shelf and SONET Subsystem Software Release R13 and Later**



**NOTE:**

The following example explains the basic signal paths starting at the *SLC-2000* HDT and ending at the channel unit slots in the ONU.

Figure 2-16 shows an HDT hosting a DDM-2000 FiberReach NBS ONU with four DSX-1 feeders. This configuration uses the DS1 circuit packs and 26G2-U OLIUs in Function group C to transmit the signal between the HDT and the ONU. As stated earlier, the NBS operating in the octet mode can contain four V-DTs. Therefore, to configure a complete system with 40 ISDN lines, the HDT MDS assemblies must contain at least four Servers to support this ONU.

In a typical configuration, each Server sends a DSX-1 signal to the DS1 circuit packs in Function Group C of the ARM shelf in the HDT. The DS1 circuit packs multiplex the signals into a VT-G and pass them to the 26G2-U OLIUs in Function Group C. The OLIUs multiplex the electrical signals into an OC-1 optical signal to interface with the OC-1 ring. The OC-1 ring carries the signal to the ONU. At the ONU, a WBS receives the OC-1 signal and demultiplexes it back into four DSX-1 signals and sends them to the DSXBIU. The DSXBIU then conditions the signals to be received by the three channel unit slots being hosted by the specific DSX-1 signal. Using this method, V-DT A (the first three slots in Shelf #1) is hosted by Server A at the HDT. V-DT B (the first three slots in Shelf #2) is hosted by Server B at the HDT. V-DT C (the last three slots in Shelf #1) is hosted by Server C at the HDT. V-DT D (the last three slots in Shelf #2) is hosted by Server D at the HDT.

As shown in Figure 2-16, the 26G2-U OLIUs in Function Group C and the WBS are part of an OC-1 ring. The ARM shelf serves as a host for the WBSs in the ring.

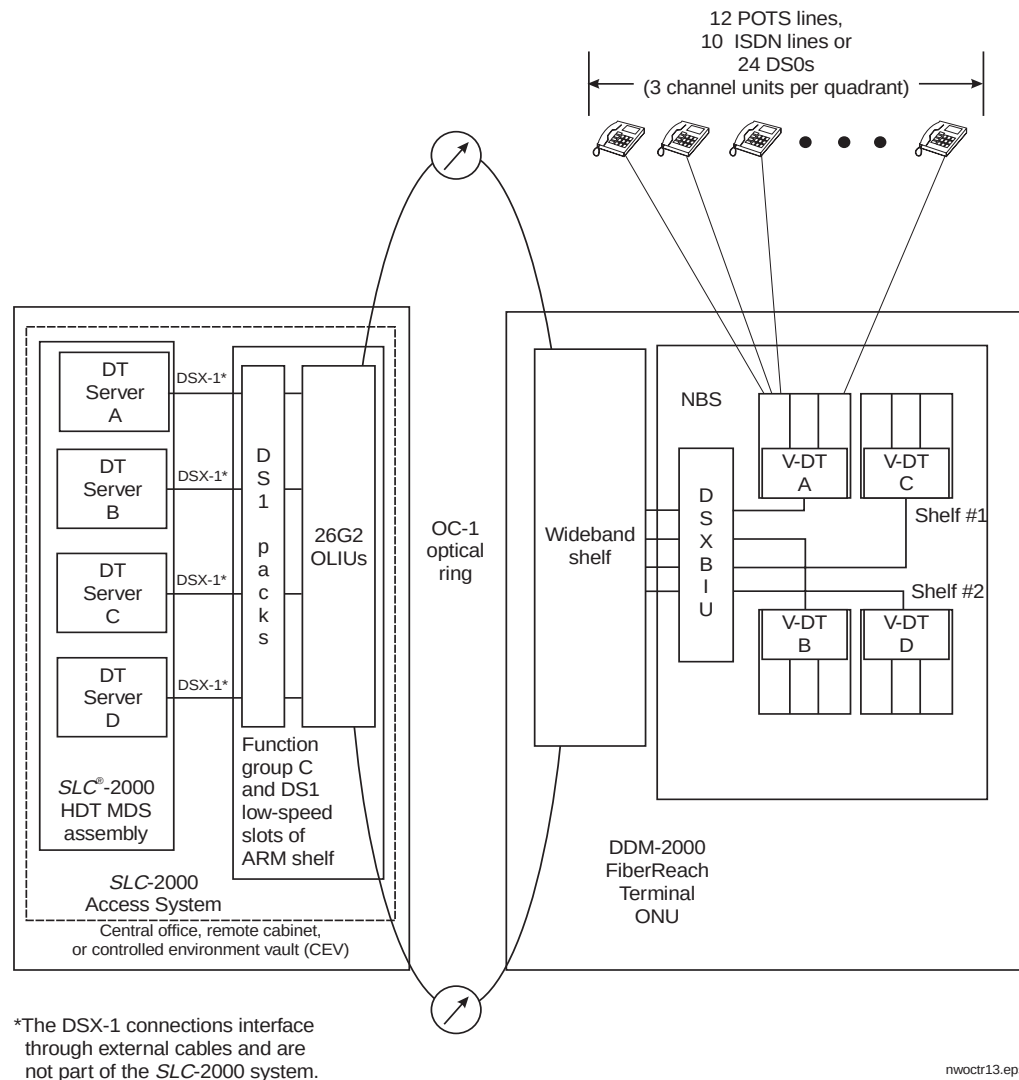


**Figure 2-16. Basic DDM-2000 FiberReach NBS ONU Configuration Operating in the Octet Mode — J1C265AA-1, L4 ARM Shelf with SONET Subsystem Software Release R13 or Later**

### Narrowband Shelf Services

When the V-DT is operating in the quad mode, SLC-2000 Software Release 4.4 or later allows the DDM-2000 FiberReach NBS to contain any of the channel units with NBS listed in the **Terminal** column in Table 4-1 in Chapter 4.

Table 2-2 shows the possible provisioning combinations for the DSX-1 signals A, B, C, and D feeding the V-DTs in the NBS. It also gives possible reasons for each provisioning combination. Refer to Figure 2-14 or Figure 2-16 for the physical location of the V-DT in the NBS.

**Table 2-2. Possible DSX-1 Provisioning Combinations for Each V-DT in the NBS (Software Release 4.4 or Later)**

| Provisioning Combination Number | Provisioned Mode of Each DSX-1 Feeding a V-DT in the NBS<br>(Upper Shelf — Slots 1 - 6<br>Lower Shelf — Slots 7 - 12) | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                               | DSX-1 A — Quad<br>DSX-1 B — Quad                                                                                      | Typically used for POTS or special services<br><br><b>Upper and Lower Shelves</b> — Each channel unit slot can operate in the quad mode. Typically, the NBS can serve up to 48 customer lines.                                                                                                                                                                                                                                                                                            |
| 2                               | DSX-1 A — Quad<br>DSX-1 B — Octet; DSX-1 D — Octet                                                                    | Typically used for a combination of POTS, special services, and ISDN services. You can also easily grow ISDN services in the future.<br><br><b>Upper Shelf</b> — Each channel unit slot fed by DSX-1 A can typically offer up to 4 customer lines for a total of 24 lines (Quad mode).<br><br><b>Lower Shelf</b> — A typical use for these slots fed by DSX-1 B and D is ISDN service (Octet mode). Each DSX-1 can serve up to 10 ISDN lines for a total of 20 ISDN lines (2B+D service). |
| 3                               | DSX-1 A — Octet; DSX-1 C — Octet<br>DSX-1 B — Quad                                                                    | Typically used for a combination of POTS, special services, and ISDN services. You can also easily grow ISDN services in the future.<br><br><b>Upper Shelf</b> — A typical use for these slots fed by DSX-1 A and C is ISDN service (Octet mode). Each DSX-1 can serve up to 10 ISDN lines for a total of 20 ISDN lines (2B+D service).<br><br><b>Lower Shelf</b> — Each channel unit slot fed by DSX-1 B can typically offer up to 4 customer lines for a total of 24 lines (Quad mode). |
| 4                               | DSX-1 A — Octet; DSX-1 C — Octet<br>DSX-1 B — Octet; DSX-1 D — Octet                                                  | Typically used for ISDN service.<br><br><b>Upper and Lower Shelves</b> — A typical use of this combination will allow the NBS to offer up to 40 ISDN lines (2B+D service).                                                                                                                                                                                                                                                                                                                |

Chapter 7 gives the mode provisioning options and restrictions for each of the four DSX-1 signals feeding the NBS. It also gives the channel unit slot restrictions when operating in the octet mode.



### Software Release 4.5 or Later

Software Release 4.5 adds the Enhanced FiberReach/MSDT feature to the *SLC-2000* system. This feature allows each MDS assembly shelf configured for FITL to support 144 lines instead of 96 lines for earlier releases. This is done by allowing the MDS assembly shelf to contain the following number of DT Servers:

- Up to six 24-line DT Servers
- Up to eight 12-line DT Servers along with two 24-line DT Servers
- Up to ten 12-line DT Servers (*SPQ809* or *SPQ810* Server with Software Release R4.5 or later)
- Up to twelve 12-line DT Servers (requires *SPQ811* DT Server and Software Release R4.6 or later)

With this feature, a complete *SLC-2000* HDT with all 8 MDS assembly shelves configured for FITL can serve up to 1152 POTS lines or 480 ISDN lines.



**NOTE:**

To serve 480 ISDN lines, the *SLC-2000* HDT must be hosting DDM-2000 FiberReach NBS with each DSX-1 feeder provisioned for the octet mode. See Chapter 7 for octet mode provisioning information.

### Optical and Metallic DS1 Rate Extensions

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The *SLC-2000* Access System RT with SONET feeder supports both metallic and optical DS1 rate extensions using the DDM-Plus system. The DDM-Plus system can be configured as a repeater shelf to support metallic T1 extensions.

Alternatively, the DDM-Plus system can be configured to provide optical extensions. Four DS1 rate pipes are carried on each optical interface. Each optical interface may be 1:1 protected. In this configuration, the DDM-Plus is ideal for serving DS1 rate extensions from a *SLC-2000* Access System, or fiber in the riser applications, or from a *SLC-2000* Access System in the outside plant. For more details on the DDM-Plus system, refer to 363-206-150, *DDM-Plus User/Service Manual*.

### Fiber Services Module (FSM)

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The fiber services module (FSM) provides the *SLC-2000* Access System with expanded distribution capability for FITL applications using the larger line size *SLC-2000* MSDT cabinets and the DDM-2000 FiberReach NBS. The FSM allows up to 96 DS0 and up to eight unprotected DS1 rate services to be served from one ONU cabinet via a single 51.84-Mb/s optical link.

An FSM accepts up to 12 DSX-1 inputs that are multiplexed into a 51.84-Mb/s signal. At the HDT, the DSX-1 inputs may consist of DS0 channels from one or more *SPQ808/809/810* MSDT or DT Servers in MDS assemblies or may be

DSX-1 inputs from a multiplexer (such as the DDM-2000) or a digital cross-connect system (such as DACS IV-2000) to provide DS1 service. The 12 DS1s are transported over an unprotected, single-fiber, point-to-point optical link to the corresponding FSM in the MSDT cabinet or to an FSM mounted in a miscellaneous shelf collocated with the DDM-2000 FiberReach NBS. At the remote FSM, the DS1s carrying DS0 traffic are connected to one or more MSDTs, V-MSDTs, or V-DTs housing the DS0 channel units, while the remaining DS1 rate signals are routed physically to the appropriate destinations.

The FSM meets telephone company needs for fiber distribution of DS0 and DS1 rate services, whether shared across several end users or dedicated to a single customer. The FSM is designed to meet *SLC-2000* Access System FITL interface requirements and is compatible in current HDT/ONU applications.

For a detailed functional and physical description of the FSM, see Appendix D. This appendix also includes ordering information.

## **Operations, Administration, Maintenance, and Provisioning (OAM&P)**

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### **OAM&P Capabilities**

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For Release 3.2 or later, the *SLC-2000* Access System supports a full range of local and remote OAM&P capabilities in both the SONET and DSX-1 feeder configurations. These OAM&P capabilities include:

- Service and resource provisioning
- Alarm reporting and retrieval
- Continuous performance monitoring
- Circuit testing
- System turn-up testing
- Single-ended operations (SEOs) (SONET configuration only).

The OAM&P functions are supported through several interfaces including the user interface panel, the craft interface terminal, and the TL1 interface to operations systems.

### **User Interface Panel (UIP)**

---

The user interface panel (UIP) serves as the primary point for local maintenance activities and alarm summary information. The UIP provides an array of test access jacks similar to those used with the *SLC* Series 5 Carrier System craft interface unit (CIU). There are also several light-emitting diode (LED) summary

indicators similar to those used with the DDM-2000 multiplexer. The UIP also has a 24-character alphanumeric display that maintenance personnel may use for basic OAM&P activities. The maintenance personnel scroll through a series of built-in menus and execute the commands to perform selected tasks.

### **Craft Interface Terminal (CIT)**

---

To support more complex applications and maintenance, the UIP has a port for connecting the CIT. The CIT supports local or remote provisioning, maintenance, configuration, administration, inventory, and performance monitoring activities for both the SONET and DLC subsystems. The same CIT can be used with the DDM-2000 multiplexer and the *SLC-2000* Access System.

The CIT is either an American Standard Code for Information Interchange (ASCII) terminal or *MS-DOS*\* personal computer (PC) running software that emulates an ASCII terminal. Menu-driven and prompt command modes are available as well as extensive help features. An *MS-DOS*-based PC is required for system turn-up to download software to the *SLC-2000* system through the CIT port.

At the central office or a remote location, when the link to alarms and networks (LAN) circuit pack is installed, a rear CIT port (EIA-232) provides connection for dial-up modem access to the *SLC-2000* COT or RT (a similar connection is provided on the DDM-2000 multiplexer).

The *SLC-2000* Access System offers protection against unauthorized access via its CIT port or through a remote operations port. The use of security is provisionable for the front CIT port, the rear CIT (modem) port, and through the SONET data communications channel (DCC). The system supports three user levels:

- **Privileged** — with full read/write access to all information on the system, including passwords
- **Standard** — with read/write access to system provisioning and maintenance information
- **Reports-only** — with read access to system information but no ability to change provisioning or maintenance parameters.

Each user has an individual login and password, and each user selects and maintains his/her own password.

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\* Registered trademark of Microsoft Corporation.

## **TL1 Interfaces to Operations Systems**

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The *SLC-2000* Access System provides a TL1/X.25 interface to alarm surveillance operations systems such as Bellcore's NMA and OPS/INE along with other operations systems (OSs). This interface allows the system to report alarm and status information in more detail than the telemetry interfaces. This interface also supports remote and automated provisioning from operations systems such as Bellcore's OPS/INE. The *SLC-2000* system also supports a provisioning and alarm interface to ACD's FNESS\* operations system.

A security option feature allows the administrator to control access by general users (for provisioning and retrieval), and retrieve-only users.

## **Embedded Operations Channel (EOC) Interface to the Local Digital Switch for TR-303**

---

In addition to these interfaces, Release 4.0 and later provides an EOC interface to the LDS for the OAM&P functions of the TR-303 VRT. These OAM&P functions can be used in addition to the OAM&P capabilities of Release 3.1 and 3.2 and provide operations specific to the TR-303 VRT. The functions that are provided include:

- Autonomous reporting of *SLC-2000* Access System alarm conditions
- On-demand reporting of performance monitoring data for ISDN lines and DSX-1 feeders
- Autonomous reporting of DSX-1 feeder and ISDN performance monitoring threshold crossings
- Service activation (provisioning) of POTS and ISDN lines
- Activation and release of DS1 line loopbacks
- Autonomous reporting of *SLC-2000* system alarm conditions.

## **ISDN Provisioning via TL1 Messages (Release 4.5 or Later)**

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With Software Release 4.5 or later, you can provision ISDN 2B+D services from any of the following user interfaces:

- EOC interface
- *SLC-2000* TL1/X.25 interface (Bellcore's OPS/INE system R2.6 supports this feature)
- CIT port on the UIP
- Rear CIT port.

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\* FNESS is an operations system being developed by Applied Computing Devices (ACD) for GTE telephone companies.

## SONET Data Communications Channel (DCC)

In a SONET feeder configuration, remote access to OAM&P capabilities is available via the SONET DCC for the SONET and DLC subsystems from the central office (CO) or operations system. Remote access allows maintenance personnel located at an RT or CO site to log in to other network elements (*SLC-2000 Access Systems* or *DDM-2000 multiplexers*) on a maintenance subnetwork. Centralized access allows personnel located in an operations work center to access *SLC-2000 Access Systems* at different RT or CO sites.

The single-ended operations (SEO) capability (Figure 2-17) provides remote or centralized access to, and control of, all network elements in a SONET maintenance subnetwork from a single location. This minimizes maintenance personnel travel between sites since most maintenance, diagnostic, provisioning, and administration can be performed on a remote or centralized basis.

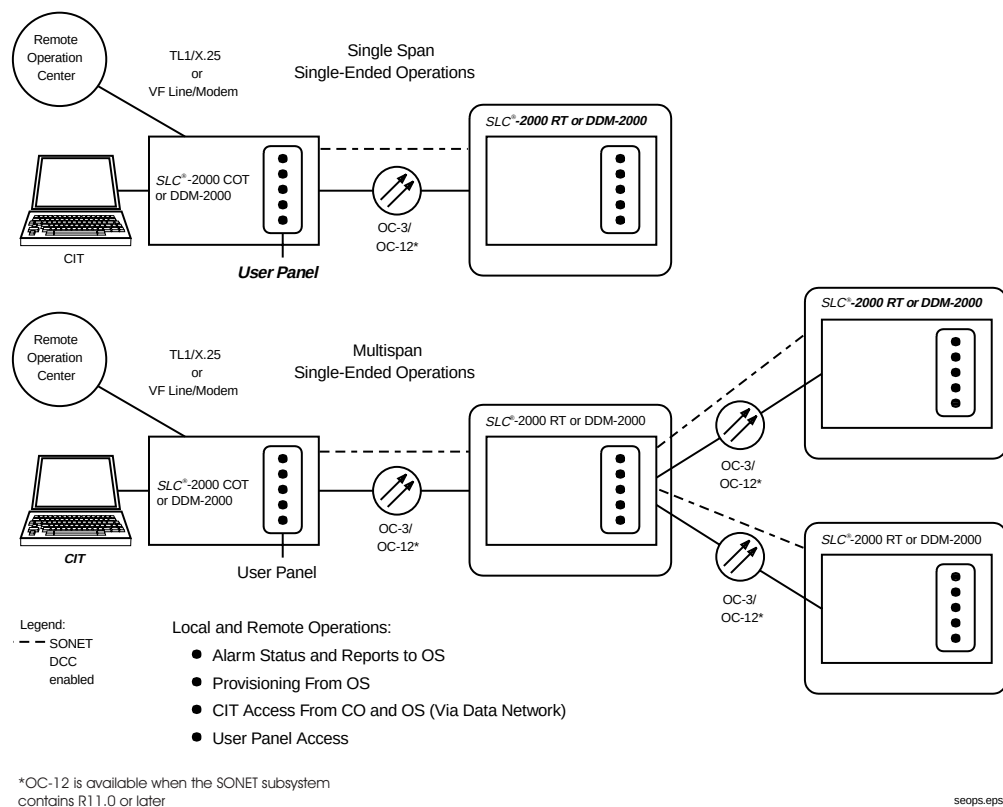


**Figure 2-17. Single-Ended Operations**

## **Automatic Maintenance**

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### **SONET Features**

In a SONET configuration, the *SLC-2000* Access System continuously monitors transmission parameters and provides 1:1 high-speed (optical path, multiplexer card, synchronization core) protection and 1:7 VT1.5 and DS1 low-speed circuit pack protection. Also, the external DS1 timing references are 1:1 protected. For COT configurations, the composite clock input (for DS0 digital services) is protected as well.

In a ring configuration, the system supports path protection switching according to the DDM-2000 multiplexer and the Bellcore TR-496\* scheme. This protects against single failure of a node or an optical path to maintain service and is more economical than a linear topology in using fiber and optical line interface unit (OLIU) resources.

### **Automatic Synchronization Reconfiguration**

In SONET feeder configurations, the *SLC-2000* Access System uses synchronization messaging to convey the current quality of the timing source from one *SLC-2000* Access System to the next. This allows SONET network elements such as the *SLC-2000* Access System to determine the best timing reference available and switch to that reference. The capability also allows the *SLC-2000* Access System to alert a local building integrated timing supply (BITS) clock when the DS1 timing output has been degraded and should no longer be used as a reference. Through this mechanism, the synchronous operation of the subnetwork can be maintained. The switching of timing references is hitless, and the synchronization messages also allow switching to be done without creating timing loops in the process. Details on synchronization are given in Chapter 8; also, see 363-208-001, *SLC-2000 Access System, User/Service Manual*.

### **DSX-1 Feeder Features**

In a DSX-1 feeder configuration, the *SLC-2000* Access System provides 1:7 DS1 protection for the line interface unit (LIU) circuit pack. In loop timing mode, the system provides hitless synchronization reference switching. The system always loop times from a valid DS1 feeder input, which can be provisioned for primary and protection inputs.

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\* Bellcore Technical Reference TR-TSY-000496, Issue 2, September 1989, *SONET Add-Drop Multiplex Equipment (SONET ADM) Generic Criteria*.

## **Circuit Testing Capabilities**

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The *SLC-2000* Access System provides access for the following circuit maintenance features:

- Loop testing
- Special services testing
- Local test access.

The *SLC-2000* Access System is compatible with external loop testing operating systems in integrated TR-08, TR-303, and in universal configurations. The system is compatible with a DC bypass pair, electronic bypass pair, or remote measurements units (RMUs). It also supports external special services remote test units (see Chapter 7).

Test access for special services is controlled via a local CIT and the ITH. The UIP provides test access jacks for the following:

- Full-splitting metallic access
- Half-splitting bit stream access towards the channel unit
- Half-splitting access to the ear and mouth (E&M) signaling leads (towards the channel unit).

If the ITH is used for local test access, it must be equipped with the following:

- Test head controller (THC) circuit pack
- Power converter unit (PCU) circuit pack
- Craft access unit (CAU) circuit pack.

The *SLC-2000* Access System is compatible with *ngRTH*<sup>\*</sup> test head for special services testing as follows:

- Provides a TR-834<sup>†</sup> interface
- Compatible with SARTS when used with the XL:201-to-TL1 protocol translator and *REACT*<sup>‡</sup> for special services testing
- Also can be equipped for loop testing that is compatible with mechanized loop testing (MLT) II/III.

Special services provisioning can be performed locally or remotely over the SONET DCC with the CIT. Test access for alignment is provided via the UIP jacks, local CIT access, and the ITH.

### **Analog Line to Integrated *SLC*<sup>®</sup> Carrier at *5ESS*<sup>®</sup> Switch Cut (ALIC5)**

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The *SLC-2000* Access System allows in-service transfer of circuits on a 1A *ESS*<sup>™</sup> analog switch to a TR-08 virtual remote terminal (VRT) on a *5ESS* switch.

The *SPQ450* ALIC5 channel unit is designed for 2-wire POTS and locally switched special services. The *SPQ450* allows for a benign bridging of the *SLC-2000* RT to in-service circuits on the 1A *ESS* analog switch in preparation for the transfer of the circuits to a *SLC-2000* RT integrated into a *5ESS* switch.

The *SPQ450* facilitates the cutover of metallic circuits served by a 1A *ESS* analog switch to a DLC system integrated into a *5ESS* switch. Prior to the cutover, a relay on the *SPQ450* channel unit is kept open by *5ESS* switch signaling to prevent loading of the in-service circuit. During the precutover period, the *5ESS* switch can momentarily close the relay to conduct automated office-to-office tests. At switch cutover, the *5ESS* switch signals the *SPQ450* to permanently close the relay.

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\* Trademark of Tautron Inc.

† Bellcore Technical Reference TR-NWT-000834, Issue 4, December 1992, *Operations Application MES Network Maintenance: Access Testing Messages*.

‡ Trademark of Hekimian.



## Field-Proven Remote Terminal Cabinets

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Lucent Technologies' field-proven 80A, 80D, and 80G remote terminal cabinet arrangements are available for *SLC-2000* Access System applications. Configurations for serving metallic, FITL, and T1 or optical extensions using DDM Plus are available with bulk powering. You can also install the *SLC-2000* system in an indoor 90A cabinet that is available with a bulk power cabinet power system (CPS). Refer to Chapter 6 for details of cabinet arrangements.

## Increased Line Density

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The *SLC-2000* Access System is very compact in size and allows for flexible and economical packaging arrangements in a variety of enclosures. The system provides twice the line density of the *SLC* Series 5 Carrier System when the *SLC-2000* Access System is equipped with quad channel units. See Chapter 6 for line sizes of various *SLC-2000* RT arrangements.

## Industry Standards Compliance

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The *SLC-2000* Access System is designed to meet all applicable industry standards for DLC systems and services (such as TR-08, TR-303, TA-313<sup>\*</sup>, TR-834, TR-909, TR-57<sup>†</sup>, and TR-30<sup>‡</sup>), SONET transmission systems, operations systems interfaces and messages, ISDN services (including TR-821<sup>§</sup>, TR-367<sup>¶</sup>, TA-784<sup>\*\*</sup>, and TR-397<sup>††</sup>), and environmental and electromagnetic compatibility, as noted in Chapter 10.

- 
- |    |                                                                                                                                                                                                                                                         |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *  | Bellcore Technical Advisory TA-TSY-000313, Issue 2, July 1988, <i>Generic Requirements for Circuit Maintenance of POTS and Special Services on Digital Loop Carrier (DLC) Systems</i> .                                                                 |
| †  | Bellcore Technical Reference TR-TSY-000057, (A Module of TSGR, FR-NWT-000440), Issue 1 (April 1987) plus Revision 1 (November 1988), Supplement 2 (June 1988), and Supplement 3 (November 1991). "Functional Criteria for Digital Loop Carrier Systems" |
| ‡  | Bellcore Technical Reference TR-NWT-000030, Issue 2, October 1992, <i>Voiceband Data Transmission Interface Generic Requirements</i> (replaces TA-TSY-000030, Issue 3, April 1992).                                                                     |
| §  | Bellcore Technical Reference TR-TSY-000821, Issue 1 (June 1990) and all Revisions and Supplements, <i>OTGR: Network Maintenance: Transport Surveillance - Additional Transport and Transport-Based Surveillance</i> .                                   |
| ¶  | Bellcore Technical Reference TR-TSY-000367, Issue 2, September 1987 <i>ISDN Basic Access Line Maintenance Requirements</i> .                                                                                                                            |
| ** | Bellcore Technical Advisory TA-TSY-000784, Issue 1, August 1988, <i>ISDN Basic Access Mediation Function for Operations, Administration, Maintenance, and Provisioning</i> .                                                                            |
| †† | Bellcore Technical Reference TR-NWT-000397, Issue 2, January 1991, <i>ISDN Basic Access Transport System Requirements</i> .                                                                                                                             |

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# System Configurations and Applications

# 3

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## System Configurations and Applications

# 3

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### Introduction

The *SLC*<sup>®</sup>-2000 Access System supports a variety of central office configurations, remote terminal configurations, and feeder topologies. These equipment configurations and feeder topologies can be flexibly combined to meet a variety of service applications.

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### Central Office Configurations

Central office (CO) configurations include the DDM-2000 OC-3 multiplexer or *SLC*-2000 Access System central office terminal (COT). Either configuration provides a direct digital interface to local digital switches (in integrated applications) and to universal applications. The *SLC*-2000 COT provides high-density voice-frequency (VF)/DS0 connectivity, while existing *SLC* 96 COTs can terminate DS1s from the DDM-2000 multiplexer.

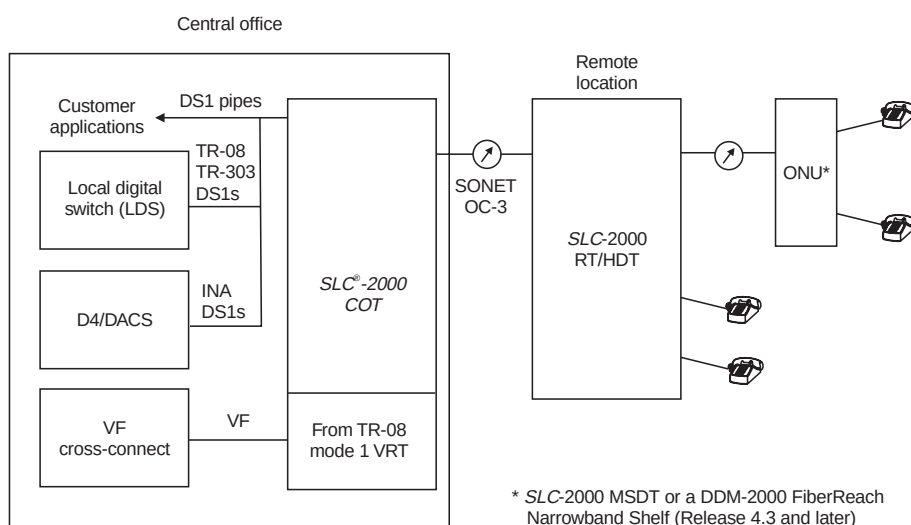
The *SLC*-2000 Access System synchronous optical network (SONET) based central office terminal (COT) provides DS0 and/or DS1 interfaces at the central office for universal digital loop carrier (DLC) applications. With the built-in SONET feeder, the *SLC*-2000 Release 3.1 COT terminates metallic DS0 services and interfaces up to 28 DS1s from the Release 3.1 remote terminal (RT). The *SLC*-2000 Release 3.2 COT adds a metallic DSX-1 feeder interface (optional) with the Release 3.2 or later RT. The *SLC*-2000 COT serves as the operations gateway in a SONET subnetwork (Chapter 7). Release 4.0 or later will not operate as a COT.

A DDM-2000 SONET multiplexer in the central office also can provide the DS1 interfaces to the *SLC*-2000 RT. The DDM-2000 multiplexer also provides an

operations gateway to the remote terminal. Each *SLC-2000* Access System remote terminal can be divided among any combination of integrated and universal central office terminations as required. For an RT, combinations of TR-08 and TR-303 can be supported in this configuration.

## Universal Configuration

The universal *SLC-2000* Access System terminates on a *SLC-2000* COT (Figure 3-1). The *SLC-2000* COT and the *SLC-2000* RT must be running the correct software release as shown in Table 3-1.



univcot.eps

**Figure 3-1. Universal Configuration: *SLC-2000* Central Office Terminal (COT) with Fiber and Metallic Distribution at RT/HDT**

**Table 3-1. COT/RT DLC Software Release Compatibility**

| <b>RT Software Release</b> | <b>COT Software Release</b> |
|----------------------------|-----------------------------|
| 2.0 <sup>*</sup>           | SLC <sup>®</sup> 96 COT     |
| 3.1                        | 3.1                         |
| 3.2                        | 3.2, 3.3                    |
| 4.0                        | 3.2, 3.3                    |
| 4.1                        | 3.2, 3.3                    |
| 4.2 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.3 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.4 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.5 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |
| 4.6 <sup>†</sup>           | 3.2, 3.3 <sup>‡</sup>       |

<sup>\*</sup> The SLC-2000 Release 2.0 RT is not compatible with the SLC-2000 Software Release 3.1/3.2/3.3 COT.

<sup>†</sup> The SLC-2000 Release 4.2 RT or later is required to obtain complete end-to-end compatibility with the new channel units supported by Releases 3.3 and 4.2 or later.

<sup>‡</sup> The SLC-2000 Release 3.3 COT is required to ensure all features are available (for example, full capacity of new channel units) when using Release 4.2 or later at the RT.

A SONET configuration allows combined universal and integrated operation for the TR-08 interface, with some TR-08 Mode 1 or Mode 2 virtual remote terminals<sup>\*</sup> (VRTs) integrated to a local digital switch (LDS) while other TR-08 Mode 1 VRTs terminate in a universal configuration (Figure 3-1). The TR-303 interface does not support the universal configuration. Also, TR-08 Mode 2 is not supported in the universal configuration.

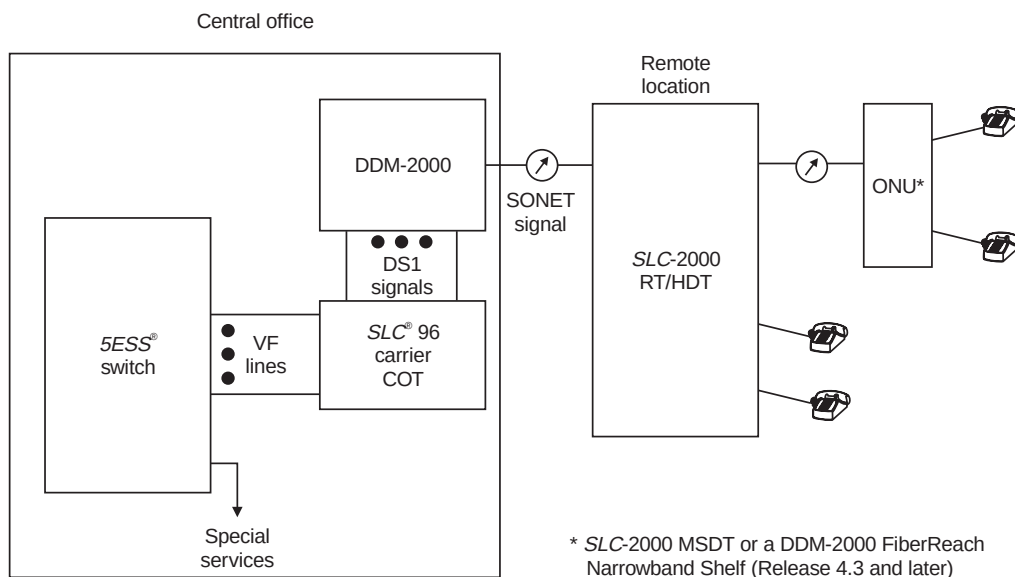
Universal termination on the SLC-2000 COT supports up to seven TR-08 Mode 1 VRTs, up to 28 integrated network access (INA) DS1 feeders, or a combination of the two.

---

<sup>\*</sup> A TR-08 VRT represents 96 lines derived from the DLC system RT (see the section on remote terminal configurations in this chapter). Chapter 2 also contains a description of VRTs.

The DS1s carrying INA digroups can be routed from the RT to the interoffice network (Digital Access and Cross-Connect Systems, D4 or D5 channel banks, etc.).

In another universal configuration, the *SLC-2000* RT/HDT terminates on a *SLC 96* COT through a *DDM-2000* multiplexer interface at the central office (Figure 3-2).



univ96.eps

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**Figure 3-2. Typical Universal Configuration: *SLC 96* Carrier System COT (Fiber and Metallic Distribution at RT/HDT)**

### **Integrated Configuration**

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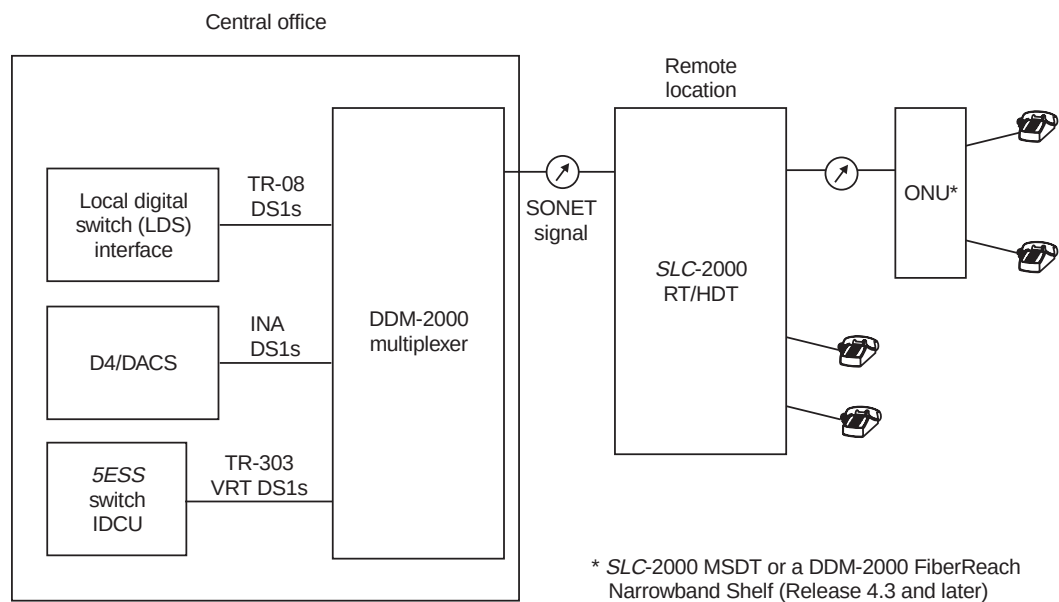
For TR-08 VRTs, the *SLC-2000* Access System integrates directly into an LDS interface, including the following:

- The *5ESS®* switch digital carrier line unit (DCLU) or integrated digital carrier unit (IDCU)
- A Northern Telecom *DMS 100\** switch SCM 100S interface.

For Release 4.0 and later, the TR-303 VRT also integrates directly into an LDS interface. Figure 3-3 shows a typical integrated configuration.

---

\* Trademark of Northern Telecom, Ltd.



integr4.eps

**Figure 3-3. Typical Integrated Configuration (Release R4.0 and Later) with Metallic and Fiber Distribution**



## Hairpin Feature for Special Services (5ESS Switch)



**NOTE:**

The hairpin feature is allowed only with the 5ESS IDCU interface. This feature is NOT allowed with the 5ESS Digital Networking Unit — SONET (DNU-S) interface.

The hairpin feature provides a semipermanent connection (for the duration of the service subscription) between two DS0 ports on the same IDCU. Unlike nailed-up connections that use switching module (SM) time slot interchange unit (TSIU) and, possibly, communication module (CM) resources, the hairpin connection is made in a time slot interchanger on the IDCU.

The 5ESS switch (generic 5E8 and later software) allows hairpinning of nonswitched and nonlocally switched special services terminating in IDCUs (the same services supported with DCLU nail-up). Hairpinning also supports Digital Data System (DDS) with second channel error correction (SCEC), integrated services digital network (ISDN) basic rate interface transmission extension (BRITE) (TR-08 and INA only), and PGM<sup>\*</sup>-2000 program service.

For DDS with SCEC, the DS0 time slots associated with the data channel and the error correction channel are hairpinned. When hairpinning TR-08 BRITE services to a D4 or D5 channel bank (equipped with BRITE channel units), up to three DS0 time slots (B1, B2, and the D-channel) associated with the T-BRITE or U-BRITE ISDN channel units are hairpinned.

A hairpin connection acts like a stable call and is not processed like a normal call; that is, inband signaling is passed unchanged through the IDCU. There are no restrictions on hairpin connections because they are intra-IDCU. Connections that can be hairpinned from an IDCU include: RT to RT; RT to DACS I, II, or DACS IV-2000; and RT to D4 or D5 channel bank (see Figure 3-4). The hairpinned connection is provisioned by an assignment in the 5ESS switch data base using the recent change/verify (RC/V) capability.

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\*

Trademark of Tollgrade Communications, Inc.

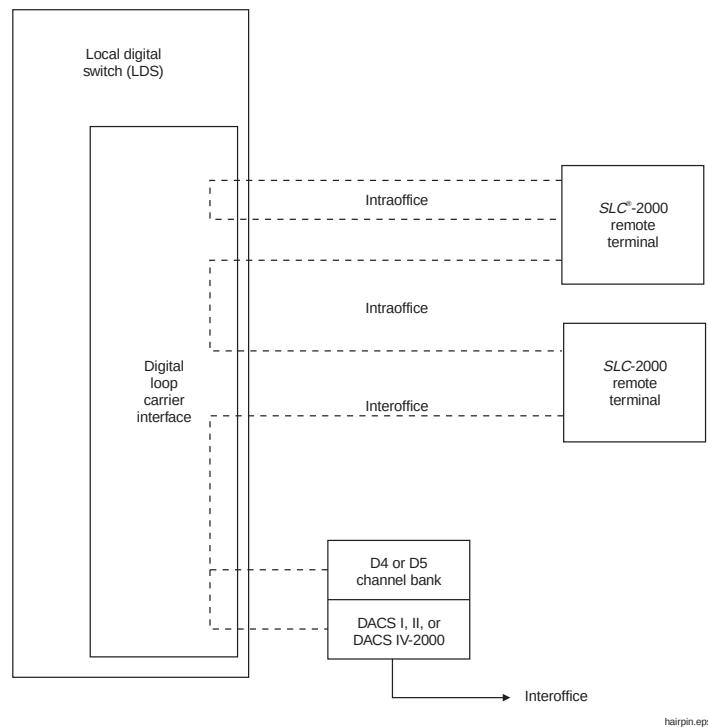


**Figure 3-4. Integrated Applications — Hairpin Feature**

A hairpin connection continues to provide normal service during switch failures that do not corrupt the IDCU data base or cause associated hardware to malfunction. If a failure occurs that affects the IDCU, the switch automatically restores any hairpin connections following recovery from the failure. The switch also routinely verifies (without affecting service) the integrity of hairpin connections. If the integrity of a connection is questionable, the switch automatically restores the connections.

### **Nail-Up Feature for Special Services (5ESS Switch)**

The nail-up feature provides a dedicated path (fixed time slot assignments) through the 5ESS switch for the integrated SLC-2000 Access System RT. This capability is called nail-up because the transmission path is guaranteed, and signaling information is not subject to normal call processing functions.

The 5ESS switch allows nail-up of RT special service circuits terminating in digital carrier line units (DCLUs). This allows integrated special service circuit applications for intraoffice and interoffice circuits.

Refer to 363-099-091TD Customer Information Release (CIR) for more information on the applications and implementation of *5ESS* switch nail-up circuits.

## Remote Terminal Configurations

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**NOTE:**

For a detailed description of the *virtual remote terminals* (VRTs), see Chapter 2.

The *virtual remote terminal* (VRT) is a logical or software-defined segment of a *SLC-2000* system remote terminal that appears to the CO interface to be a complete remote terminal. This VRT will have equal or fewer end users **and** equal or fewer feeder facilities than the complete remote terminal. The CO interface is a COT if universal or an integrated digital terminal (IDT) if integrated.

This logical (virtual) definition allows a number of VRTs to be established within a single physical RT/HDT. Each VRT appears to the central office switch interface to be an independent remote terminal that can be administrated separately.

The *SLC-2000* Access System RT supports the following configurations:

- **TR-08 Mode 1:** Up to seven 96-line VRTs
- **TR-08 Mode 2:** Up to eight 96-line VRTs
- **INA DS1s:** Up to 28 INA DS1s
- **TR-303:**
  - **Software Release R4.0 and R4.1:** One VRT of up to 768-lines per *SLC-2000* Access System (VRT line size defined in the software).
  - **Software Release R4.2 or Later:** Up to two VRTs whose line size can total up to 768-lines per *SLC-2000* Access System (VRT line size defined in the software).
  - **Software Release R4.5 or Later:** For metallic distribution only, same as Software Release R4.2. For FITL distribution, up to two VRTs whose line size can total up to 1152-lines per *SLC-2000* Access System (VRT line size defined in the software).



**NOTE:**

The *SLC-2000* system can contain a mixture of TR-08, TR-303 VRTs, and INA DS1s. Refer to the "T0 Cross-Connect/Checkerboarding Restrictions" section of this chapter for checkerboarding restrictions. However, when using the Enhanced FiberReach/MSDT feature to support up to 1152 lines with Software Release 4.5 and later, at least one VRT must be a TR-303 VRT.

Up to seven Mode 1 TR-08 VRTs can be terminated on a *SLC-2000* COT.

The system allows any DS0 channel (logical line) in a VRT to be assigned to any physical line on a channel unit. This allows grooming of INA DS1s and bandwidth shedding for fiber in the loop (FITL) or fractional DS1 applications. Also, the *SLC-2000* Access System can support up to 28 DS1 pipes (including ISDN primary rate interfaces) in addition to providing distribution.

### **TR-08 VRTs**

---

The *SLC-2000* Access System supports TR-08 Mode 1 (nonconcentrated) configurations where 96 customers are mapped directly onto 96 DS0s (four feeder DS1s). The DS1s are designated in TR-08 as the A, B, C, and D feeder DS1s. The *SLC-2000* Access System supports up to seven 96-line systems when configured for TR-08 Mode 1 operation.

The *SLC-2000* Access System also supports TR-08 Mode 2 (2:1 concentration) VRT configurations where 96 customers are split into two 48-line groups. Each group provides 2:1 concentration of 48 customers onto 24 DS0 time slots in a single DS1. This uses two feeder DS1s, designated as the A and C feeder DS1s. The *SLC-2000* Access System supports up to eight 96-line systems when configured for TR-08 Mode 2 operation.

Physically, each TR-08 VRT corresponds to one shelf [upper or lower in a metallic distribution shelf (MDS) assembly]. On the physical feeder side, the DS1s from the VRTs are processed by the virtual tributary units/line interface units (VTUs/LIUs) in the DS1/VT feeder interface section of the access resource manager (ARM) shelf. A VTU/LIU supports one or two VRTs, depending on the mode. In Mode 1, each VTU/LIU supports one VRT. In Mode 2, one VTU/LIU supports two VRTs.

Table 3-2 shows the relationship between VTU/LIU slots, MDS assemblies, metallic distribution shelves, and the TR-08 modes. (Each metallic distribution shelf houses 96 lines with quad channel units, equivalent to one TR-08 VRT.)

**Table 3-2. VTU/LIU Slot to MDS Assembly Mapping (TR-08)**

| VTU/<br>LIU<br>Slot | MDS<br>Assembly | Metallic Distribution Shelf |                                                 |
|---------------------|-----------------|-----------------------------|-------------------------------------------------|
|                     |                 | Mode 1<br>VRTs              | Mode 2<br>VRTs                                  |
| 1                   | 1               | 1                           | 1 and 2 (Mode 2)                                |
| 2                   |                 | 2                           | (VTU/LIU Slot 2 empty unless used for INA DS1s) |
| 3                   | 2               | 3                           | 3 and 4 (Mode 2)                                |
| 4                   |                 | 4                           | (VTU/LIU Slot 4 empty unless used for INA DS1s) |
| 5                   | 3               | 5                           | 5 and 6 (Mode 2)                                |
| 6                   |                 | 6                           | (VTU/LIU Slot 6 empty unless used for INA DS1s) |
| 7                   | 4               | 7                           | 7 and 8 (Mode 2)                                |

In the *SLC-2000* Access System, Mode 1 supports up to 672 voice-frequency (VF) lines. In a *SLC-2000* RT/HDT with all MDS assemblies configured for TR-08 Mode 1, Shelf 8 in MDS assembly 4 is unusable. The three remaining MDS assemblies in the system are each equipped for 192 lines (48 channel unit slots  $\times$  4 channels per slot), assuming that quad plain old telephone service (POTS) and/or *SPOTS*<sup>®</sup> channel units are used. (For access to all 192 channels in the MDS assembly, the last MDS assembly should be configured for Mode 2 instead of Mode 1.) Table 3-3 shows the number of TR-08 Mode 1 systems and the total number of lines based on the number of Mode 1 MDS assemblies. In addition, the eighth shelf can accommodate channel units that can be cross-connected via TSI into Mode 1 VRTs, INA DS1s, or the TR-303 VRT (Release R4.0 and later) to fill vacant time slots.

**Table 3-3. TR-08 Mode 1 Systems**

| <b>MDS Assemblies</b> | <b>TR-08 Mode 1 96-Line Systems</b> | <b>DS1s</b> | <b>Total Lines</b> |
|-----------------------|-------------------------------------|-------------|--------------------|
| 1                     | 2                                   | 8           | 192                |
| 2                     | 4                                   | 16          | 384                |
| 3                     | 6                                   | 24          | 576                |
| 4*                    | 7                                   | 28          | 672                |

\* Shelf number 8 is unavailable in the last MDS assembly.

---

The TR-08 Mode 2 configuration supports up to 768 VF lines (the total of 4 MDS assemblies  $\times$  48 channel unit slots  $\times$  4 channels per slot). In this configuration, all four MDS assemblies may be equipped for 192 lines, assuming that quad POTS and/or *SPOTS* channel units are used. Table 3-4 shows the number of TR-08 Mode 2 systems and the total number of lines based on the number of Mode 2 MDS assemblies.

**Table 3-4. TR-08 Mode 2 Systems**

| <b>MDS Assemblies</b> | <b>TR-08 Mode 2 96-Line Systems</b> | <b>DS1s</b> | <b>Total Lines</b> |
|-----------------------|-------------------------------------|-------------|--------------------|
| 1                     | 2                                   | 4           | 192                |
| 2                     | 4                                   | 8           | 384                |
| 3                     | 6                                   | 12          | 576                |
| 4                     | 8                                   | 16          | 768                |

---

The T8U circuit packs are required in each MDS shelf assembly that is configured as TR-08 Mode 1 or Mode 2. Starting with Release 4.0, the craft interface terminal (CIT) digital loop carrier (DLC) command, **ED-MODE-T8U**, specifies whether a pair of T8U circuit packs is required to be present on a particular channel unit shelf. The default for this parameter is that T8Us are required to remain consistent with previous *SLC-2000 Access System* releases that support only the TR-08 interface.

### **Mixed TR-08 Mode 1 and Mode 2**

---

For Release 3.1 and later, the *SLC-2000 Access System* also supports mixed configuration with *pairs* of VRTs (192 lines) in any arrangement (up to 768 lines) of Mode 1 and Mode 2. (Release 2.0 supported only a fixed configuration of up to two Mode 1 and up to six Mode 2 TR-08 VRTs.) The mode for each pair of VRTs is provisioned via the craft interface terminal (CIT) or user interface panel (UIP). Refer to 363-208-003, *SLC-2000 Access System, Commands and Messages* for the UIP command **SET-MODE-TR8** and the CIT DLC subsystem command **ED-MODE-TR8**. Each MDS assembly may be equipped for up to 192 lines using quad POTS and/or *SPOTS* channel units.

### **TR-303 VRT**

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Starting with Release 4.0, the *SLC-2000 Access System* supports the TR-303 configuration where from 1 to 768 customers are mapped onto the configured number of DS0s. If using Software Release 4.5 or later, the Enhanced FiberReach/MSDT feature allows the RT/HDT configured entirely for FITL distribution to support TR-303 configuration where from 1 to 1152 customers are mapped onto the configured number of DS0s. The number of TR-303 VRTs you can configure for each RT/HDT is as follows:

- **Release 4.0 and 4.1:** One TR-303 VRT
- **Release 4.2 and later:** Up to two TR-303 VRTs.

The concentration ratio is determined by the number of feeder DS1s cross-connected to the TR-303 VRT. Refer to Chapter 8 for traffic engineering details.

When the RT is configured for metallic distribution only, the TR-303 configuration supports up to 768 VF or ISDN lines (the total of 4 MDS assemblies × 48 channel unit slots × 4 channels per slot). In this configuration, all four MDS assemblies may be equipped for 192 lines, assuming that quad POTS and/or *SPOTS* channel units are used.

When the RT/HDT contains Software Release 4.5 or later and is configured for FITL distribution only, the TR-303 configuration supports up to 1152 VF lines (the total of 4 MDS assemblies × 12 24-line DT Servers × 24 lines per DT Server).

For the TR-303 VRT, there is no physical relationship between the VTU/LIU slots and the metallic distribution shelves. Logical DS1 #1 is required to support the

primary “embedded operations channel”/ “time slot management channel” (EOC/ TMC) data links and logical DS1 #2 is required to support the secondary EOC/ TMC data links. Any physical DS1s can be used for logical DS1 #1 and #2, although it is recommended that they be established on different VTU/LIU circuit packs for VTU/LIU hardware protection. Connection of the logical DS1 #2 is not mandatory, but is recommended to prevent an alarm condition at the RT because of the lack of the secondary EOC channel. Logical to physical mapping for remaining DS1s assigned to the TR-303 VRT can be assigned as needed using the appropriate CIT command.

The T8U circuit packs are not required in MDS shelf assemblies that are DS0 cross-connected to the TR-303 VRT. If the **ED - MODE - T8U** option parameter is set to YES, however, absence of the T8U circuit packs will cause a system alarm and removing the T8U will also disrupt transmission.

## INA DS1 Description

---

### General

Up to 28 INA DS1s can be supported at the RT. An INA DS1 is a logical or software-defined DS1 that can be handled much like a VRT. The INA DS1 must be cross-connected to a physical feeder DS1 to be activated for transporting groomed, nonlocally switched or nonswitched special services to DACS or D-banks in the central office. INA DS1s can be optioned for superframe (SF)\* or extended superframe (ESF) framing and to sequentially count (map) distribution time slots. The **ED - INA** command is used to set the framing format for INA DS1.

In the SONET configuration, INA DS1s pass through the COT as low-speed DS1 pipes. The system supports INA DS1s in the COT as follows, depending on the software release:

- **COT Software Release 3.2 and earlier** — not supported
- **COT Software Release 3.3 and later** — supported.

---

\* Superframe (SF) is the same format as D4.

#### 4-Wire FX Line Through 5ESS Switch DFI/DNU-S Feature

For specific 5ESS switch software update releases, this feature allows you to connect a loop start or ground start circuit to the trunk side of a 5ESS switch over a INA DS1 facility. At the SLC-2000 RT, you can then use a SPQ<sup>®</sup> 443 or an AUA43() ESPOTS channel unit to connect to a customer termination using either of the following signaling types:

- Loop start (for example, POTS telephone)
- Ground start (for example, PBX).

You must provision the 5ESS switch for either loop start or ground start service. The DS1 accesses the switch through one of the following interfaces instead of an IDCU or DCLU:

- Digital Facility Interface (DFI)
- Digital Networking Unit — SONET (DNU-S).

This feature is available with specific software updates of the following 5ESS software releases depending on the type of interface:

- **DFI** — Release 5E10, 5E11, or 5E12
- **DNU-S** — Release 5E11 or 5E12.

When one of these new software features has been installed, you can activate the 4-wire FX line capability at the 5ESS switch by setting the signaling value to **LOOP** or **GRND** in the **INSTRSIG** field on RC/V view 1.6 depending on the signaling type.

#### Mixed TR-08, TR-303, and INA Configuration

In Releases 3.1 and 3.2, the SLC-2000 Access System allows TR-08 Mode 1 and Mode 2 VRTs and INA to be configured in the same RT. The TR-08 mode is provisioned with the CIT or UIP for each 192-line shelf in the MDS assembly (one VRT pair). (Refer to 363-208-003, *SLC-2000 Access System, Commands and Messages*, for the UIP command **SET-MODE-TR8** and CIT DLC subsystem command **ED-MODE-TR8**.) If the last shelf assembly (#4) is configured for Mode 1, VRT number 7 is available for Mode 1 operation and VRT number 8 is unusable.

Starting with Release 4.0, the SLC-2000 Access System allows a mixed configuration of TR-08 VRTs, INA, and TR-303 VRTs. The mixed configuration supports pairs of TR-08 VRTs within the same MDS assembly in any arrangement of Mode 1 and Mode 2, along with either one or two TR-303 VRTs (depending on the software release) and/or INA facilities. The mode of the TR-08 VRT must be set the same for each pair of VRTs associated with an MDS assembly. Refer to the "T0 Cross-Connect/Checkerboarding Restrictions" section of this chapter for checkerboarding restrictions.



The limitation of 28 physical feeder DS1s permits the following configurations:

- Maximum of seven Mode 1 TR-08 VRTs (and no INA DS1s)
- Maximum of eight Mode 2 TR-08 VRTs (with 12 physical DS1s available for INA DS1s or TR-303)
- TR-303 VRT(s) depending on the software release (variable concentration allows remaining DS1s for INA or TR-08 VRTs)
  - **Release 4.0 and 4.1:** Maximum of one TR-303 VRT
  - **Release 4.2 and later:** Maximum of two TR-303 VRTs.
- Maximum of 28 INA DS1s (no VRTs if 28 used).

## Feeder Topology Applications

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### Feeder Options

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The *SLC-2000* Access System supports the following standard SONET feeder rates depending on the SONET subsystem software release:

- **SONET Subsystem Software Release 9.1 or Earlier** — OC-3 feeder only
- **SONET Subsystem Software Release 11 or Later** — OC-3 or OC-12 feeder.

For *SLC-2000* Release 3.2 and later, an optional metallic DSX-1 feeder is also available. A DSX-1 metallic feeder interface can be used for interconnecting with existing external multiplexers or external T1 span terminating/protection equipment.

### Feeder Rates

The *SLC-2000* Access System offers an integrated optical OC-3 interface operating at 155 Mb/s. This OC-3 can be multiplexed into an OC-12 by using an external DDM-2000 OC-12 shelf. The digital rate of an OC-12 feeder is 622 Mb/s. If the SONET subsystem software in the *SLC-2000* system is Release 11 or later, the external DDM-2000 OC-12 shelf is not needed. By equipping the *SLC-2000*'s SONET subsystem with 24G-type optical line interface units (OLIUs) in the MAIN slots, the system can interface directly with an OC-12 ring.

The metallic DSX-1 feeder operates at the standard DS1 rate (1.544 Mb/s). The DSX-1 feeder is unprotected in the *SLC-2000* Access System, but it may be protected using an external T1 (not line powering) repeater shelf.

## Feeder Media

Single mode optical fiber is used to support high-speed SONET rates. If the feeder route has not been upgraded to fiber, the metallic DSX-1 feeder may be used instead. Multimode fiber can be used for short-distance applications. The *SLC-2000* Access System does not support mixed metallic and SONET feeders.

## RT Hub Applications

The *SLC-2000* Access System supports “hubbing” applications where up to three RTs are connected to a DDM-2000 hub served by an OC-3 or OC-12 service node. The DDM-2000 serving as the hub uses point-to-point topology through SONET OC-3 feeders. Each OC-3 feeder uses bandwidth in STS-1 increments to transport service to the RT customer location. Figure 3-5 shows an RT hubbing application.

Hubbing and drop capabilities are designed expressly for loop feeder and customer location applications. Reduced plant costs and rapid service turn-up are key benefits of deploying DDM-2000 OC-3 or OC-12 Multiplexers in STS-1 drop and OC-3 hubbing configurations (STS-1 drops are explained in Chapter 5). Refer to 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for more information.

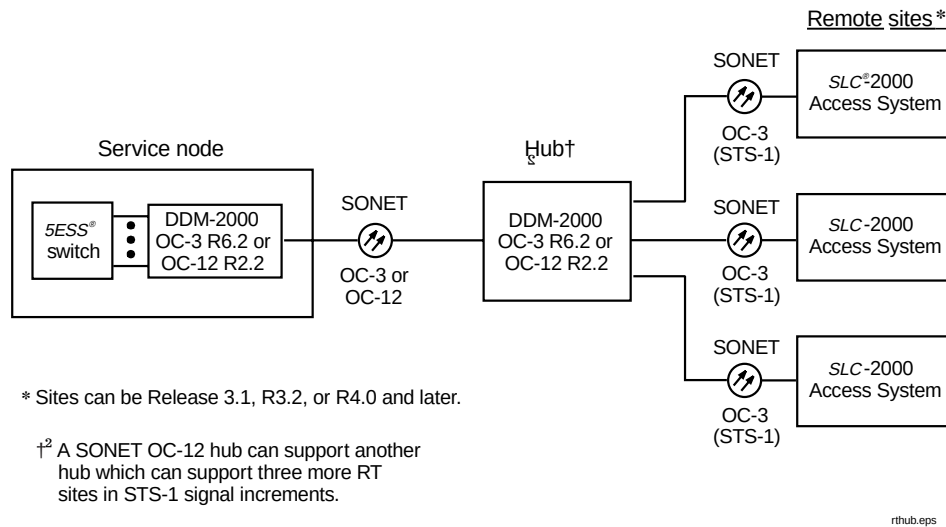


**Figure 3-5. Typical RT Hubbing Application Using OC-3 Point-to-Point Topology**

## Point-to-Point Topology

The *SLC-2000* Access System supports a point-to-point topology using SONET OC-3 feeder (Figure 3-6).

The OC-3 point-to-point topology utilizes a SONET fiber link that consists of service and protection fiber pairs for a total of four fibers. Optical feeder protection switching is implemented at both the remote terminal (RT) and central office (CO) sites with all bandwidth dropped at the RT site. Additional *SLC-2000* Access Systems can be added at the RT site if service requirements increase beyond the capacity of the initial *SLC-2000* Access System. As needed, multiple fiber links can be installed to support multiple point-to-point systems at the site.

Also, an OC-3 point-to-point topology can grow into an OC-12 point-to-point topology by adding the DDM-2000 OC-12 shelf at the service node (CO-2000) and RT if service requirements exceed the OC-3 bandwidth.

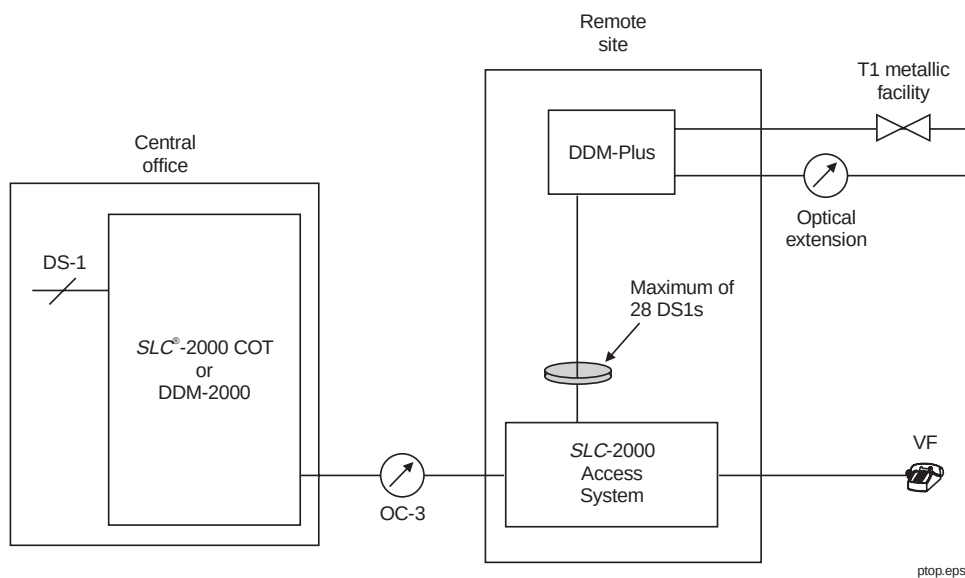


**Figure 3-6. Typical OC-3 Point-to-Point Topology**

## OC-3 Linear Drop (Taper) Topology

The *SLC-2000* Access System supports two types of linear drop topology (often called tapers). An STS-1 linear drop topology provides for one function group (an STS-1 signal carries up to 28 DS1 signals) to be dropped at up to three RT SONET nodes. A VT1.5 linear drop topology provides for 1 to 56 VT1.5 signals (the VT1.5 signal carries one DS1 signal) to be dropped at up to nine RT SONET

nodes. The VT1.5 signals can be cross-connected from any of the three STS-1 multiplex groups to either function group A or C.

To support the linear drop topology, the ARM shelf assembly must be configured with four optical line interface units (OLIUs) as described in Chapter 8, "System Planning and Engineering." When the ARM shelf is configured with four OLIUs, the option for DS1 pipes cannot be supported.

The OC-3 linear drop topology can grow into an OC-12 linear drop topology by adding the DDM-2000 OC-12 shelf at the service node and at each RT site if service requirements exceed the OC-3 bandwidth.

### OC-3 STS-1 Linear Drop (Taper) Topology

The *SLC-2000* Access System supports an STS-1 linear drop topology where up to three *SLC-2000* Access Systems or DDM-2000 Multiplexers can be deployed as shown in Figure 3-7. This arrangement is also referred to as an STS-1 taper topology. At each RT, one STS-1 function group is cross-connected to A or C function group (A, B, or C for a DDM-2000 RT). Any unused bandwidth in a multiplexer group cannot be cross-connected to another RT. An OC-3 SONET fiber connects the service node to RT1, connects RT1 to RT2, and connects RT2 to RT3. Each SONET fiber link consists of service and protection fiber pairs. Line protection switching is implemented at all RT sites and the service node site. For short distances (less than 2 km), the low-cost IS-3 interface can be used in place of the OC-3 (via the **21D** OLIU). The IS-3 operates at the same rate as the OC-3 (155 Mb/s) but uses less expensive optics for signal transmission.

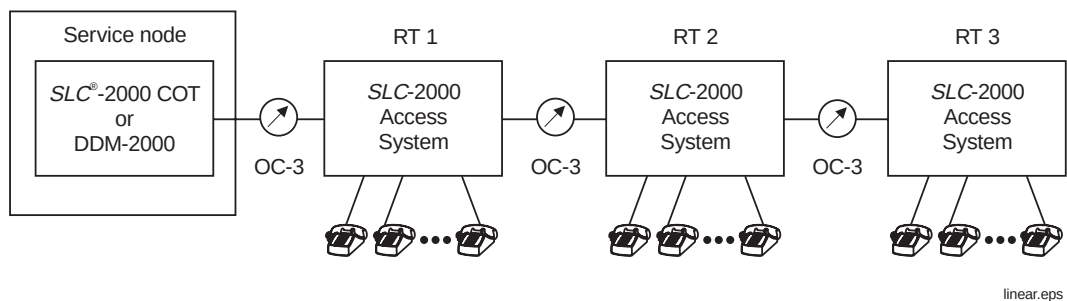


**Figure 3-7. Three-Node Linear Taper Topology**

### OC-3 VT1.5 Linear Drop (Taper) Topology

The *SLC-2000* Access System supports a VT1.5 linear drop topology where up to seven *SLC-2000* Access Systems or DDM-2000 systems are used at RT SONET node locations. The VT1.5 linear drop provides the same type of topology as the STS-1 linear drop, but it allows better bandwidth utilization. To support VT1.5

linear drops, **22F** OLIUs must be installed. Then, at each RT, only the required number of VT1.5 signals are cross-connected to A or C function group (A, B, or C for a DDM-2000 RT). Any unused bandwidth in a multiplexer group is then cross-connected to another RT.

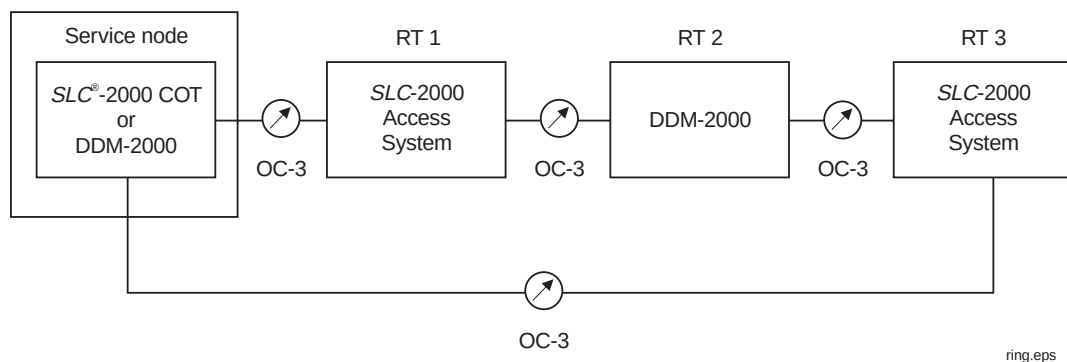
### **Diversely Routed Ring Configurations**

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Ring topologies offer savings in fiber and equipment in comparison to multiple point-to-point topologies. Fiber savings are achieved by eliminating the separate fiber spans for each RT site. Ring topologies provide more effective utilization of bandwidth since traffic to and from several RT sites can be combined and sent to the *SLC-2000* SONET COT or one DDM-2000 multiplexer at the service node. This is more efficient than having separate links from multiple RT sites each terminated in separate DDM-2000s at the service node.

Using SONET ring topology, a DDM-2000 multiplexer or *SLC-2000* COT can support up to 15 network elements (Release 3.2 RTs).

There are two types of ring configurations: diversely routed rings and *folded* rings. Figure 3-8 illustrates a diversely routed ring. This ring implementation provides protection against fiber cuts and nodal failures.



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**Figure 3-8. Typical OC-3 Diversely Routed Ring Application**

The OC-3 point-to-point topology can be upgraded in-service to a self-healing ring topology (Figure 3-8). Some fiber facility rearrangements and protection switching are necessary to establish the counter-rotating traffic path, but these changes can be performed in service. The ring topology consists of two unidirectional, counter-rotating fiber rings (per TR-496<sup>\*</sup>) interconnecting the service node to other service node sites and/or multiple RT sites. If one of the fiber rings is cut, or a nodal failure occurs, service is maintained since a path exists from each site back to the service node. This substantially improves availability. Each service node and RT uses two 22-type OLIUs.

A folded ring implies that the fibers connecting network elements in a ring are in the same sheath (Figure 3-9). A folded ring protects only against nodal failures but provides the same cost savings as diversely routed rings. If the fiber sheath is cut, communication is lost downstream.

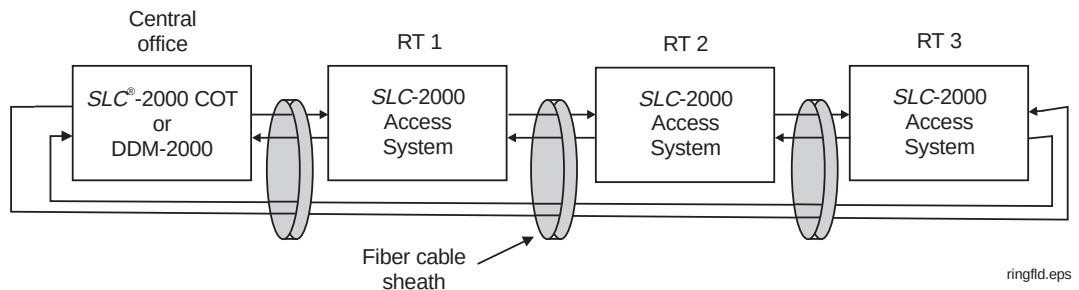


**Figure 3-9. Folded Ring**

### **SONET Ring Technology Applied to Taper and Hub Topologies**

SONET ring technology can be applied to taper and hub feeder routes, substantially improving the reliability of these topologies. For applications of this type of topology, see Document 363-206-200, *DDM-2000 OC-3 and OC12 Multiplexers, Applications, Planning, and Ordering Guide*.

\* Bellcore Technical Reference TR-TSY-000496, Issue 2, September 1989, *SONET Add-Drop Multiplex Equipment (SONET ADM) Generic Criteria*.

### OC-3 Path-Switched Ring Topology

The *SLC-2000* Access System supports OC-3 path-switched ring topologies containing a maximum of ten nodes (including the gateway network element at the central office) as shown in Figure 3-10. The remote nodes can be any combination of *SLC-2000* Access Systems or DDM-2000 multiplexers. Traffic on the ring is automatically rerouted to maintain transmission when any feeder path is broken or any node fails. An OC-3 ring provides a total bandwidth of 84 DS1 channels. These DS1 channels can be flexibly allocated among the remote nodes, subject to the total bandwidth capacity of each *SLC-2000* Access System.

To support the path-switched ring topology, the ARM shelf is equipped with two **22**-type optical line interface units (OLIUs) as described in Chapter 8, "System Planning and Engineering." In this configuration, the *SLC-2000* Access System supports a maximum of 28 service DS1 channels for DLC traffic and up to 28 additional DS1 pipes for customer service or supplemental feeder at the remote site.

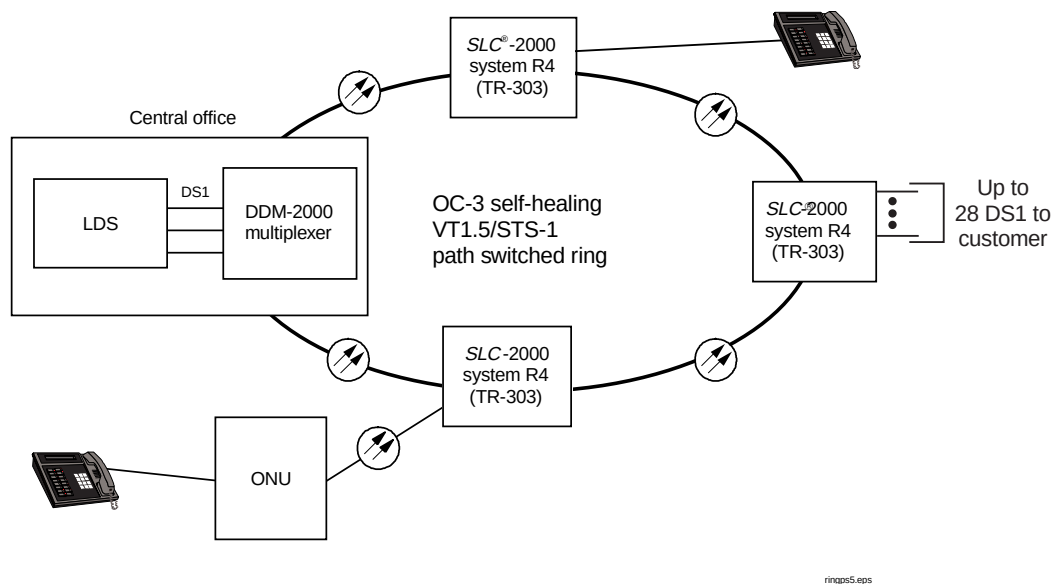


**Figure 3-10. Typical OC-3 Path-Switched Ring Topology**

A ring network can be engineered to provide route diversity for surviving feeder damage. In some applications, a folded ring (without route diversity) may also prove useful due to the bandwidth flexibility that it provides. For example, the tapered route shown in Figure 3-7 can also be provided by a folded ring; this configuration could provide DS1 pipes at the RT nodes.

### **OC-12 Path-Switched Rings (SONET Subsystem Software Release R11 or Later)**

Figure 3-11 and Figure 3-12 on page 3-23 show the *SLC*-2000 system in an OC-12 ring. SONET subsystem Software Release 11 or later allows you to use OC-12 OLIUs in the MAIN slots of the ARM shelf to interface with the OC-12 ring. The OC-12 ring can consist of the following network elements:

- *SLC*-2000 systems and DDM-2000 OC-3 Multiplexer shelves (Figure 3-11)
- *SLC*-2000 systems and DDM-2000 OC-12 Multiplexer shelves (Figure 3-12)
- A mix of *SLC*-2000 systems and DDM-2000 OC-12 and OC-3 Multiplexer shelves upgraded with OC-12 optics.

Using the OC-12 OLIU's TSI cross connection circuitry, each node allows access to 3 STS-1s or 84 VT1.5s within those 3 STS-1s. The *SLC*-2000 ARM shelf uses up to one STS-1 or 28 VT1.5s for Function Group A to provide DLC services. The other STS-1s are available for Function Group C to provide services such as DS1 pipes through the low-speed interface slots of the ARM shelf.

The *SLC*-2000 system with OC-12 optics may be used as an in-service upgrade of an existing OC-3 ring when traffic demand exceeds the STS-1 capacity of the OC-3 ring. This upgrade strategy quadruples the capacity of the ring using the existing fiber and *SLC*-2000 systems or DDM-2000 OC-3 shelves. This can allow additional *SLC*-2000 and/or DDM-2000 nodes to the ring. It can also allow you to drop more traffic at existing nodes.



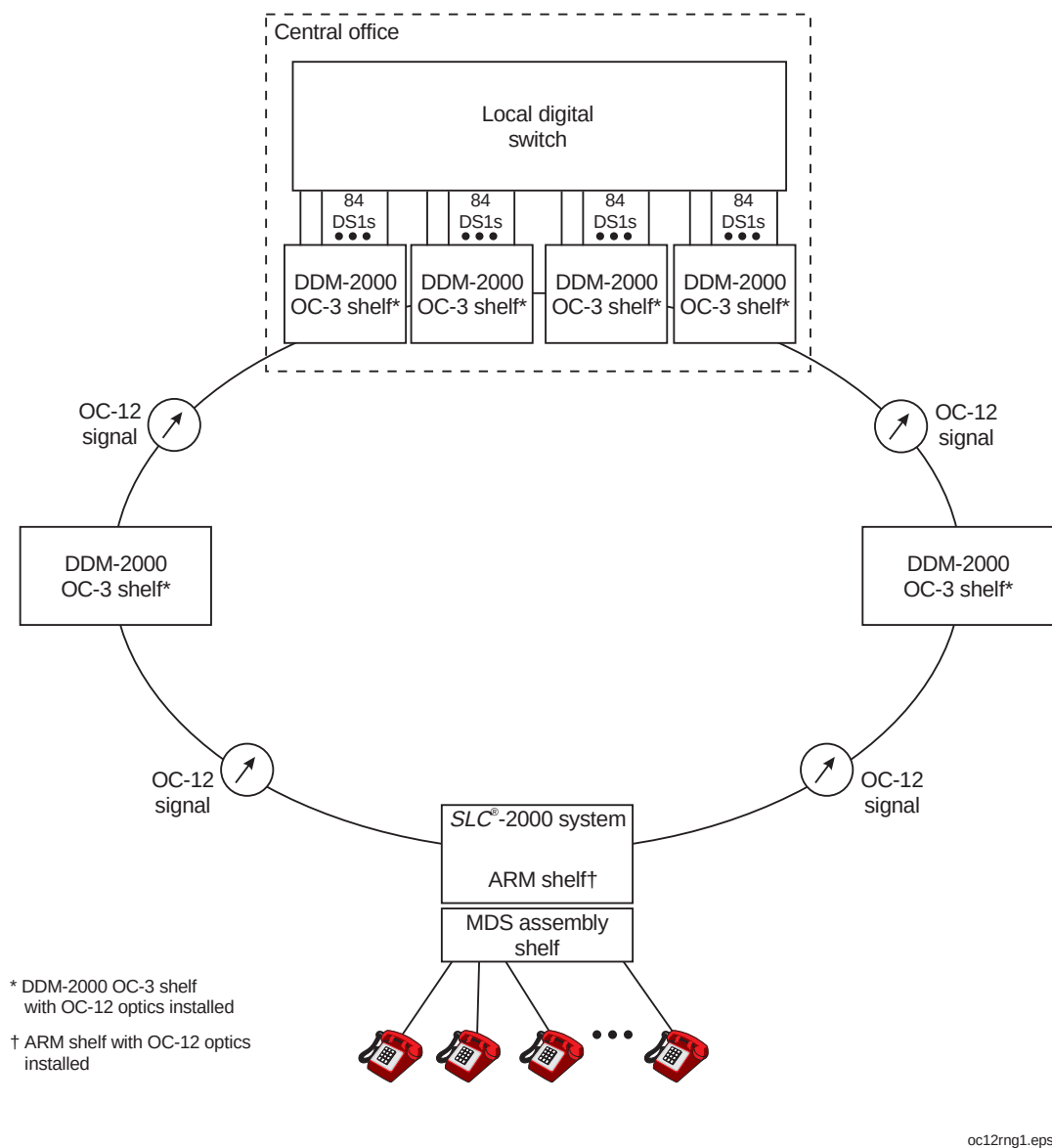


**Figure 3-11. Typical OC-12 Ring Using DDM-2000 OC-3 Shelves and the SLC-2000 System (SONET Subsystem Software Release 11 or Later)**

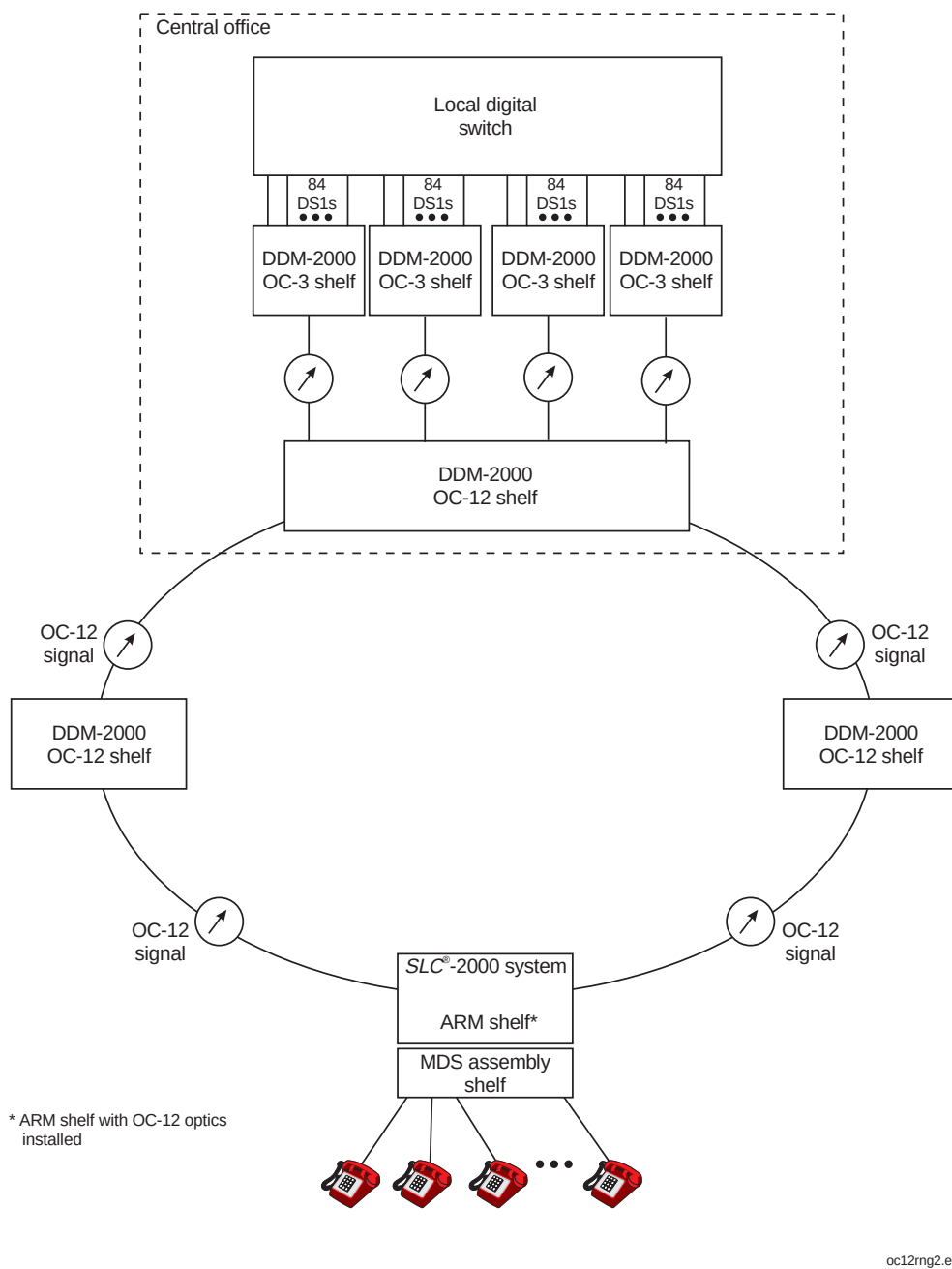


**Figure 3-12. Typical OC-12 Ring Using DDM-2000 OC-12 Shelves and the SLC-2000 System (SONET Subsystem Software Release 11 or Later)**

## DSX-1 Metallic Feeder Configuration

The *SLC-2000* Access System supports a DSX-1 metallic feeder configuration as shown in Figure 3-13. The metallic feeder interface also may be used with span protection shelves (Chapter 8).

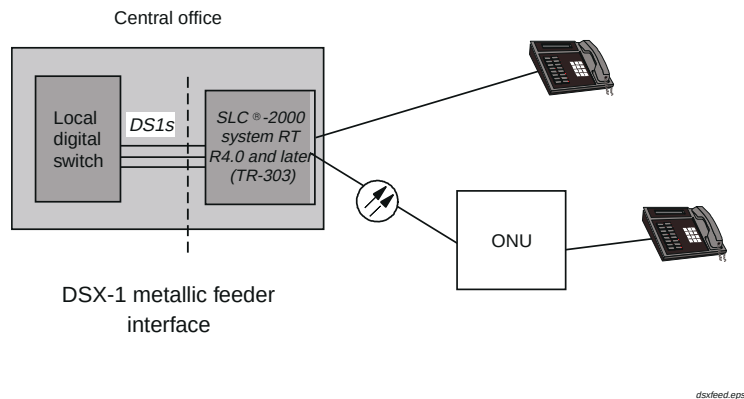


**Figure 3-13. Typical DSX-1 Metallic Feeder Configuration**

## SLC-2000 Access System to DDM-2000 FiberReach Narrowband Shelf Applications

The *SLC-2000* DLC subsystem can host a DDM-2000 FiberReach Narrowband shelf (NBS) optical network unit (ONU) through an OC-1 ring using DDM-2000 FiberReach Wideband shelves (WBSs). Each OC-1 ring can carry up to 28 DSX-1s to the NBSs from the Servers installed in the MDS assemblies at the *SLC-2000* HDT. However, an external DDM-2000 OC-3 Multiplexer or the SONET subsystem of the ARM shelf must host the WBSs in the OC-1 ring. The host equipment provides single-ended operations for the elements in the OC-1 ring. If you are using more than 28 DSX1-based DT Servers to host the NBSs from the HDT, you may need additional collocated multiplexing equipment (DDM-2000 OC-3 shelves or DDM-2000 FiberReach WBSs) to add additional OC-1 rings to the configuration.

See Chapter 8 for the methods of configuring the ARM shelf to provide each application.

This section shows typical configurations for OC-1 rings. For detailed applications connecting the *SLC-2000* Access System to the DDM-2000 FiberReach NBS ONU, see 363-206-300, *DDM-2000 FiberReach Applications, Planning, and Ordering Guide*.

### DDM-2000 OC-3 Multiplexer Collocated with the SLC-2000 System

Figure 3-14 shows a SLC-2000 system hosting a NBS through a collocated DDM-2000 OC-3 shelf. In this configuration, the collocated DDM-2000 OC-3 shelf is part of an OC-1 ring and provides a CIT connection to maintain single-ended operation capability for the elements of the OC-1 ring. This configuration allows the CO interface to feed the HDT with either SONET or DSX-1 feeders. It also allows customer access to the 28 DS-1 pipes if fed by SONET feeders.

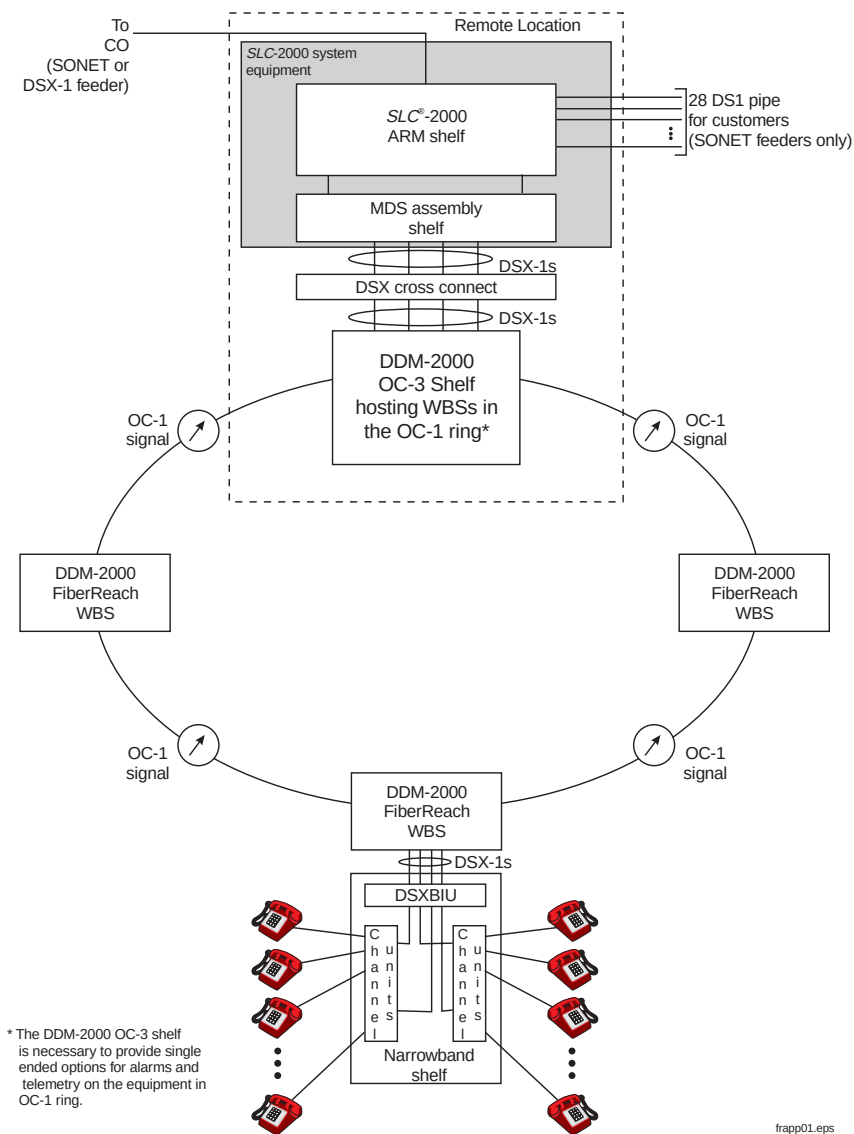


**Figure 3-14. SLC-2000 System Hosting a FiberReach NBS Through a Collocated WBS — WBSs Hosted by an External DDM-2000 Multiplexer**

The diagram illustrates a remote location connection for a DDM-2000 system. At the top, a dashed box labeled "Remote Location" contains the "SLC-2000 system equipment" (which includes the "SLC-2000 ARM shelf" and "27G2-U OLIUs in function group C"), the "MDS assembly shelf", the "DSX cross connect", and the "DDM-2000 FiberReach WBS". This remote location is connected via "OC-1 signal" lines to three "DDM-2000 FiberReach WBS" units. These units are then connected to a central "DDM-2000 FiberReach WBS" unit, which is connected to a "DSXBIU" and a "Narrowband shelf" containing "Channels" and "Narrowband shelf" components, ultimately leading to multiple telephone icons.

**Figure 3-15. SLC-2000 ARM Shelf Hosting DDM-2000 FiberReach WBSs**

### SONET Subsystem of ARM Shelf Using 27G2-U OLIUs to Multiplex DSX-1s onto an OC-1 Ring (SLC-2000 System DSX-1 Metallic CO Interface Only)

If the SLC-2000 system uses a DSX-1 metallic CO interface, then the ARM shelf can use the SONET subsystem to multiplex DSX-1s from the Servers in the MDS assembly onto an OC-1 ring as shown in Figure 3-16. This configuration requires a full compliment of SONET subsystem circuit packs with the exception of MXRV0s in Function Group A. The MAIN slots contain 27G2-U OLIUs and the Function Group C slots contain MXRV0s. The DS1 low-speed slots contain DS1 circuit packs as needed. The SONET subsystem must contain software release R9.1 or later. The 27G2-U OLIUs can interface with two OC-1 rings if needed. It also eliminates the need for a collocated WBS as well as a separate DDM-2000 OC-3 multiplexer host for providing single-ended operations. However, this configuration can not provide DS1 pipes from the ARM shelf. A typical example of this application is when the SLC-2000 HDT is collocated with the LDS, making DSX-1 feeders from the LDS interface a practical alternative.

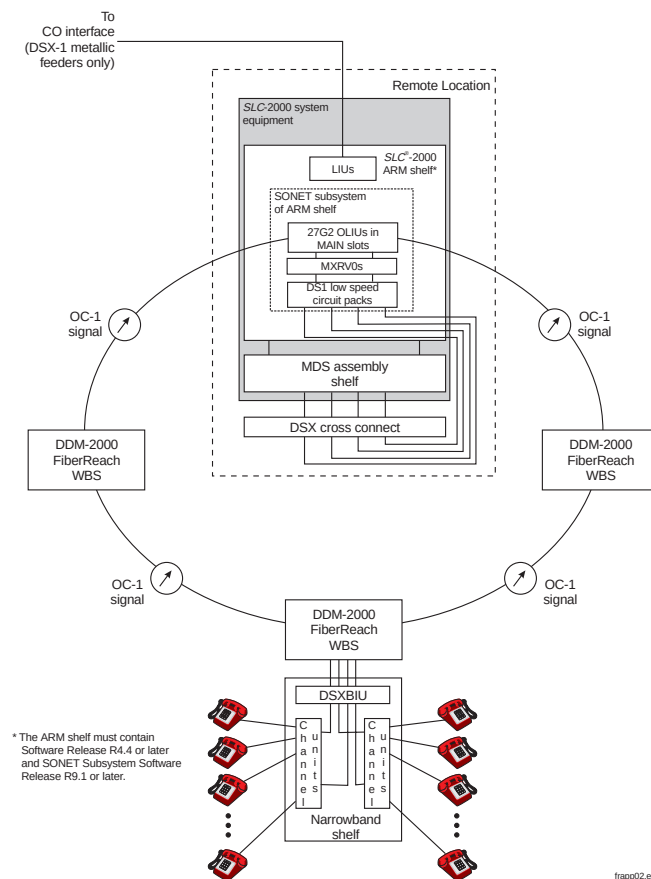


**Figure 3-16. SLC-2000 System Hosting a FiberReach NBS using 27G2-U OLIUs in the MAIN Slots of the ARM Shelf**

### J1C265AA-1, L4 ARM Shelf with 26G2-U OLIUs in Function Group C to Multiplex DSX-1s onto an OC-1 Ring

In this configuration, the J1C265AA-1, L4 ARM shelf contains 26G2-U OLIUs in Function Group C as part of the OC-1 ring (Figure 3-17). The ARM shelf must contain SONET subsystem Software Release R13 or later and the WBSs in the ring must contain FiberReach software R3.0 or later. This configuration eliminates the need for a collocated WBS and a separate DDM-2000 OC-3 shelf to host the WBSs in the OC-1 ring. However, the 26G2-U OLIUs only support one FiberReach OC-1 ring. In this configuration, the 28 DS1 pipes are not accessible from the DS1 low-speed slots in Function Group C of the ARM shelf. However, as shown in Figure 3-18, DS1 pipes are accessible from any of the WBSs on the ring if the bandwidth to support them is available on the OC-1 ring.

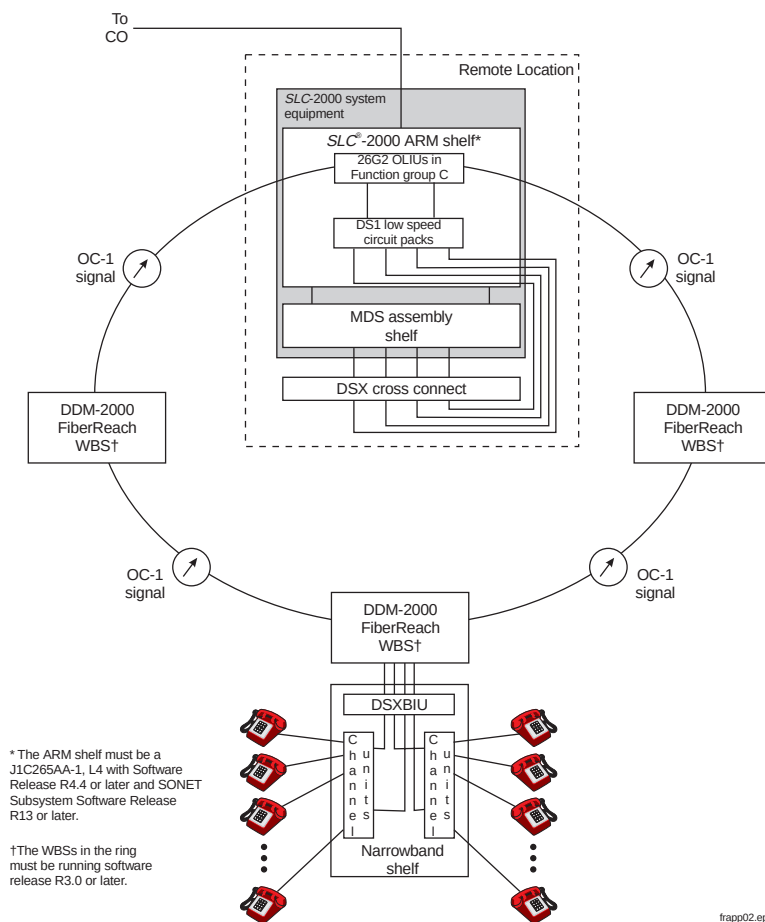


**Figure 3-17. SLC-2000 System Hosting a FiberReach NBS using 26G2-U OLIUs and a J1C265AA-1, L4 ARM Shelf**

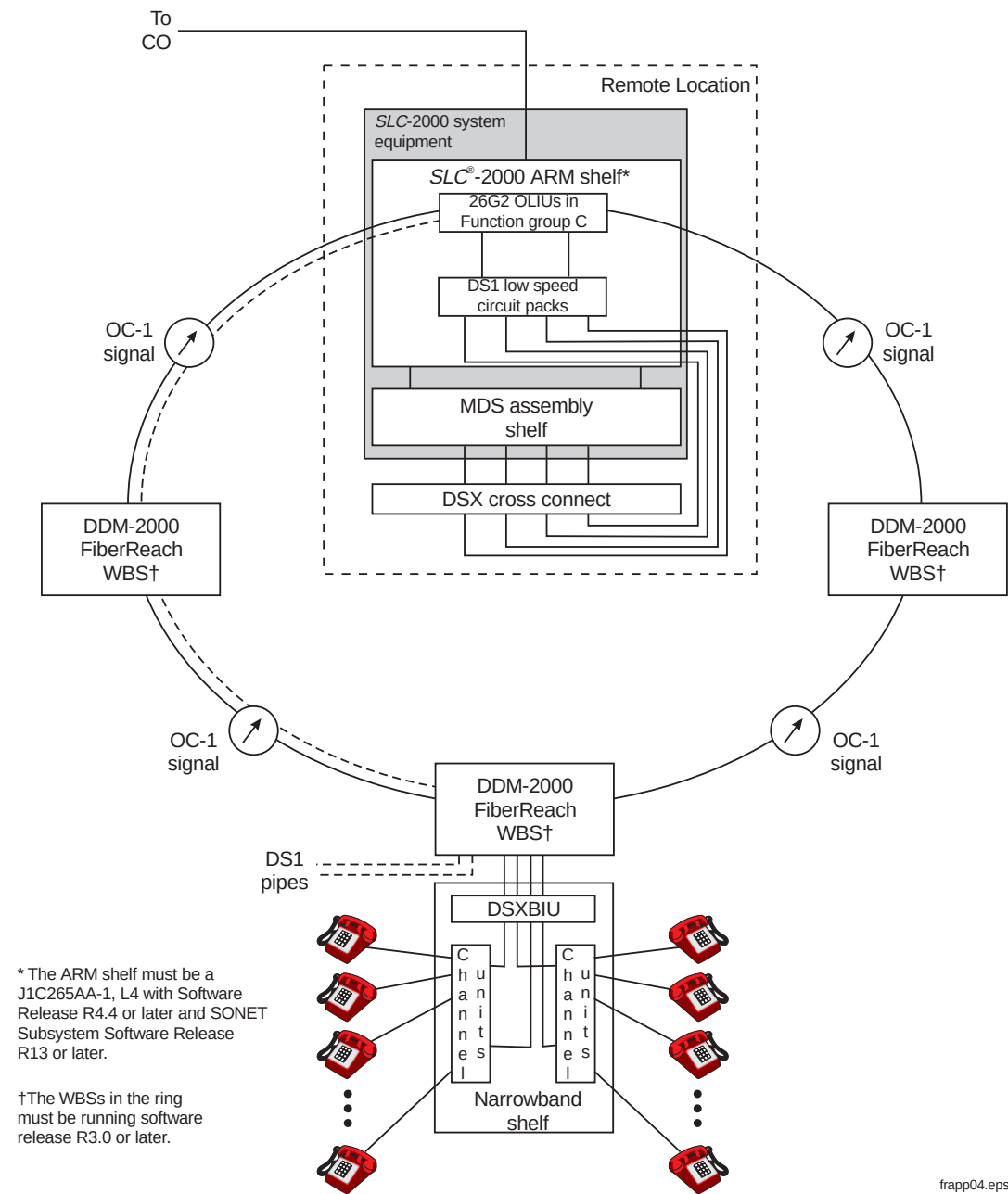


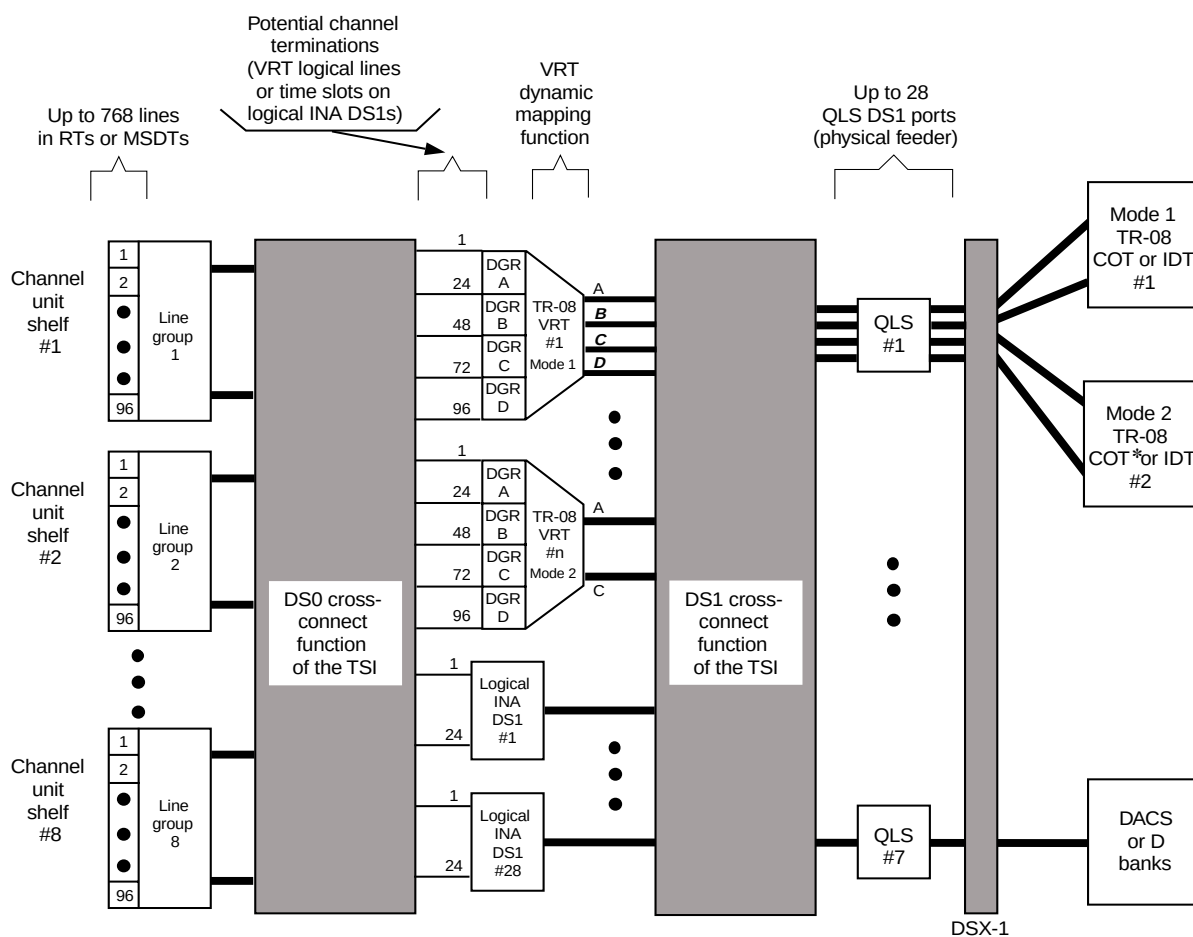
**Figure 3-18. SLC-2000 System Hosting a FiberReach NBS using 26G2-U OLIUs and a J1C265AA-1, L4 ARM Shelf Providing DS1 Pipes Through a WBS**



## Bandwidth Management Applications

### DS0 and DS1 Cross-Connections in the DLC Subsystem

Figure 3-19, Figure 3-20, and Figure 3-21 show a *logical* view of the SLC-2000 cross-connect arrangement. For the DLC subsystem, *cross-connection* is the ability of the DLC subsystem of a SLC-2000 system (rather than the SONET subsystem) to associate a physical resource (such as a physical DS1 or channel circuit) with a logical entity (such as a logical feeder DS1 on a VRT or a logical line).



\*SLC® 96 COT only

tpa 847795-01

**Figure 3-19. SLC-2000 Release R3.2 Time Slot Interchange (TSI)**

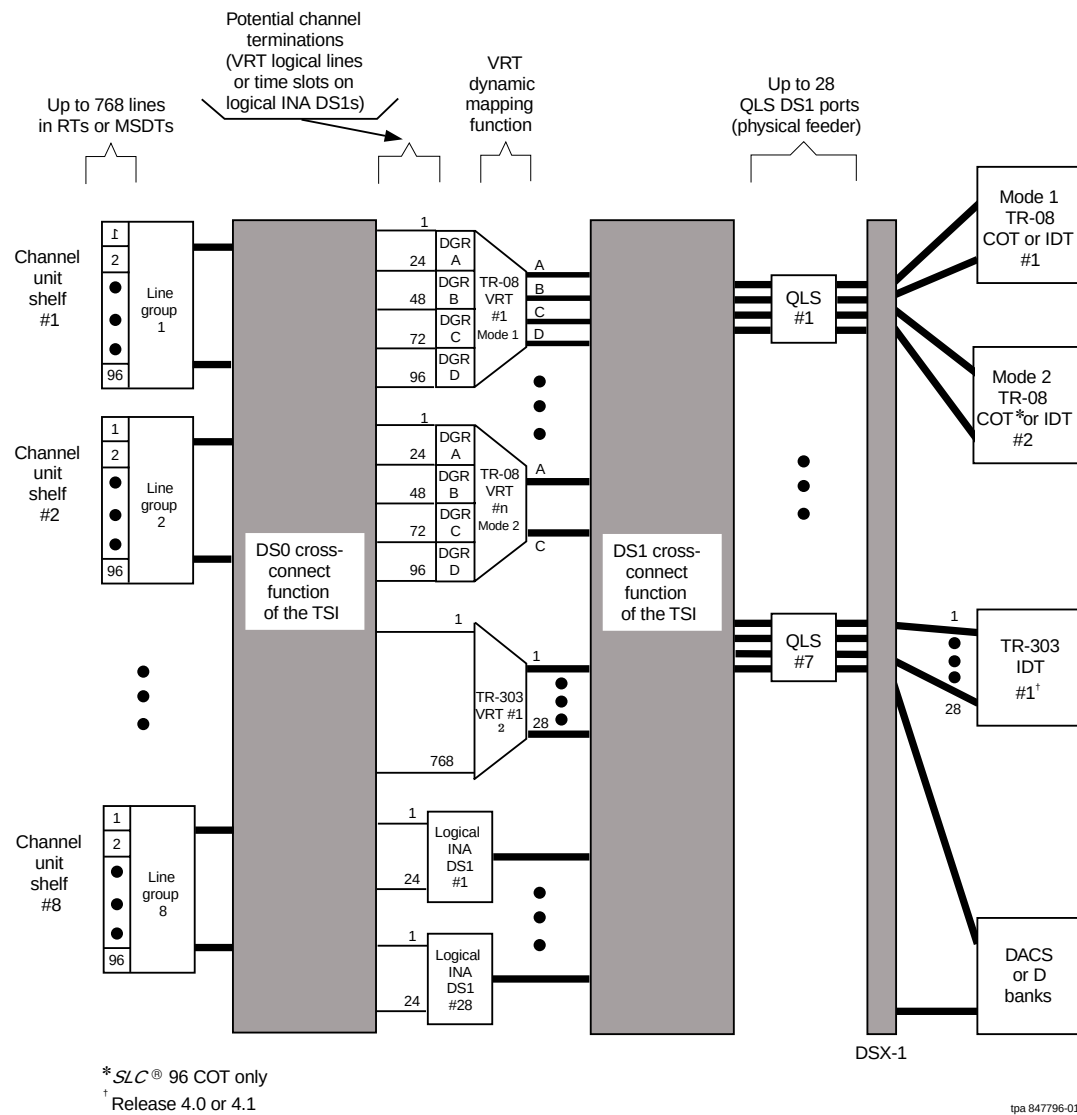


**Figure 3-20. Cross-Connect Function of the TSI (Releases R4.0 and R4.1)**

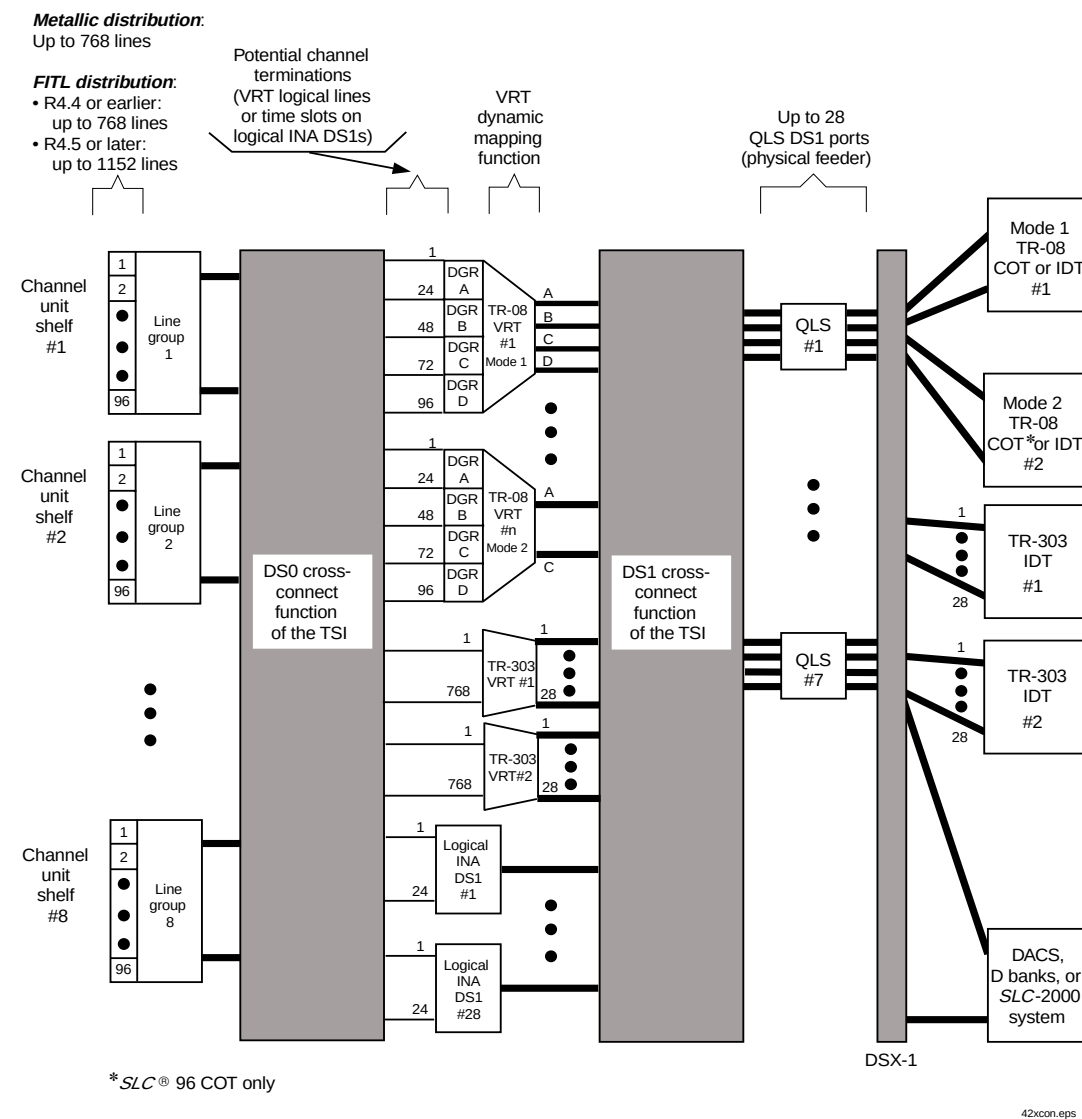


**Figure 3-21. Cross-Connect Function of the TSI (Release R4.2 or Later)**

The system uses the functionality in the TSI circuit packs to make these associations.

This logical-to-physical mapping associated with DS0 and DS1 cross-connection is also referred to as a *static* time slot assignment. In a nonconcentrated virtual system (TR-08 Mode 1 VRT or INA DS1), the combination of static DS0 and DS1 cross-connections results in a DS0 cross-connection between a feeder DS0 time slot and a DS0 from a channel unit.

Call processing results in *dynamic* time slot assignment in concentrated systems (TR-08 Mode 2 and TR-303 VRTs). In a concentrated system, the central office interface (the LDS or a TR-08 Mode 2 COT such as the *SLC* 96 COT) requests a dynamic time slot assignment. It sends the logical feeder time slot and logical line number [also called the call reference value (CRV) in TR-303] to the RT/HDT when making this request. The RT/HDT uses its static DS0 and DS1 time slot mapping and this dynamic mapping request to make the DS0 cross-connection between the physical feeder and the channel unit. Likewise, in a TR-303 configuration, the LDS may request a semipermanent time slot for a VF or special services line or a DDS or ISDN channel\*. The RT/HDT uses its static DS0 and DS1 time slot mapping and this semipermanent time slot request to make the cross-connection between the physical feeder and the channel unit. Therefore in concentrated systems, the static time slot assignments are not really cross-connected until a dynamic or semipermanent time slot assignment is completed. There are no dynamic cross-connections in nonconcentrated systems.

For example, when a Mode 2 TR-08 VRT on a *SLC*-2000 system RT receives a concentrator time slot assignment message from a local digital switch or *SLC* 96 COT that refers to logical line number 3, it looks in a table to determine (for example) that logical line 3 is actually physical line 3 on channel unit shelf 5. The system then instructs the RT TSI to make the requested connection to physical line 3 on Shelf 5.

The system supports only standard (static) cross-connections at the *SLC*-2000 COT, which terminates only TR-08 Mode 1 VRTs. For more information, see the section "Creating Standard DS1 and DS0 Cross-Connections on Turn-Up" in this chapter.

### **DS1 Cross-Connect Capabilities and Limitations**

VRTs and INA DS1s and, as a result, their distribution side terminations (VRT logical lines and DS0 time slots on INA DS1s, respectively) are activated and deactivated by making and breaking DS1 cross-connections. DS1 cross-connections are made using the **ENT-CRS-T1** CIT command and deleted using the **DLT-CRS-T1** CIT command.

The fundamental rules for DS1 cross-connections in the *SLC*-2000 system are:

1. A maximum of 28 physical feeder DS1s is available to any given *SLC*-2000 system remote terminal.
2. If a physical DS1 is currently assigned to logical entity (VRT or INA DS1), it cannot be used for another entity without first breaking the existing DS1 cross-connection. This deactivates all or part of the first logical entity.

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\* Details for provisioning integrated services digital network (ISDN) services are given in Chapter 7.

As a result, not all logical VRTs and INA DS1s can be in service simultaneously. Specifically, the limit of 28 physical feeder DS1s allows the following:

- A maximum of seven Mode 1 TR-08 VRTs can be cross-connected simultaneously with no INA or TR-303 DS1s available.
- A maximum of eight Mode 2 TR-08 VRTs can exist simultaneously with 12 physical DS1s available for cross-connection to INA or TR-303 DS1s.
- A maximum of one TR-303 VRT using approximately 1:1 concentration can exist using 28 DS1s (Release 4.0 and later).
- A maximum of 28 INA DS1s can exist with no VRTs.

You can also have other mixtures of Mode 1 TR-08 VRTs, Mode 2 TR-08 VRTs, TR-303 VRTs (Release 4.0 and later), and INA DS1s; but they are always limited to a maximum of 28 physical DS1s.

A Mode 1 TR-08 VRT always consists of 96 logical lines and four logical feeder DS1s designated A, B, C, and D. A Mode 2 TR-08 VRT always consists of 96 logical lines and two logical feeder DS1s designated A and C. However, it is possible for part or all of the lines on a TR-08 VRT to be out-of-service (OOS) if one or more of its logical feeder DS1s is not DS1 cross-connected to physical feeder DS1s. Typically, this occurs because the physical feeder DS1 to which the VRT is normally cross-connected has been converted to an INA DS1.

Table 2-1 on page 2-20 in Chapter 2 shows the maximum number of lines for a *SLC-2000* system depending on the software release and the mode of distribution. The concentration is determined by the following:

- ***Metallic Distribution (all software releases):*** The concentration is determined by the number of DS1 feeders that are cross-connected to the TR-303 VRT. With the minimum of two DS1s assigned, the concentration is 17.4:1. With all DS1 feeders cross-connected to the TR-303 VRT, the concentration is 768:668.
- ***FITL Distribution with Software Release R4.5 or Later:*** With all DS1 feeders cross-connected to the TR-303 VRT, the concentration is 1152:668.

Refer to the “T0 Cross-Connect/Checkerboarding Restrictions” section of this chapter for checkerboarding restrictions.

A logical INA DS1 is activated by DS1 cross-connecting it to the correspondingly numbered physical INA DS1 [where the first DS1 port on the second quad low-speed (QLS) unit (VTU or LIU) is considered the fifth physical INA DS1, and so forth]. Since logical INA DS1s are only an abstract concept that allows INA DS1s to be treated similarly to VRTs, DS1 cross-connections to physical DS1s other than the correspondingly numbered one are not permitted.

Configuration information that is needed on the feeder side of the DS0 TSI is the following:

- How many and what mode (1 or 2) TR-08 VRTs are activated
- How many and what logical number INA DS1s are activated
- How many DS1s are assigned to a TR-303 VRT (if it is in service) (Release 4.0 and later).

The *SLC-2000* system requires that the two TR-08 VRTs assigned to an MDS assembly must both be Mode 1 or both be Mode 2 (with the further restriction that if VRT number 7 is Mode 1, then VRT number 8 cannot be used for TR-08 service). In addition, the *SLC-2000* system allows the feeder DS1s of TR-08 VRTs to be cross-connected only to the specific QLS DS1 ports shown in Table 3-5.

In Table 3-5, (Ak) (Bk) (Ck) (Dk) represent the four logical feeder DS1s of TR-08 VRT *k*. For example, the table entry in the last column of the first row [No. 1/(A1)(C1)(A2)(C2)] means that the four DS1 ports of QLS number 1 are DS1 cross-connected sequentially to the following:

- The A logical feeder DS1 of Mode 2 VRT number 1
- The C logical feeder DS1 of Mode 2 VRT number 1
- The A logical feeder DS1 of Mode 2 VRT number 2
- The C logical feeder DS1 of Mode 2 VRT number 2.

**Table 3-5. Standard DS1 Cross-Connections for TR-08 VRTs and LIU/VTU Ports**

| MDS Assembly | TR-08 VRT | LIU/VTU DS1s for Mode 1                          | LIU/VTU DS1s for Mode 2 |
|--------------|-----------|--------------------------------------------------|-------------------------|
| 1            | 1<br>2    | No. 1/(A1)(B1)(C1)(D1)<br>No. 2/(A2)(B2)(C2)(D2) | No. 1/(A1)(C1)(A2)(C2)  |
| 2            | 3<br>4    | No. 3/(A3)(B3)(C3)(D3)<br>No. 4/(A4)(B4)(C4)(D4) | No. 3/(A3)(C3)(A4)(C4)  |
| 3            | 5<br>6    | No. 5/(A5)(B5)(C5)(D5)<br>No. 6/(A6)(B6)(C6)(D6) | No. 5/(A5)(C5)(A6)(C6)  |
| 4            | 7<br>8    | No. 7/(A7)(B7)(C7)(D7)<br>(not available)        | No. 7/(A7)(C7)(A8)(C8)  |

Because of the DS1 cross-connect restrictions in Table 3-5 and the fact that a logical INA DS1 may be DS1 cross-connected only to its corresponding physical DS1 feeder, any time a logical INA DS1 is activated, one or more TR-08 digroups may be made unusable.

The TR-08 digroups (if any) that become unusable depends on which INA DS1 is activated and whether the affected VRT (if any) is set for Mode 1 or Mode 2. Table 3-6 lists the digroups (and ranges of TR-08 VRT logical lines) rendered unusable by activating each of the 28 (logical) INA DS1s.

**Table 3-6. TR-08 VRT Digroups That Are Unavailable for Each Active INA DS1**

| <b>AID of Physical Feeder DS1</b> | <b>(Logical) INA DS1 Activated</b> | <b>Mode 1 TR-08 VRT Number and Digroup (Logical Lines) Unavailable</b> | <b>Mode 2 TR-08 VRT Number and Digroup (Logical Lines) Unavailable</b> |
|-----------------------------------|------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>a-1-1</b>                      | 1                                  | VRT #1/Digroup A (lines 1 to 24)                                       | VRT #1/Digroups A and B (lines 1 to 48)                                |
| <b>a-1-2</b>                      | 2                                  | VRT #1/Digroup B (lines 25 to 48)                                      | VRT #1/Digroups C and D (lines 49 to 96)                               |
| <b>a-1-3</b>                      | 3                                  | VRT #1/Digroup C (lines 49 to 72)                                      | VRT #2/Digroups A and B (lines 1 to 48)                                |
| <b>a-1-4</b>                      | 4                                  | VRT #1/Digroup D (lines 73 to 96)                                      | VRT #2/Digroups C and D (lines 49 to 96)                               |
| <b>a-2-1</b>                      | 5                                  | VRT #2/Digroup A (lines 1 to 24)                                       | None                                                                   |
| <b>a-2-2</b>                      | 6                                  | VRT #2/Digroup B (lines 25 to 48)                                      | None                                                                   |
| <b>a-2-3</b>                      | 7                                  | VRT #2/Digroup C (lines 49 to 72)                                      | None                                                                   |
| <b>a-2-4</b>                      | 8                                  | VRT #2/Digroup D (lines 73 to 96)                                      | None                                                                   |
| <b>a-3-1</b>                      | 9                                  | VRT #3/Digroup A (lines 1 to 24)                                       | VRT #3/Digroups A and B (lines 1 to 48)                                |
| <b>a-3-2</b>                      | 10                                 | VRT #3/Digroup B (lines 25 to 48)                                      | VRT #3/Digroups C and D (lines 49 to 96)                               |
| <b>a-3-3</b>                      | 11                                 | VRT #3/Digroup C (lines 49 to 72)                                      | VRT #4/Digroups A and B (lines 1 to 48)                                |
| <b>a-3-4</b>                      | 12                                 | VRT #3/Digroup D (lines 73 to 96)                                      | VRT #4/Digroups C and D (lines 49 to 96)                               |
| <b>a-4-1</b>                      | 13                                 | VRT #4/Digroup A (lines 1 to 24)                                       | None                                                                   |
| <b>a-4-2</b>                      | 14                                 | VRT #4/Digroup B (lines 25 to 48)                                      | None                                                                   |
| <b>a-4-3</b>                      | 15                                 | VRT #4/Digroup C (lines 49 to 72)                                      | None                                                                   |
| <b>a-4-4</b>                      | 16                                 | VRT #4/Digroup D (lines 73 to 96)                                      | None                                                                   |
| <b>a-5-1</b>                      | 17                                 | VRT #5/Digroup A (lines 1 to 24)                                       | VRT #5/Digroups A and B (lines 1 to 48)                                |
| <b>a-5-2</b>                      | 18                                 | VRT #5/Digroup B (lines 25 to 48)                                      | VRT #5/Digroups C and D (lines 49 to 96)                               |
| <b>a-5-3</b>                      | 19                                 | VRT #5/Digroup C (lines 49 to 72)                                      | VRT #6/Digroups A and B (lines 1 to 48)                                |
| <b>a-5-4</b>                      | 20                                 | VRT #5/Digroup D (lines 73 to 96)                                      | VRT #6/Digroups C and D (lines 49 to 96)                               |
| <b>a-6-1</b>                      | 21                                 | VRT #6/Digroup A (lines 1 to 24)                                       | None                                                                   |
| <b>a-6-2</b>                      | 22                                 | VRT #6/Digroup B (lines 25 to 48)                                      | None                                                                   |
| <b>a-6-3</b>                      | 23                                 | VRT #6/Digroup C (lines 49 to 72)                                      | None                                                                   |

*Continued on next page*

**Table 3-6. TR-08 VRT Digroups That Are Unavailable for Each Active INA DS1 (Continued)**

| AID of Physical Feeder DS1 | (Logical) INA DS1 Activated | Mode 1 TR-08 VRT Number and Digroup (Logical Lines) Unavailable | Mode 2 TR-08 VRT Number and Digroup (Logical Lines) Unavailable |
|----------------------------|-----------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
| a-6-4                      | 24                          | VRT #6/Digroup D (lines 73 to 96)                               | None                                                            |
| a-7-1                      | 25                          | VRT #7/Digroup A (lines 1 to 24)                                | VRT #7/Digroups A and B (lines 1 to 48)                         |
| a-7-2                      | 26                          | VRT #7/Digroup B (lines 25 to 48)                               | VRT #7/Digroups C and D (lines 49 to 96)                        |
| a-7-3                      | 27                          | VRT #7/Digroup C (lines 49 to 72)                               | VRT #8/Digroups A and B (lines 1 to 48)                         |
| a-7-4                      | 28                          | VRT #7/Digroup D (lines 73 to 96)                               | VRT #8/Digroups C and D (lines 49 to 96)                        |

**CAUTION:**

*The physical feeder DS1 that supports the A digroup of an in-service TR-08 VRT should not be used for an INA DS1 because it causes the TR-08 data link to fail on that VRT.*

In a TR-303 system, there is no physical relationship between the VTU/LIU slots and the shelves. Logical to physical mapping is assigned as needed using the appropriate CIT commands. There are no standard DS1 cross-connections for the TR-303 VRT.

### **DS0 Cross-Connect Capabilities and Limitations**

DS0 cross-connections are made by entering **ENT-CRS-T0** CIT commands and deleted by entering **DLT-CRS-T0** CIT commands. The feeder side access identifier (AID) will be a TR-08 or TR-303 VRT logical drop (logical line) or an INA DS0. These AIDs are *logical* drops. On the distribution side, the AIDs to be used depend on whether the channel unit shelf is configured for metallic or fiber distribution. These AIDs are *physical* drops.

**NOTE:**

The **ENT-CRS-T0** CIT command does not actually make DS0 cross-connections in TR-303 systems. This command actually makes logical to physical *mappings* that are T0 cross-connections. To make DS0 cross-connections, use the EOC from the LDS.

Checkerboarding provides the capability to cross-connect electronically any of the physical subscriber line appearances with any of the logical line terminations on any of the VRTs. Refer to the "T0 Cross-Connect/Checkerboarding Restrictions"



section of this chapter for checkerboarding restrictions. In a checkerboarding example, this permits the four subscriber lines of a quad POTS channel unit to be provisioned as distinct logical lines of four different VRTs. Checkerboarding permits individual subscriber lines to be moved between VRTs for load balancing, to access customer-requested switch features, or to assist system growth operations.

## Creating Standard DS1 and DS0 Cross-Connections on Turn-Up

---

### TR-08 Systems

When the system is turned up, there are no DS0 or DS1 cross-connections on the system. The UIP command **INITIALIZE-CRS** provides standard TR-08 DS0 or DS1 cross-connections, respectively, depending on whether you use T0 or T1 as an argument. The standard DS0 cross-connections are as follows:

- **For metallic distribution.** The 96 logical lines (drops) of specific TR-08 VRT are DS0 cross-connected sequentially to the corresponding physical lines (drops) on the MDS assembly shelf.
- **For fiber distribution.** The 96 logical lines (drops) of TR-08 VRT shall be DS0 cross-connected sequentially to 96 physical lines provided by the MSDT or DT Servers on channel unit shelf. The location of the physical lines that get cross-connected depends on the provisioning of the MSDT or DT Servers (via the **ED-DT** command). Any MSDT or DT Server provisioning combination that results in 96 physical lines may be used with the **INITIALIZE-CRS** command. Table 3-7 shows possible MSDT logical to physical cross-connections depending on MSDT or DT Server provisioning. For example, Table 3-7 shows that the physical lines provided from a 24-line MSDT or DT Server housed in Slot 5 are cross-connected in sequence to TR-08 VRT logical lines 25 to 48.



**NOTE:**

For Software Releases 4.3 and later, the MSDT mentioned above and in Table 3-7 can include a V-MSDT or V-DT located in the DDM-2000 FiberReach NBS ONU. See Chapter 2 for a definition of V-MSDT or V-DT.

The system is turned up without DS0 cross-connections because most provisioning operations systems (OSs) [such as OPS/INE] expect it to come up without DS0 cross-connections. Hence, if an OS, such as OPS/INE, that does administer DS0 cross-connections is used with the *SLC-2000* system, the **INIT-CRS-T0** command will not be used on turn-up.

See 363-208-003, *SLC-2000 Access System Commands and Messages* for details.

**Table 3-7. Sample of Logical to Physical Line Cross-Connections Depending on MSDT Configuration (TR-08 Systems)**

| MSDT Type*      | Slot 1 | Slot 3 | Slot 5 | Slot 7 | Slot 13 | Slot 15 | Slot 17 | Slot 19 |
|-----------------|--------|--------|--------|--------|---------|---------|---------|---------|
| 24-Line         | 1-24   |        | 25-48  |        | 49-72   |         | 73-96   |         |
| 12-Line         | 1-12   | 13-24  | 25-36  | 37-48  | 49-60   | 61-72   | 73-84   | 85-96   |
| 12-/24-Line Mix | 1-24   |        | 25-36  |        | 49-60   | 61-72   | 73-96   |         |

\* In Software Releases 4.3 and later, MSDT can include a 24-line V-MSDT or V-DT located in the DDM-2000 FiberReach NBS. See Chapter 2 for a definition of V-MSDT or V-DT.

---

### TR-303 Systems (Release 4.0 and Later)

When the system is turned up, there are no DS0 or DS1 cross-connections on the system. To create a TR-303 VRT, logical DS1 number 1 must be connected to establish communications with the local digital switch. You should cross-connect logical DS1 number 2 to the local digital switch to prevent an alarm condition at the RT.

For metallic distribution, a TR-303 VRT supports a maximum of 768 DS0 cross-connections between physical and logical lines; however, the OS or LDS can address these logical lines within the range of 1 to 1536.

When using Software Release 4.5 or later — and with all MDS assembly shelves provisioned for FITL distribution — a TR-303 VRT supports a maximum of 1152 DS0 cross-connections between physical and logical lines; however, the OS or LDS can address these logical lines within the range of 1 to 1536.

For Release 4.0 and later, a standard set of TR-303 DS0 cross-connections can be assigned using the CIT command **INIT-CRS-T0**. This command will allow the establishment of N 96-line cross-connections, starting with the specified shelf. Any MSDT or DT Server provisioning combination that results in the following *physical* lines per shelf may be used with the **INIT-CRS-T0** command:

- **Release 4.4 or earlier:** 96 physical lines
- **Release 4.5 or later:** 144 physical lines.

See 363-208-003, *SLC-2000 Access System Commands and Messages* for details on these commands.

## T0 Cross-Connect/Checkerboarding Restrictions

The Enhanced FiberReach/MSDT feature of the *SLC-2000* system takes advantage of the variable concentration ratio flexibility of the *SLC-2000* system's TR-303 interface. This allows the system to expand the potential FITL line capacity by as much as 50 percent. However, because the architecture of the *SLC-2000* system allows TR-08, TR-303, and INA CO interfaces, you must carefully consider cross-connection or checkerboarding restrictions when using the Servers in the expanded slots.

Table 3-8 shows T0 cross-connect (checkerboarding) restrictions for the *SLC-2000* system. As shown in the table, if a customer's line interfaces the *SLC-2000* system on a Server in slots 9, 11, 21, and 23; then that line can only be cross-connected to a VRT or INA DS1 interfacing the central office that is provisioned for TR-303 or INA service. Lines interfacing the system through these slots can NOT be cross-connected to DS1 feeders provisioned for TR-08 service.



### NOTE:

The R4.5 Enhanced FiberReach/MSDT feature generally benefits systems equipped to support TR-303 and INA VRTs only. Use of TR-08 VRTs, with the restrictions shown in Table 3-8, should be used with caution, noting that restrictions are present.

**Table 3-8. T0 Cross-Connect (Checkerboarding) Restrictions**

| If a customer's line terminates on an ONU hosted by a Server located in MDS assembly shelf... | Then, observe the following restrictions when cross-connecting to a DS1 feeder using the type of CO interface shown ...                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slot 1, 3, 5, 7, 13, 15, 17, or 19                                                            | <ul style="list-style-type: none"> <li>■ <b>TR-303 and INA Interfaces:</b> No Restrictions.</li> <li>■ <b>TR-08 Mode 1 Interfaces:</b> No Restrictions.</li> <li>■ <b>TR-08 Mode 2 Interfaces:</b> Cross-connections are only allowed within the shelf terminating the customer line</li> </ul> |
| Slot 9, 11, 21, or 23                                                                         | <ul style="list-style-type: none"> <li>■ <b>TR-303 and INA Interfaces:</b> No Restrictions.</li> <li>■ <b>TR-08 Mode 1 and Mode 2 Interfaces:</b> Not supported. Cross-connections are <i>not</i> allowed from these slots to these types of CO interfaces.</li> </ul>                          |

## Dual Entity Service Node

VRTs allow one *SLC-2000* Access System to communicate with different switches within the same service node. For example, as Figure 3-22 shows, Switch 1 may be an analog switch, while Switch 2 may be a digital switch. For VRT 1, a *SLC 96* COT interfaces the 1A *ESS*™ switch; VRT 2 is routed directly to the 5*ESS* switch.

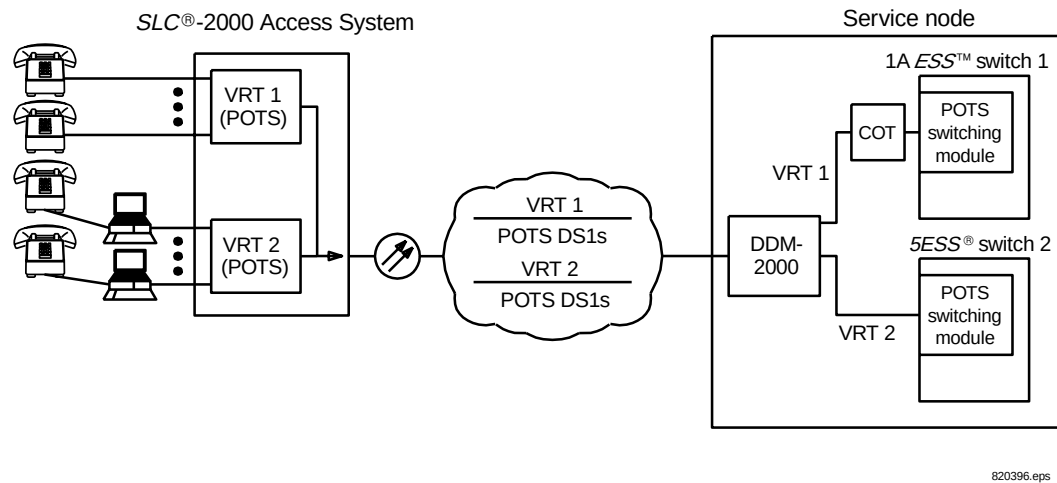


**Figure 3-22. Dual Entity Service Node Application**

## SONET VT1.5/STS-1 Bandwidth Management

For SONET feeder applications, the 672 (maximum) feeder side DS0s are groomed into VT1.5 signals (up to 28) (Figure 3-23). When the *SLC-2000* Access System is configured in a SONET ring, a VT1.5 TSI fabric in the OLIU is available. The 28 VT1.5 signals can be groomed into any one of 84 VT1.5 signals, which map into three STS-1s in the OC-3 feeder. The OLIU's  $84 \times 84$  VT1.5 TSI fabric integrated into the *SLC-2000* Access System provides efficient use of bandwidth and equipment and adds flexibility to support SONET OC-3 self-healing rings.

Where an OC-12 feeder interface is required, the DDM-2000 OC-12 multiplexer is used with the *SLC-2000* Access System to provide full-access  $12 \times 12$  STS-1 TSI fabric. If your system contains SONET subsystem Software Release 11 or later, the OC-12 feeder can interface directly with the ARM shelf. Any of the three user selectable STS-1s from the *SLC-2000* Access System can be groomed into any STS-1 position in the OC-12 feeder, which again provides efficient use of bandwidth and equipment and adds flexibility that supports SONET OC-12 self-healing rings.

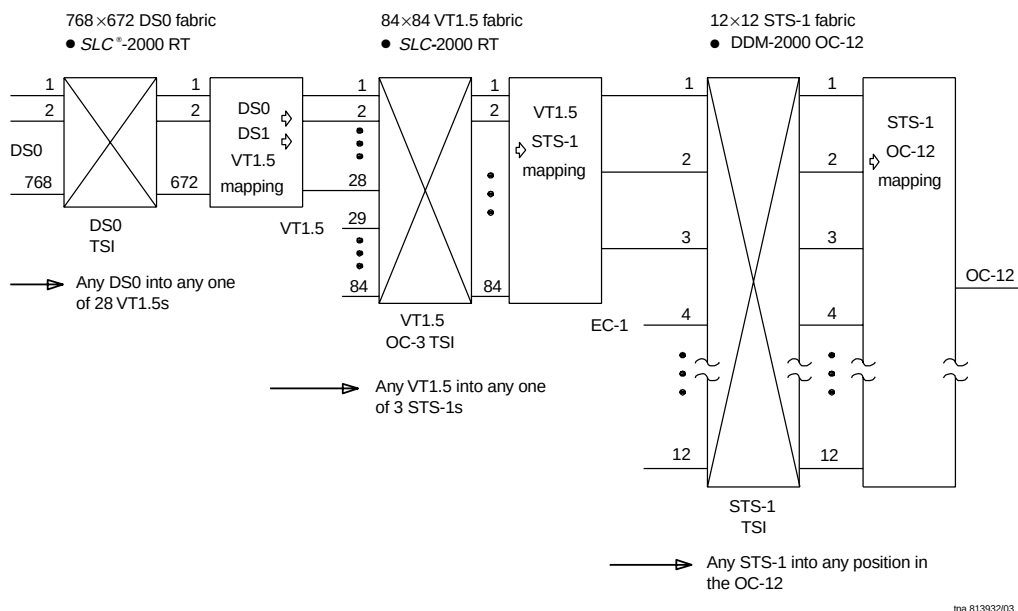


**Figure 3-23. SLC-2000 Access System Time Slot Interchange (TSI) into a DDM-2000 OC-12**

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### Introduction

The SLC<sup>®</sup>-2000 Access System supports most end-user services including plain old telephone service (POTS), coin, multiparty, frequency selective ringing, locally-switched special services, direct inward dial (DID) service, nonlocally switched and nonswitched special services, enhanced business services (EBS), program services, digital data services, DS1 pipes, integrated services digital network (ISDN) basic rate and primary rate interfaces, and others.

For additional information on services such as installing, provisioning, operating, and testing, see the following documents:

- 363-208-001, *SLC-2000 Access System, User/Service Manual*  
Contains procedures for channel unit installation and provisioning.
- 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service and Ordering Manual*  
Contains information on channel unit operation in the SLC-2000 Multi-Services Distant Terminal (MSDT) for fiber-in-the-loop (FITL) applications.
- 363-206-301, *DDM-2000 FiberReach Multiplexer, User/Service Manual*  
Contains information on channel unit operation in the DDM-2000 FiberReach Narrowband Shelf (NBS) for FITL applications.
- 915-710-115, *SLC Series 5 Carrier System, Application Engineering, Facility Design Systems*  
Contains engineering and applications guidelines for using the POTS, SPOTS<sup>®</sup> and M SPOTS channel units, coin, multiparty, frequency selective ringing (FSR), and DID channel units.

- 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting*

Contains guidelines for selecting the proper channel unit and determining the options for a specific special service circuit application.

## DS0 Services and Applications (Channel Units)

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Table 4-1 lists the *SLC-2000* system and *SLC Series 5* carrier channel units (CUs) that may be used in the *SLC-2000* Access System. The table divides the channel units into three groups:

- **Nonprovisionable** — requires no provisioning by the user from the user interface panel (UIP) or craft interface terminal (CIT), or no option switch/jumper settings.
- **Manually Provisionable** — requires the user to *manually* set switches and/or jumpers on the printed wiring board or the faceplate.
- **Electronically Provisionable** — requires the user to *electronically* provision the channel unit or channel unit slot using the CIT, the X.25 interface to an operations support system (OSS), or the user interface panel (UIP).

The table lists the following information for each channel unit:

- **Code** — channel unit code.
- **Description** — brief description of the service provided by the channel unit.
- **Data Sheet** — the number of the data sheet that gives detailed information on the channel unit.
- **Terminal** — shows where the CU can be used:
  - **COT**: central office terminal.
  - **RT**: remote terminal.
  - **MSDT**: *SLC-2000* Multi-Services Distant Terminal (MSDT).
  - **NBS**: *DDM-2000* FiberReach Narrowband Shelf (NBS) (see Note).

⇒ **NOTE:**  
 Unless otherwise specified in Table 4-1, *NBS* denotes a channel unit compatible with *SLC-2000* Software Release 4.4 or later when used in the *DDM-2000* FiberReach NBS. Software Release 4.3 allows the use of a limited number of channel units. These channel units are specified with footnotes in Table 4-1. For a detailed description of the *DDM-2000* FiberReach NBS, including the *virtual MSDT* (V-MSDT) or *Virtual-DT* (V-DT) concept, see Chapter 2.

- **#Ch** — (number of channels) column specifies how many channels or lines are available on the channel unit.
- **Range** — gives the supervision or operating range of the unit if used in a remote terminal/optical network unit (RT/ONU).
- **Rel** — (release) shows the earliest *SLC-2000* system release required to support the channel unit. (No entry in the **Rel** column means the channel unit is supported in Release 3.1 or later.)
- **Inven** — (inventory) column specifies whether the channel unit provides a valid *COMMON LANGUAGE CLEI*<sup>\*</sup> code for the **RTRV-EQPT** command.

This chapter describes the services provided by the *SLC-2000* Access System and the channel units required to support those services. If more than one special service channel unit can provide a service, the preferred choice is presented first. For example, the *SPQ*<sup>®</sup>442 channel unit is discussed before the *AUA42()*<sup>†</sup> because the *SPQ442* provides four lines instead of two lines. For details about *SLC* Series 5 carrier channel units not described in this chapter, see the Series 5 documents listed at the beginning of this chapter.

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\* *COMMON LANGUAGE* is a registered trademark and *CLEI*, *CLLI*, *CLCI*, and *CLFI* are trademarks of Bell Communications Research, Inc.

† A circuit pack code shown with a pair of empty parentheses "()" behind the code indicates that all the letter-suffixed versions of that pack are included. The letter suffix also may be specified [for example, *AUA38(B,C)* includes the *AUA38*, *AUA38B*, and *AUA38C* circuit packs]. Without the parentheses, it refers only to the specific code (for example, *AUA34B* does *not* include the *AUA34* code).

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units**

| Code                    | Description                                      | Data Sheet  | Terminal                     | #Ch | Range                | Rel. | Inven. |
|-------------------------|--------------------------------------------------|-------------|------------------------------|-----|----------------------|------|--------|
| <b>Nonprovisionable</b> |                                                  |             |                              |     |                      |      |        |
| SPQ <sup>®</sup> 300()  | POTS CS + OHT/CLASS <sup>*</sup> + LSAS          | 363-005-380 | COT/RT/MSDT/NBS              | 4   | —                    |      | Yes    |
| SPQ318                  | Quad Coin CS                                     | 363-005-330 | COT                          | 4   | —                    | 3.3  | Yes    |
| SPQ328                  | Quad EBS (P-Phone)                               | 363-005-397 | COT                          | 4   | —                    | 3.3  | Yes    |
| SPQ333                  | Dual Coin CS                                     | 363-005-331 | COT                          | 2   | —                    | 3.3  | Yes    |
| SPQ336                  | Quad DID                                         | 363-005-334 | COT                          | 4   | —                    | 3.3  | Yes    |
| SPQ340                  | POTS/SPOTS <sup>®</sup> CU CS + OHT/CLASS + LSAS | 363-005-381 | COT/RT/MSDT/NBS              | 4   | —                    |      | Yes    |
| SPQ400                  | ALC POTS CF + OHT/CLASS                          | 363-005-368 | COT/RT/MSDT/NBS <sup>†</sup> | 4   | 900Ω                 |      | Yes    |
| SPQ400B                 | ALC POTS CF + OHT/CLASS                          | 363-005-368 | COT/RT/MSDT/NBS              | 4   | 1200Ω <sup>‡</sup>   |      | Yes    |
| xSPQ400                 | ALC POTS CF + OHT/CLASS                          | 363-208-345 | COT/RT/MSDT/NBS              | 4   | 1200Ω <sup>‡</sup>   |      | Yes    |
| SPQ401()                | ALC POTS CF + OHT/CLASS, VFDE (SPQ401B)          | 363-005-344 | COT/RT/MSDT/NBS              | 4   | 1400Ω                |      | Yes    |
| SPQ419                  | Quad Coin CF                                     | 363-005-340 | RT/MSDT/NBS                  | 4   | 900Ω                 | 4.2  | Yes    |
| SPQ429                  | Quad EBS (P-Phone)                               | 363-005-398 | RT/MSDT/NBS                  | 4   | 750/200 <sup>§</sup> | 4.2  | Yes    |
| SPQ440(B)               | ALC POTS/SPOTS CU CF + OHT/CLASS+LSAS            | 363-005-369 | COT/RT/MSDT/NBS              | 4   | 900Ω/CSA             |      | Yes    |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

<sup>\*</sup> Service mark of Bellcore.<sup>†</sup> The SPQ400 and the SPQ440C CUs are supported by Software Release 4.3 and later when installed in the NBS.<sup>‡</sup> On the SPQ400B and the XSPQ400, range can be increased to 1450 ohms if full power is available.<sup>§</sup> The range for this channel unit depends on the type of EBS telephone set: Basic EBS Telephone Set – 750 ohms; Enhanced EBS Telephone Set – 200 ohms.*Continued on next page*

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                    | Description                                                  | Data Sheet  | Terminal                     | #Ch | Range           | Rel.                 | Inven. |
|-------------------------|--------------------------------------------------------------|-------------|------------------------------|-----|-----------------|----------------------|--------|
| <b>Nonprovisionable</b> |                                                              |             |                              |     |                 |                      |        |
| SPQ440(C,D)             | Quad Extended Range <i>SPOTS</i> , VFDE ( <i>SPQ440D</i> )   | 363-005-369 | COT/RT/MSDT/NBS <sup>*</sup> | 4   | 1500            | †                    | Yes    |
| SPQ450                  | ALC POTS/ <i>SPOTS</i> CU CF + OHT/ <i>CLASSALIC5</i> + LSAS | 363-005-384 | RT/MSDT/NBS                  | 4   | 900Ω/CSA        |                      | Yes    |
| SPQ453                  | Dual Coin CF                                                 | 363-005-342 | RT/MSDT/NBS                  | 2   | 900             | 4.2                  | Yes    |
| SPQ478                  | ALC C-POTS CF OHT/CLASS                                      | 363-005-377 | RT/MSDT/NBS                  | 4   | 900             |                      | Yes    |
| SPQ909( )               | Low-Power POTS CF + OHT/ <i>CLASS</i>                        | 363-005-295 | MSDT/NBS <sup>‡</sup>        | 4   | 20Ω<br>170Ω (B) | 3.2                  | Yes    |
| SPQ494 <sup>§</sup>     | Quad ISDN ANSI-U                                             | 363-005-388 | RT/NBS                       | 4   | CSA             | 4.1/4.2 <sup>¶</sup> | Yes    |
| AUA25(B)                | POTS/M <i>SPOTS</i> CU CF                                    | 363-005-124 | RT/MSDT/NBS <sup>**</sup>    | 2   | 6 dB            |                      | No     |
| AUA26                   | POTS CS + OHT (VerSus feature not avail.)                    | 363-005-127 | COT                          | 2   | —               |                      | No     |
| AUA27                   | POTS CF + OHT (VerSus feature not avail.)                    | 363-005-128 | RT/MSDT/NBS                  | 2   | 900Ω            |                      | No     |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated *SLC* carrier at *5ESS*<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

*SPOTS* CU - channel unit provides locally switched loop- and ground-start service<sup>\*</sup> The *SPQ400* and the *SPQ440C* CUs are supported by Software Release 4.3 and later when installed in the NBS.<sup>†</sup> Channel unit is supported by Software Releases 3.3, 4.1, and 4.2 and later. *SPQ440D* is supported by R4.6.<sup>‡</sup> This channel unit is supported by Software Release 4.3 and later when installed in the NBS.<sup>§</sup> In Release 4.4 or earlier, the *SPQ494* is recent change provisionable from the LDS. It is *not* provisionable from the *SLC-2000* CIT. In Release 4.5 or later, the *SPQ494* can be provisioned from the CIT.<sup>¶</sup> Lucent Technologies recommends the use of Software Release 4.2 or later if you are equipping more than 200 ISDN lines.<sup>\*\*</sup> The NBS can contain the AUA25B. It does not support the AUA25.*Continued on next page*

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                    | Description                                           | Data Sheet  | Terminal                     | #Ch | Range     | Rel.      | Inven.           |
|-------------------------|-------------------------------------------------------|-------------|------------------------------|-----|-----------|-----------|------------------|
| <b>Nonprovisionable</b> |                                                       |             |                              |     |           |           |                  |
| AUA31                   | POTS CS                                               | 363-005-101 | COT                          | 2   | —         |           | No               |
| AUA32                   | POTS/ <i>SPOTS</i> CU CS                              | 363-005-102 | COT/RT/MSDT                  | 2   | —         |           | No               |
| AUA33( )                | Coin CS                                               | 363-005-103 | COT                          | 1   | —         | 3.3*      | *                |
| AUA35                   | Multiparty                                            | 363-005-109 | COT                          | 2   | —         |           | No               |
| AUA36( )                | DID                                                   | 363-005-114 | COT                          | 2   | —         |           | Yes <sup>†</sup> |
| AUA37                   | FSR CS                                                | 363-005-121 | COT                          | 1   | —         |           | No               |
| AUA38( )                | POTS CS +OHT/ <i>CLASS</i><br>+ LSAS                  | 363-005-118 | COT                          | 2   | —         |           | No               |
| AUA39 <sup>‡</sup>      | POTS/ <i>SPOTS</i> CU CS<br>+OHT/ <i>CLASS</i>        | 363-005-120 | COT/RT/<br>MSDT/NBS          | 2   | —         |           | No               |
| AUA39B <sup>‡</sup>     | POTS/ <i>SPOTS</i> CU CS<br>+OHT/ <i>CLASS</i> + LSAS | 363-005-120 | COT/RT/MSDT                  | 2   | —         | R3.2 only | Yes              |
| AUA51                   | POTS/ <i>SPOTS</i> CU CF                              | 363-005-110 | RT/MSDT                      | 2   | 1500Ω/CSA |           | No               |
| AUA53                   | COIN CF                                               | 363-005-112 | RT/MSDT/NBS                  | 1   | 1500Ω     |           | No               |
| AUA53B                  | Single Coin CF                                        | 363-005-112 | RT/MSDT/<br>NBS <sup>§</sup> | 1   | 900Ω      |           | Yes              |
| AUA55(B)                | Multiparty CF                                         | 363-005-116 | RT/MSDT/NBS                  | 2   | 1500Ω     |           | No               |
| AUA56                   | DID (DPT)                                             | 363-005-115 | RT/MSDT/NBS                  | 2   | CSA       |           | No               |
| AUA58( )                | POTS CF +OHT/ <i>CLASS</i>                            | 363-005-117 | RT/MSDT/<br>NBS <sup>§</sup> | 2   | 900Ω      |           | No               |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

*SPOTS* CU - channel unit provides locally switched loop- and ground-start service

\* AUA33B is available with Software Releases 3.3 and later. Inventory: AUA33 — No, AUA33B — Yes.

† Inventory information available for the AUA36B only.

‡ BUSY light emitting diode (LED) is on continuously.

§ This channel unit is supported by Software Release 4.3 and later when installed in the NBS.

*Continued on next page*

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                    | Description                            | Data Sheet  | Terminal                      | #Ch | Range                    | Rel. | Inven.                  |
|-------------------------|----------------------------------------|-------------|-------------------------------|-----|--------------------------|------|-------------------------|
| <b>Nonprovisionable</b> |                                        |             |                               |     |                          |      |                         |
| AUA59                   | SPOTS CU CF +OHT/<br>CLASS             | 363-005-119 | RT/MSDT /<br>NBS              | 2   | 1500Ω/CSA                |      | No                      |
| AUA90                   | ISDN T-BRITE                           | 363-005-129 | COT/RT/<br>MSDT/NBS           | 1   | 1 km                     |      | No                      |
| AUA94( )*               | ISDN Dual ANSI-U                       | 363-005-135 | RT/MSDT/<br>NBS <sup>†</sup>  | 2   | AUA94 CSA<br>AUA94B 18kf | 4.0  | AUA94: No<br>AUA94B:Yes |
| AUA150                  | POTS/SPOTS CU CF<br>+OHT/CLASS         | 363-005-133 | COT/RT/<br>MSDT/NBS           | 2   | 1500Ω/CSA                |      | No                      |
| AUA150C                 | Dual POTS/SPOTS<br>CF+OHT/CLASS+ALC    | 363-005-133 | COT/RT/<br>MSDT/NBS           | 2   | 1500Ω                    | ‡    | Yes                     |
| AUA151                  | POTS/SPOTS CU CF wo<br>OSIP +OHT/CLASS | 363-005-134 | RT/MSDT                       | 2   | 1500Ω/CSA                |      | No                      |
| AUA158(B,C)             | ALC POTS CF +OHT/<br>CLASS             | 363-005-303 | RT/MSDT /<br>NBS <sup>§</sup> | 2   | 900Ω                     |      | Yes                     |
| AUA158D                 | ALC POTS CF +OHT/<br>CLASS             | 363-005-303 | RT/MSDT /<br>NBS              | 2   | 1400Ω                    |      | Yes                     |
| AUA159(B,C)             | ALC POTS/SPOTS CU<br>+OHT/CLASS        | 363-005-304 | RT/MSDT /<br>NBS <sup>§</sup> | 2   | 900Ω/CSA                 |      | Yes                     |
| AUA178( )               | ALC C-POTS CF OHT/<br>CLASS            | 363-005-314 | RT/MSDT/<br>NBS               | 2   | 900Ω                     |      | Yes                     |
| AUA179                  | ALC POTS/SPOTS CU<br>+ALIC5 +OHT/CLASS | 363-005-311 | RT/MSDT /<br>NBS              | 2   | 900Ω/CSA                 |      | Yes                     |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

\* In Release 4.4 or earlier, the AUA94( ) is recent change provisionable from the LDS. It is *not* provisionable from the SLC-2000 CIT. In Release 4.5 or later, the SPQ494 can be provisioned from the CIT

† This channel unit is supported by Software Release 4.3 and later when installed in the NBS.

‡ Inventory feature is supported by Software Releases 3.3, 4.1, and 4.2, and later.

§ The AUA158B and AUA159B are not supported in Software Release 4.4 or later when installed in the NBS.

*Continued on next page*



**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                          | Description                         | Data Sheet  | Terminal         | #Ch | Range     | Rel. | Inven. |
|-------------------------------|-------------------------------------|-------------|------------------|-----|-----------|------|--------|
| <b>Manually Provisionable</b> |                                     |             |                  |     |           |      |        |
| AUA45(B)                      | Dual Ringing Repeater (Manual Ring) | 363-005-123 | COT/RT/MSDT/NBS* | 2   | 10 dB     |      | No     |
| AUA56B                        | Dual DID (DPT)                      | 363-005-115 | RT/MSDT/NBS      | 2   | 750 (CSA) |      | Yes    |
| AUA57                         | FSR CF                              | 363-005-122 | RT/MSDT / NBS    | 1   | 900Ω      |      | No     |
| AUA75                         | Private Line Automatic Ring (PLAR)  | 363-005-132 | COT/RT/MSDT/NBS  | 2   | 10 dB     |      | No     |
| AUA92                         | ISDN BRITE II ANSI-U                | 363-005-130 | COT              | 1   | —         |      | No     |
| AUA93 †                       | ISDN BRITE II ANSI-U                | 363-005-131 | RT/MSDT / NBS    | 1   | CSA       |      | No     |
| AUA200                        | 2-wire Switched 56-kb/s DPX         | 363-005-313 | RT/MSDT / NBS‡   | 1   | 42 dB     | 3.2  | No     |
| AUA232                        | RS-232 DSU Dataport                 | 363-005-312 | COT/RT/MSDT/NBS  | 1   | RS-232    | 3.2  | No     |
| AUA293†                       | ISDN BRITE II ANS-U                 | 363-005-347 | COT/RT/MSDT/NBS  | 1   | 18kf      | 3.1  | Yes    |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

\* The NBS can contain the AUA45B. It does not support the AUA45.

† When used in the MSDT, the AUA93/AUA293 is manually provisionable for software releases earlier than Release 4.2 and electronically provisionable in Software Releases 4.2 and later.

‡ This channel unit is supported by Software Release 4.3 and later when installed in the NBS

*Continued on next page*

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                                | Description                       | Data Sheet            | Terminal        | #Ch | Range | Rel.        | Inven. |
|-------------------------------------|-----------------------------------|-----------------------|-----------------|-----|-------|-------------|--------|
| <b>Manually Provisionable</b>       |                                   |                       |                 |     |       |             |        |
| MCU <sup>*</sup> -5205              | Metallic Channel Unit (Tollgrade) | TLGD5205 <sup>†</sup> | COT/RT/MSDT/NBS | 1   | ‡     |             | No     |
| MCU-5405                            | Digital Bypass Pair (Tollgrade)   | TLGD5405 <sup>†</sup> | COT/RT          | 1   | ‡     | 3.2         | No     |
| PGM <sup>*</sup> -2000 <sup>§</sup> | Program Channel Unit              | TLGD2000 <sup>†</sup> | COT/RT          | 1   | ‡     | 3.3/<br>4.2 | No     |
| <b>Electronically Provisionable</b> |                                   |                       |                 |     |       |             |        |
| SPQ334                              | Dual DS0 Dataport                 | 363-005-332           | COT             | 2   | —     | 3.3         | Yes    |
| SPQ442                              | E SPOTS CU CS                     | 363-005-382           | COT/RT/MSDT/NBS | 4   | CSA   | 3.2         | Yes    |
| SPQ443                              | E SPOTS CU CF                     | 363-005-383           | COT/RT/MSDT/NBS | 4   | CSA   | 3.2         | Yes    |
| SPQ444                              | 4-Wire CS (FXO/TDM)               | 363-005-385           | COT/RT          | 4   | 2800Ω | 3.2         | Yes    |
| SPQ452                              | Dual OCU Dataport                 | 363-005-341           | COT/RT/MSDT/NBS | 2   | 45 dB | 3.3/<br>4.2 | Yes    |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

\* Trademark of Tollgrade Communications, Inc.

† Obtain data sheet from Tollgrade Communications, Inc.

‡ See the data sheet for range.

§ The bandwidth capability of the PGM-2000 channel unit is set by printed wiring board (PWB)-mounted switches.  
**Release 4.2:** The function code of the channel unit is provisioned electronically to allow the remote terminal (RT) software to configure the system bandwidth to match the bandwidth setting on the PGM-2000 unit.

**Release 3.3:** The central office terminal (COT) software treats the PGM-2000 channel unit as a POTS unit and does not prompt for the function code. This is because the bandwidth setting is communicated to the system automatically upon channel unit installation.

*Continued on next page*

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code     | Description                              | Data Sheet  | Terminal                                           | #Ch | Range     | Rel. | Inven. |
|----------|------------------------------------------|-------------|----------------------------------------------------|-----|-----------|------|--------|
|          | <b>Electronically Provisionable</b>      |             |                                                    |     |           |      |        |
| SPQ454   | 4-Wire E&M/PLR                           | 363-005-386 | COT/RT                                             | 2   | 500Ω      | 3.2  | Yes    |
| SPQ456   | Quad DID                                 | 363-005-343 | RT/MSDT/<br>NBS                                    | 4   | 750 (CSA) | 4.2  | Yes    |
| AUA34    | DS0 Dataport                             | 363-005-104 | COT                                                | 1   | —         |      | No     |
| AUA34B   | DS0 Dataport (All-rate)                  | 363-005-104 | COT                                                | 1   | —         |      | Yes    |
| AUA41( ) | 4-wire CF (FXS/ETO/DX)                   | 363-005-105 | COT/RT/<br>MSDT/NBS*                               | 1   | 15 dB     |      | †      |
| AUA42( ) | E SPOTS CU CS                            | 363-005-106 | COT/RT/<br>MSDT/NBS                                | 2   | CSA       | 3.2  | †      |
| AUA43( ) | E SPOTS CU CF                            | 363-005-107 | COT/RT/<br>MSDT/NBS                                | 2   | CSA       | 3.2  | †      |
| AUA44( ) | 4-Wire VF CS (Includes<br>TDM signaling) | 363-005-108 | MSDT/NBS                                           | 1   | 15 dB     |      | No     |
| AUA52    | OCU Dataport                             | 363-005-111 | COT/RT/<br>MSDT/NBS                                | 1   | 34 dB     |      | No     |
| AUA52B   | OCU Dataport (All-rate)                  | 363-005-111 | COT/RT/<br>MSDT <sup>‡</sup> /<br>NBS <sup>§</sup> | 1   | 34 dB     |      | Yes    |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

\* The AUA41B channel unit is supported by Software Release 4.3 or later while the AUA41 is supported by Software Release 4.4 or later when installed in the NBS.

† Inventory:

**YES** = AUA41B, AUA42B, and AUA43B**NO** = AUA41, AUA42, and AUA43.

‡ MSDT AUA52B application requires switch settings (Software Release 4.1 and earlier).

§ This channel unit is supported by Software Release 4.3 and later when installed in the NBS.

***Continued on next page***

**Table 4-1. SLC<sup>®</sup>-2000 Access System Channel Units (Continued)**

| Code                                | Description                    | Data Sheet  | Terminal        | #Ch | Range | Rel. | Inven. |
|-------------------------------------|--------------------------------|-------------|-----------------|-----|-------|------|--------|
| <b>Electronically Provisionable</b> |                                |             |                 |     |       |      |        |
| AUA54( )                            | 4-Wire VF Types I & II E&M/PLR | 363-005-113 | MSDT/NBS        | 1   | 500Ω  |      | No     |
| AUA93 *                             | ISDN BRITE II ANSI-U           | 363-005-131 | RT/MSDT / NBS   | 1   | CSA   |      | No     |
| AUA141                              | 4-Wire VF CF (GTE)             | 363-005-300 | COT/RT/MSDT     | 1   | 15 dB |      | No     |
| AUA142                              | E SPOTS CU CS (GTE)            | 363-005-301 | COT/RT/MSDT     | 2   | CSA   |      | No     |
| AUA152                              | OCU Dataport (GTE)             | 363-005-302 | COT/RT/MSDT/NBS | 1   | 34 dB |      | No     |
| AUA252( ) <sup>†</sup>              | OCU Dataport                   | 363-005-212 | COT/RT/MSDT/NBS | 1   | 34 dB |      | No     |
| AUA293*                             | ISDN BRITE II ANS-U            | 363-005-347 | COT/RT/MSDT/NBS | 1   | 18kf  | 3.1  | Yes    |

**Legend:**

(See definitions on pages 4-2 and 4-3)

ALC - automatic level compensation; ALIC5 - analog line to integrated SLC carrier at 5ESS<sup>®</sup> switch cutover

CF - current feed, CS - current sink; CSA - carrier serving area; CU - channel unit

LSAS - line side answer supervision, also carrier line side supervision; NBS - Narrowband Shelf (R4.4 and later)

OHT - on-hook transmission; wo OSIP - without open switching interval protection

SPOTS CU - channel unit provides locally switched loop- and ground-start service

\* When used in the MSDT, the AUA93/AUA293 is manually provisionable for software releases earlier than Release 4.2 and electronically provisionable in Software Releases 4.2 and later.

† Switched 56-kb/s services must be manually provisioned for all terminal applications.

## Switched Services

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The *SLC-2000* Access System provides the full range of switched services\*, including support of on-hook transmission (OHT), calling party identification (CPI), *CLASS*† services, the analog line to integrated *SLC* Carrier at *5ESS*® switch cutover (ALIC5) feature, universal voice grade (UVG) services, and support of Centrex services.

## Single-Party Service

Single-party POTS service is provided by the following channel units with compatible equipment at the central office (CO):

- **Remote Terminal (RT):** *SPQ400*( ), *XSPQ400*, *SPQ401*( ) POTS channel units
- **ONU (MSDT and NBS):** *SPQ400*( ), *XSPQ400*, *SPQ401*( ), *SPQ909*( ) POTS channel unit.

These channel units support four subscriber channels per circuit pack (quad CUs).

Single-party service can also be provided using the *SLC-2000 SPQ440*( ) and *SPQ450* POTS/*SPOTS* channel unit at the RT or ONU and compatible equipment at the central office. These channel units are described in the section "2-Wire Locally Switched Special Services."

The *SLC-2000* Access System also supports the existing *SLC* Series 5 POTS and POTS/*SPOTS* channel units listed in Table 4-1. These channel units provide two channels of service. This section describes the new *SLC-2000* POTS channel units only; for detailed information on the *SLC* Series 5 channel units, see the appropriate Series 5 documentation listed at the beginning of this chapter and the data sheets listed in Table 4-1.

The POTS channel units provide 2-wire single-party POTS business or residential service with loop-start supervision and fast-forward disconnect feature. There are no option settings required for these channel units.

In a universal system, single-party services are provided with corresponding *SLC-2000* COT or *SLC 96* COT channel units as follows:

- *SLC-2000* system *SPQ300* POTS channel unit
- *SLC-2000* system *SPQ340 SPOTS* channel unit, loop-start only

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\* The TR-303 software compatibility testing with the Siemens *EWSD* Switch was performed and documented by Siemens. Lucent Technologies assumes no responsibility for the software compatibility when the *SLC-2000* Access System is used with the *EWSD* Switch.

† Service mark of Bellcore.

- *SLC* 96 carrier WP10( ) POTS
- *SLC* 96 carrier WP36 *SPOTS* channel unit, loop-start only.

In an integrated Release 3.1 or 3.2 system, single-party service is provided by switch assignment software (recent change and verify) and is terminated on the TR-08<sup>\*</sup> interface of a local digital switch (LDS). Release 4.0 allows integration into the TR-303<sup>†</sup> interface of the LDS.

### **SPQ300 Quad COT POTS Channel Unit**

**Data Sheet :** 363-005-380

The *SPQ300* channel unit is designed for 2-wire, loop-start POTS service. This unit provides four channels of service and is usually located at the COT. The *SPQ300* channel unit furnishes a current sink (CS) interface and supports a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms).

The *SPQ300* channel unit stores in nonvolatile memory an inventory record (including the ten-character *COMMON LANGUAGE CLEI* code) available for reading by a compatible operations support system (OSS).

The far-end termination can be any of the following:

- *SPQ400* or *XSPQ400* POTS channel unit
- *SPQ440*( ) *SPOTS* channel unit
- *SPQ450* *SPOTS* channel unit, ALIC5
- *SPQ909* low-power POTS channel unit (MSDT/NBS).

There are no switches to set on this channel unit. The *SPQ300* channel unit is compatible with mechanized loop testing (MLT) or the Teradyne *4TEL*<sup>‡</sup> system through the pair gain test controller (PGTC) or the extended test controller (XTC in PGTC mode).

The *SPQ300* channel unit provides the following features/functions:

- Fast-forward disconnect.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Compatibility with *CLASS* services.

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\* Bellcore Technical Reference TR-TSY-000008, Issue 2, August 1987, *Digital Interface Between The SLC 96 Digital Loop Carrier and a Local Digital Switch*.

† Bellcore Technical Reference TR-NWT-000303, Issue 2, December 1992, and all Revisions and Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*.

‡ Registered trademark of Teradyne, Inc.

- Compatibility with calling number delivery (CND) and calling name delivery (CNAM) services.
- Support for line side answer supervision (LSAS) if paired with an *SPQ440* channel unit at the RT.
- Inventory information (for example, *COMMON LANGUAGE CLEI* code, date of manufacture, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.

### ***SPQ400( ) Quad RT POTS Channel Unit***

***Data Sheet*** : 363-005-368

The *SPQ400( )* channel unit is designed for 2-wire, loop-start POTS service. This channel unit provides four channels of service and is usually located at the RT or ONU. The unit has automatic level compensation (ALC), which increases loss when connected to shorter loops. This feature optimizes the loss level for ranges of metallic extensions up to 900  $\Omega$ . If a digital loop carrier (DLC) is replacing long metallic loops, the ALC feature minimizes the loss contrast experienced on cutover. The ALC feature also increases the *SPQ400( )* channel unit on-hook loss when connected to shorter loops, supporting the operation of on-hook services such as individual calling line identification (ICLID) and CNAM.

The *SPQ400B* channel unit exhibits an off-hook loss profile with less maximum loss (4.25 dB versus 6 dB) than the loss profile of the *SPQ400 CU*. The nominal on-hook loss of the *SPQ400B CU* is fixed at 4.25 dB. The loop range of the *SPQ400B CU* is increased from 900 to 1200 ohms. The *SPQ400B* is backward compatible with the *SPQ400 CU* for all applications.

The *SPQ400( )* channel unit furnishes a current feed (CF) interface to the customer loop and provides a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms).

The *SPQ400( )* channel unit stores in nonvolatile memory an inventory record (including its ten-character *COMMON LANGUAGE CLEI* code) readable by using the CIT or a compatible OSS.

The far-end termination can be any of the following:

- *SLC 96* carrier *WP10( )* POTS channel unit
- *SLC 96* carrier *WP36( )* *SPOTS* channel unit, loop-start only
- *SLC-2000* system *SPQ300* POTS channel unit
- *SLC-2000* system *SPQ340* *SPOTS* channel unit, loop-start only
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)

- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- *DMS 100*<sup>\*</sup> switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5*<sup>†</sup> Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD*<sup>‡</sup> Digital Switch (integrated TR-303 only).

There are no switches to set on this channel unit. The *SPQ400*( ) channel unit is compatible with MLT or the Teradyne *4TEL* system through the pair gain test controller (PGTC) or extended test controller (XTC in PGTC mode) and, in *5ESS* switch integrated systems, through the test bus control unit (TBCU).

The *SPQ400*( ) channel unit provides the following features/functions:

- Automatic loss compensation.
- Compatibility with evolving fixed loss plan in ST-NPL-000060.
- Fast-forward disconnect.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Compatibility with *CLASS* services.
- Compatibility with CND and CNAM services.
- Inventory information (*COMMON LANGUAGE CLEI* code, date of manufacture, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.

### ***XSPQ400* Quad RT POTS Channel Unit**

***Data Sheet*** : 363-005-345

The *XSPQ400* channel unit is designed for 2-wire, loop-start POTS service. This channel unit provides four channels of service and is usually located at the RT or ONU. The unit has automatic level compensation (ALC), which increases loss when connected to shorter loops. This feature optimizes the loss level for ranges of metallic extensions up to 1200  $\Omega$ . If a digital loop carrier (DLC) is replacing long metallic loops, the ALC feature minimizes the loss contrast experienced on cutover. The ALC feature also increases the *XSPQ400* channel unit on-hook loss

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\* Trademark of Northern Telecom, Ltd.  
 † Registered trademark of GTE Corporation.  
 ‡ Registered trademark of Siemens Aktiengesellschaft.



when connected to shorter loops, supporting the operation of on-hook services such as individual calling line identification (ICLID) and CNAM.

The *XSPQ400* channel unit exhibits an off-hook loss profile with less maximum loss (4.25 dB versus 6 dB) than the loss profile of the *SPQ400* CU. The nominal on-hook loss of the *XSPQ400* CU is fixed at 4.25 dB. The loop range of the *XSPQ400* CU is increased from 900 to 1200 ohms.

The *XSPQ400* channel unit furnishes a current feed (CF) interface to the customer loop and provides a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms).

The *XSPQ400* channel unit stores in nonvolatile memory an inventory record readable by using the CIT or a compatible OSS.

The far-end termination can be any of the following:

- *SLC 96* carrier WP10( ) POTS channel unit
- *SLC 96* carrier WP36( ) *SPOTS* channel unit, loop-start only
- *SLC-2000* system *SPQ300* POTS channel unit
- *SLC-2000* system *SPQ340* *SPOTS* channel unit, loop-start only
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)
- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- *DMS 100* switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5* Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD* Digital Switch (integrated TR-303 only).

There are no switches to set on this channel unit. The *XSPQ400* channel unit is compatible with MLT or the Teradyne *4TEL* system through the pair gain test controller (PGTC) or extended test controller (XTC in PGTC mode) and, in *5ESS* switch integrated systems, through the test bus control unit (TBCU).

The *XSPQ400* channel unit provides the following features/functions:

- Automatic loss compensation.
- Compatibility with evolving fixed loss plan in ST-NPL-000060.
- Fast-forward disconnect.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Compatibility with *CLASS* services.
- Compatibility with *CND* and *CNAM* services.

- Inventory information (date of manufacture, etc.)/
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.

### **SPQ401( ) Quad POTS Channel Unit**

**Data Sheet :** 363-005-344

The *SPQ401( )* channel unit is designed for 2-wire, loop-start POTS service. The unit provides four channels of service and is normally installed at the remote terminal (RT). The CU is equipped with automatic level compensation (ALC) which adds loss when connected to shorter loops. This feature optimizes the loss level for ranges of metallic extensions up to 1400 ohms. If a digital loop carrier (DLC) system or channel is replacing long metallic loops, the ALC feature minimizes the loss contrast experienced on cutover. The *SPQ401( )* furnishes a current feed interface to the customer loop and provides a fast forward disconnect feature [repeats the central office's (CO) open battery interval toward customer premises equipment (CPE), up to a maximum of 1.5 seconds if the central office interval is greater than or equal to 50 ms]. The *SPQ401( )* unit features ALC on-hook as well as off-hook. On-hook loss is determined by the tip/ring resistance during the most recent off-hook condition.

The *SPQ401* CU has an extended range of 1400 ohms and uses an adaptive balance network that automatically balances the connected cable pair. Use of the *SPQ401* unit may increase the connect rate and/or throughput performance of high-speed modems in certain situations.

The *SPQ401B* enables the voice frequency data enhancement (VFDE) feature when used in an ONU hosted by an HDT with Software Release R4.6 or later. See Chapter 2 for an explanation of the VFDE feature.

The channel unit stores a plug-in inventory record in nonvolatile memory available for reading by an inventory compatible host (for example, *SLC-2000* Access System). The inventory record includes ten-character *COMMON LANGUAGE CLEI*, *COMCODE*, equipment category item (ECI), Function, and Loss, codes.

The far-end termination can be any of the following:

- *SLC 96* carrier WP10( ) POTS channel unit
- *SLC 96* carrier WP36( ) *SPOTS* channel unit, loop-start only
- *SLC-2000* system *SPQ300* POTS channel unit
- *SLC-2000* system *SPQ340 SPOTS* channel unit, loop-start only
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)
- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)

- *DMS 100* switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5* Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD* Digital Switch (integrated TR-303 only).

There are no switches to set on this channel unit. The *SPQ401*( ) channel unit is compatible with MLT or the Teradyne *4TEL* system through the pair gain test controller (PGTC) or extended test controller (XTC in PGTC mode) and, in *5ESS* switch integrated systems, through the test bus control unit (TBCU).

The *SPQ401*( ) channel unit provides the following features/functions:

- Automatic loss compensation.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Compatibility with *CLASS* services.
- Inventory information (*COMMON LANGUAGE CLEI* code, date of manufacture, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Adaptive balance to enhance V.34 modem performance.
- Extended range to 1400 ohms.
- 900 ohms impedance.
- *UL*<sup>\*</sup> recognized.
- Faceplate BUSY indicators.

### ***SPQ909*( ) Quad Low-Power POTS Channel Unit (MSDT/NBS)**

***Data Sheet*** : 363-005-295

The *SPQ909*( ) channel unit is designed for 2-wire, loop-start POTS service on short loops. It is intended to comply with TR-909<sup>†</sup> standards. This channel unit provides four channels of service and is always located in the MSDT/NBS. It has 600 ohms nominal structural and hybrid balance impedances, 4 dB receive loss, and 2 dB transmit loss. The DC supervisory range of the *SPQ909* CU is 450 ohms as specified in TR-909. This low-power range consists of a 20-ohm loop (up to 500 ft. of AWG 22) plus telephone set and customer wiring of 430 ohms. The DC supervisory range of the *SPQ909B* CU is 700 ohms. The *SPQ909*( ) channel unit

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\* Registered trademark of Underwriters Laboratories Inc.

† Bellcore Technical Reference TR-NWT-000909, Issue 1, December 1991, *Generic Requirements and Objectives for Fiber in the Loop Systems*.

furnishes a current feed interface to the customer loop and provides a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms).

The *SPQ909*( ) channel unit stores in nonvolatile memory an inventory record (including its ten-character *COMMON LANGUAGE CLEI* code) readable by using the CIT or a compatible OSS.

To enable the low-power feature of the unit, both a low-power power interface unit (PIU) and the appropriate MSDT must be used. Either the AUA434 or AUA436 low-power PIU can be used. The appropriate MSDT is identified as "Group 11 Low-Power Modified."



**NOTE:**

The DDM-2000 FiberReach NBS does not require a PIU. It will accept the *SPQ909*( ) low-power channel unit without any modifications.

The far-end termination can be any of the following:

- *SLC* 96 carrier WP10( ) POTS channel unit
- *SLC* 96 carrier WP36( ) *SPOTS* channel unit, loop-start only
- *SLC*-2000 system *SPQ300* POTS channel unit
- *SLC*-2000 system *SPQ340* *SPOTS* channel unit, loop-start only
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)
- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- *DMS 100* switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5* Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD* Digital Switch (integrated TR-303 only).

There are no switches to set on this channel unit. The *SPQ909*( ) channel unit is compatible with MLT or the Teradyne *4TEL* system through the PGTC or XTC in PGTC mode and, in *5ESS* switch integrated systems, through the TBCU.

The *SPQ909*( ) channel unit provides the following features/functions:

- TR-909 compatibility.
- Fast forward disconnect.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Support for *CLASS* services.
- Compatibility with CND and CNAM services.

- Low-power capability (in modified G11 MSDT equipped with low-power PIU and in a DDM-2000 FiberReach NBS).
- Inventory information (*COMMON LANGUAGE CLEI* code, date of manufacture, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.
- Compatibility with the DDM-2000 FiberReach NBS.

## 2-Wire Locally Switched Special Services

Single-party services and 2-wire locally switched special services are provided by the *SPQ440*( ) and *SPQ450* POTS/*SPOTS* channel units at the RT or ONU and compatible equipment at the central office. These channel units support four subscriber channels per circuit pack (quad channel units). The service provided depends on the COT channel unit or the switch assignment. The POTS/*SPOTS* channel units provide the following services:

- POTS
- Private branch exchange - central office (PBX-CO) trunk
- Wide area telephone service (WATS) lines and trunks (to Class 5 central office)
- Off-premises extension line
- Secretarial line
- Centrex lines
- Direct out dial
- 800 service trunk or line.

In a universal system, single-party services are provided with corresponding *SLC*-2000 COT or *SLC* 96 COT channel units as follows:

- *SLC*-2000 system *SPQ300* POTS channel unit
- *SLC* 96 carrier WP10( ) POTS channel unit.

In a universal system, 2-wire locally switched special services are provided with corresponding *SLC*-2000 COT or *SLC* 96 COT channel units as follows:

- *SLC*-2000 system *SPQ340* *SPOTS* channel unit, loop-start only
- *SLC* 96 carrier WP36 *SPOTS* channel unit.

In an integrated Release 3.1 or 3.2 system, service is provided by switch assignment software (recent change and verify) and is terminated on the TR-08 interface of an LDS. Release 4.0 allows integration into the TR-303 interface of the LDS.

Two-wire locally switched special service circuits use loop-start, ground-start, or loop-reverse-battery signaling. The POTS/*SPOTS* channel units automatically configure for loop- or ground-start signaling and for POTS or *SPOTS* channel unit functionality based on the central office termination. There are no option settings required for these channel units. The loop-start signaling mode supports line side answer supervision (LSAS) or reverse battery monitoring feature. See the section "Direct Inward Dial Service" for a discussion of DID service using DID channel units with loop-reverse-battery signaling.

The *SPQ440D* enables the voice frequency data enhancement (VFDE) feature when used in an ONU hosted by an HDT with Software Release R4.6 or later. See Chapter 2 for an explanation of the VFDE feature.

### **SPQ340 Quad COT SPOTS Channel Unit**

**Data Sheet :** 363-005-381

The *SPQ340 SPOTS* channel unit is designed for 2-wire locally switched loop- and ground-start service with on-hook transmission and LSAS. This unit provides four channels of service and is usually located at the COT or the DDM-2000 FiberReach NBS (Release 4.4 and later).

The *SPQ340* channel unit furnishes a current sink interface and supports a fast-forward disconnect feature the RT reproduces the open interval when the central office open battery interval is longer than 50 ms. The *SPQ340* channel unit has hardened interfaces that may be bridged to metallic facilities. In addition, the *SPQ340* channel unit is fully compatible with "floating" battery and does not require the ground-reference option of the *5ESS* switch. When overall circuit transmission conditions permit, the *SPQ340* channel unit can be used in a *SLC-2000* Access System RT for off-premises applications. Generally accepted choices for off-premises station (OPS) applications are the Quad E *SPOTS* channel unit pair (*SPQ442* and *SPQ443* channel units), or the dual-channel *AUA42( )* and *AUA43( )* channel unit pair.

The *SPQ340* channel unit stores in nonvolatile memory an inventory record (including the ten-character *COMMON LANGUAGE CLEI* code readable by using the CIT or a compatible OSS) available for reading by a compatible OSS.

The far-end termination can be any of the following:

- *AUA158( )*, *AUA159( )*, or other *SLC Series 5 POTS (LS only)* channel unit or *SPOTS (current feed)* channel unit used at the RT
- *SPQ400( )*, *XSPQ400*, *SPQ401( )* POTS channel unit (supports loop-start service only)
- *SPQ440( ) SPOTS* channel unit
- *SPQ450 SPOTS ALIC5* channel unit
- *SPQ909* low-power POTS channel unit (MSDT/NBS).

When the far-end unit is an *SPQ440()* or *SPQ450* channel unit, that channel unit adopts a low-loss auto level compensation profile that is compatible with universal voice grade (UVG) requirements in TR-57\*.

There are no switches to set on this channel unit. The *SPQ340* channel unit is compatible with MLT or the Teradyne *4TEL* system through the PGTC or XTC in PGTC mode and, in *5ESS* switch integrated systems, through the TBCU.

The *SPQ340* channel unit provides the following features/functions:

- Compatibility with the UVG requirements in TR-57.
- Automatic loop- or ground-start service.
- Fast — forward disconnect.
- Support for bridging to metallic facilities
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Compatibility with *CLASS* services.
- Compatibility with CND and CNAM services.
- Compatibility with LSAS.
- Inventory information (for example, *COMMON LANGUAGE CLEI* code, date of manufacture, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.

### ***SPQ440()* Quad RT SPOTS Channel Unit**

**Data Sheet :** 363-005-369

The *SPQ440()* channel units, also known as UVG units, are designed for 2-wire POTS and locally switched special services. The *SPQ440B* and the *SPQ440(C,D)* versions add the following capabilities:

- ***SPQ440B Channel Unit*** — provides increased on-hook loss to improve on-hook *CLASS* services.
- ***SPQ440(C,D) Channel Unit*** — provides extended loop range up to 1500 ohms.

The *SPQ440()* channel unit is a UVG channel unit as defined in TR-57. This unit provides four channels of service and is usually located at the RT or ONU.

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\* Bellcore Technical Reference TR-TSY-000057, Issue 1, April 1987, and all Revisions and Supplements, *Functional Criteria for Digital Loop Carrier Systems* (A Module of TSGR, FR-NWT-000440).

The *SPQ440*( ) channel unit is equipped with ALC that adds loss when connected to shorter loops. This feature optimizes the loss level for ranges of metallic extensions up to 900  $\Omega$  for POTS, or across the carrier serving area (CSA) for locally switched special service. If a digital loop carrier (DLC) is replacing long metallic loops, the ALC feature minimizes the loss contrast experienced on cutover.

The *SPQ440*( ) channel unit furnishes a current feed interface to the customer loop and provides a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms). The selection of the POTS or special services loss profile is determined by the far-end channel unit or provisioning of the digital line unit. If the special services loss characteristic is desired for a loop-start circuit (for example, central office Centrex), the central office termination must be a *SPOTS* channel unit or a digital line unit provisioned for the *SPOTS* current feed channel unit interface.

The *SPQ440*( ) channel unit, when used with an *SPQ340* channel unit or properly programmed digital switch, supports the LSAS feature of business POTS services. LSAS requires reverse battery, which is required by services such as intelligent coin telephones.

The *SPQ440*( ) channel unit supports the services specified for the UVG channel unit listed in TR-57 except DID.

The *SPQ440*( ) channel unit stores in nonvolatile memory an inventory record (including its ten-character *COMMON LANGUAGE CLEI* code) readable by using the CIT or a compatible OSS.

The far-end termination can be any of the following:

- *SLC* 96 carrier WP10( ) POTS CU, loop-start applications only
- *SLC* 96 carrier WP36( ) *SPOTS* CU
- *SLC*-2000 system *SPQ300* POTS CU, loop-start applications only
- *SLC*-2000 system *SPQ340* *SPOTS* CU
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)
- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- *DMS 100* switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5* Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD* Digital Switch (integrated TR-303 only).

There are no switches to set on this unit. The *SPQ440*( ) channel unit is compatible with MLT or the Teradyne *4TEL* system through the PGTC or XTC in PGTC mode and, in *5ESS* switch integrated systems, through the TBCU.



The *SPQ440D* enables the voice frequency data enhancement (VFDE) feature when used in an ONU hosted by an HDT with Software Release R4.6 or later. See Chapter 2 for an explanation of the VFDE feature.

The *SPQ440( )* channel unit provides the following features/functions:

- Compatibility with UVG requirements in TR-57.
- Automatic loss compensation.
- Automatically provides loop- or ground-start service.
- Automatically provides POTS or special service loss profile.
- Compatibility with evolving fixed loss plan in ST-NPL-000060.
- Support for LSAS.
- Fast — forward disconnect.
- On-hook transmission (OHT). (See the section on POTS and *SPOTS* channel unit applications.)
- Support for *CLASS* services.
- Compatibility with CND and CNAM services.
- Inventory information (*COMMON LANGUAGE CLEI* code, manufacture date, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.
- Faceplate BUSY indicators.

### ***SPQ450 Quad ALIC5 RT SPOTS Channel Unit***

***Data Sheet*** : 363-005-384

The *SPQ450 ALIC5* channel unit is designed for 2-wire POTS and locally switched special services. The *SPQ450* channel unit allows for a benign bridging of the *SLC-2000 RT* to in-service circuits on the 1A *ESS™* analog switch in preparation for the transfer of the circuits to a *SLC-2000 RT* integrated into a *5ESS* switch. The *SPQ450* channel unit provides four channels of service and is normally located at the RT or ONU.

The *SPQ450* channel unit is equipped with ALC that adds loss when connected to shorter loops. This feature optimizes the loss level for ranges of metallic extensions up to 900  $\Omega$  for POTS, or across the CSA for locally switched special service. If a DLC is replacing long metallic loops, the ALC feature minimizes the loss contrast experienced on cutover.

The *SPQ450* channel unit furnishes a current feed interface to the customer loop and provides a fast-forward disconnect feature (the RT reproduces the open interval when the central office open battery interval is longer than 50 ms). The selection of the POTS or special services loss profile is determined by the far-end

channel unit or provisioning of the digital line unit. If the special services loss characteristic is desired for a loop-start circuit (for example, central office Centrex), the central office termination must be a *SPOTS* channel unit or a digital line unit provisioned for the *SPOTS* current feed channel unit interface.

The *SPQ450* channel unit facilitates the cutover of metallic circuits served by a 1A *ESS* analog switch to a DLC system integrated into a 5*ESS* switch with the analog line to integrated *SLC* carrier at 5*ESS* switch cutover feature (ALIC5). Prior to the cut, a relay on the *SPQ450* channel unit is kept open by 5*ESS* switch signaling, disconnecting the circuit connected to its tip/ring leads. This relay allows the 5*ESS* switch to be connected to the circuits that are to be cut over, without degrading transmission on the working circuits prior to the cut. During periods of low traffic during the pre-cutover period, the 5*ESS* switch can momentarily close the relay to conduct automated office-to-office tests. At switch cutover, the analog lines are disconnected from the 1A *ESS* switch, and the 5*ESS* switch signals the *SPQ450* channel unit to permanently close the relay, transferring service to the 5*ESS* switch.

The ALIC5 feature is supported in Releases 3.1, 3.2, and the TR-08 interface in Release 4.0. The ALIC5 feature is NOT supported in the Release 4.0 and later TR-303 interface.

The *SPQ450* channel unit supports the services specified for the UVG channel unit listed in TR-57 except DID.

The *SPQ450* channel unit stores in nonvolatile memory an inventory record (including its ten-character *COMMON LANGUAGE CLEI* code) readable by using the CIT or a compatible OSS.

The *SPQ450* channel unit is used in a cutover from an analog switch to a *SLC*-2000 RT integrated into a local digital switch operating in TR-08 Mode 1. The *SPQ450* channel unit is compatible with on-hook transmission services such as CND, CNAM, and meter reading.

There are no switches to set on this channel unit. The *SPQ450* channel unit is compatible with MLT or the Teradyne 4*TEL* system through the PGTC or XTC in PGTC mode and, in 5*ESS* switch integrated systems, through the TBCU.

The *SPQ450* channel unit provides the following features/functions:

- Compatibility with UVG requirements.
- Automatic loss compensation.
- Automatically provides loop- or ground-start service.
- Automatically provides POTS or special service loss profile.
- Enables pre-cutover testing with *5ESS* switch and *SLC-2000* RT bridged to working circuit (*ALIC5* feature).
- Support for *CND* and *CNAM* services.
- Support for *LSAS*.
- On-hook transmission (*OHT*). (See the section on *POTS* and *SPOTS* channel unit applications.)
- Support for *CLASS* services.
- Fast — forward disconnect.
- Inventory information (*COMMON LANGUAGE CLEI* code, manufacture date, etc.).
- No option switches.
- Faceplate test jack access to tip and ring of each channel.

## **Current Feed POTS and SPOTS Channel Unit Applications**

In POTS applications, the *SPQ400*, *SPQ440*, and *SPQ450* RT channel units provide single-party service with ALC on loops up to 900 ohms. For loops longer than 900 ohms, the *AUA51*, *AUA150*, *AUA150C*, *AUA151*, *SPQ400B*, *XSPQ400*, *SPQ401( )*, and *SPQ440(C,D)* provide service for loops up to 1500 ohms. The ranges and loss specifications of these channel units are given in the data sheets.

The *SPOTS* channel units support special services in the CSA. The CSA concept allows special services to be deployed without extra transmission treatment.

### **On-Hook Transmission (OHT)**

On-hook transmission allows data to be transmitted between the central office and the customer premises equipment (CPE), or from the CPE to the central office, using the voice path when it is idle. On-hook transmission services include calling number delivery, calling name delivery, meter reading, and visual message waiting indication.

Calling number and calling name delivery provides information about the caller to the called party before the called party answers. During the silent interval after the first ring, data are sent from the central office to the CPE using frequency-shift keying (FSK).

Meter reading usually requires bidirectional OHT, from the central office to the RT or ONU and from the RT or ONU to the central office.

The visual message waiting indication feature lights a lamp on the CPE indicating that a message is waiting for that number.

Table 4-2 shows the channel unit configurations that support OHT services. The configurations with the *SLC* 96 carrier WP10, WP10B, WP10C, or WP36( ) channel units in the COT provide OHT in the COT-to-RT/ONU direction only. These *SLC* 96 carrier channel units, therefore, require that the meter reading CPE present an off-hook when responding to a read request in order to support meter reading. The remaining configurations support bidirectional OHT, both COT to RT/ONU and RT/ONU to COT.

**Table 4-2. *SLC*®-2000 System Channel Unit (CU) Compatibility with On-Hook Transmission Services**

| Central Office | Switch          | Signaling | <i>SPQ</i> ® 400/909 CU      | <i>SPQ</i> 440( )/450 CU      |
|----------------|-----------------|-----------|------------------------------|-------------------------------|
| <i>SPQ</i> 300 | 1A <i>ESS</i> ™ | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
|                | 5 <i>ESS</i> ®  | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
| <i>SPQ</i> 340 | 1A <i>ESS</i>   | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
|                | 5 <i>ESS</i>    | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
|                | 1A <i>ESS</i>   | GS        | CNAM CND MR MWI              | CNAM CND MR <sup>§</sup> MWI  |
|                | 5 <i>ESS</i>    | GS        | CNAM CND MR MWI              | CNAM CND MR <sup>§</sup> MWI  |
| Integrated*    | DCLU/IDCU       | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
|                | DCLU/IDCU       | GS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
| WP10, B, C†    | 1A <i>ESS</i>   | LS        | CNAM CND MR <sup>‡</sup> MWI | CNAM CND MR <sup>‡</sup> MWI  |
|                |                 | LS        | CNAM CND MR <sup>‡</sup> MWI | CNAM CND MR <sup>‡</sup> MWI  |
| WP10D          | 1A <i>ESS</i>   | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
|                | 5 <i>ESS</i>    | LS        | CNAM CND MR MWI              | CNAM CND MR MWI               |
| WP36( )†       | 1A <i>ESS</i>   | LS        | CNAM CND MR <sup>‡</sup> MWI | CNAM CND MR <sup>‡</sup> MWI  |
|                | 5 <i>ESS</i>    | LS        | CNAM CND MR <sup>‡</sup> MWI | CNAM CND MR <sup>‡</sup> MWI  |
|                | 1A <i>ESS</i>   | GS        | — — — —                      | CNAM CND MR <sup>‡§</sup> MWI |
|                | 5 <i>ESS</i>    | GS        | — — — —                      | CNAM CND MR <sup>‡§</sup> MWI |

**Legend:**

CND — calling number delivery [calling party identification (CPI)]

CNAM — calling name delivery; DCLU — digital carrier line unit (5*ESS* switch)

GS — ground-start; IDCU — integrated digital carrier unit (5*ESS* switch)

LS — loop-start; MR — meter reading, MWI — visual message waiting indication

\* TR-08 interface that provides direct access to the 5*ESS* switch or other compatible digital switch. (Compatibility for MWI on ground-start circuits is not covered by TR-08. Nevertheless, these CUs support MR/MWI in GS.)

† OHT from COT to RT/ONU only; no OHT from RT/ONU to COT.

‡ Meter must present off-hook termination when responding to poll.

§ MR and MWI supported only if switch applies the loop current feed (LCF) condition to the tip/ring interface.

## Coin Service

The coin channel units provide for the following features and functions:

- Dial-tone-first service using loop-start signaling
- Coin-first service using ground-start signaling
- No option switches
- Faceplate **BUSY** indicator.

## RT Coin Channel Units

These channel units provide coin service at the RT and/or ONU. They store in their nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory includes its ten-character *COMMON LANGUAGE CLEI* code readable by using the CIT or a compatible OSS. The far-end termination can be any of the following:

- *SLC-2000 SPQ333* Dual Coin channel unit
- *SLC-2000 SPQ318* Quad Coin channel unit
- *SLC Series 5* carrier AUA33( ) Coin channel unit
- *SLC 96* carrier WP12 Coin channel unit
- *5ESS* switch digital carrier line unit (DCLU) (TR-08)
- *5ESS* switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- *DMS 100* switch integrated TR-08 interface
- *DMS 100* switch integrated TR-303 interface with Software Release NA004
- *GTD-5* Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- *EWSD* Digital Switch (integrated TR-303 only).

The following list gives a brief description of each RT/ONU coin channel unit:

- ***AUA53( ) Coin Channel Unit:*** This single circuit channel unit provides 2-wire coin service. It provides either dial-tone-first service using loop-start signaling or coin-first service using ground-start signaling. The channel unit is compatible with 1C/2C-type and 1D-type coin telephone sets and has a range of 900 ohms (1500 ohms — AUA53). It is compatible with MLT or the Teradyne *4TEL* system through the PGTC or XTC in PGTC mode and, in *5ESS* switch integrated systems, through the TBCU.  
(**Data Sheet** : 363-005-112)
- ***SPQ453 Dual Coin Channel Unit:*** This dual circuit channel unit provides 2-wire coin service. It provides either dial-tone-first service using loop-start signaling or coin-first service using ground-start signaling. The channel unit is compatible with 1C/2C-type and 1D-type coin telephone sets and has a range of 900 ohms. When the *SPQ453* channel unit is paired with an *SPQ333* COT channel unit in a universal configuration, it provides coin

service over both channels in a TR-08 mode and an INA-RT mode. In an integrated configuration, however, service is limited to only the odd/A channel where the system is operating in TR-08 Mode 2. Where the system is integrated to a 5ESS® switch in TR-08 Mode 1, the second channel is available if the 5ESS switch is provisioned to supply a third channel. This channel must be cross-connected to the even/B channel of the SPQ453 unit at the RT. (For details, see 363-005-342, *SPQ453 Dual Coin Channel Unit Data Sheet*.) Service over both channels is available in TR-303 mode without having to provision a third channel.

(**Data Sheet** : 363-005-342)

- **SPQ419 Quad Coin Channel Unit:** This quad circuit channel unit provides 2-wire coin service. It provides dial-tone-first service using loop-start signaling. The channel unit is compatible with 1C/2C-type and 1D-type coin telephone sets and has a range of 900 ohms. When the SPQ419 channel unit is paired with an SPQ318 COT channel unit in a universal configuration, it provides coin service over all four channels in a TR-08 mode and an INA-RT mode. In an integrated configuration, however, service is limited to only the first/A channel where the system is operating in TR-08 Mode 2. Where the system is integrated to a 5ESS switch in TR-08 Mode 1, the first and second channels are usable. However, the second channel is only available if the 5ESS switch is provisioned to supply a third channel. This channel must be cross-connected to the second/B channel of the SPQ419 unit at the RT. (For details see *SPQ419 Quad Coin Channel Unit Data Sheet* listed below.) Service over all four channels is available in TR-303 mode without having to provision extra channels.  
(**Data Sheet** : 363-005-340)

Each of the four channel units is usable in a universal configuration and in a TR-303 integrated configuration.

### COT Coin Channel Units

These channel units provide coin service at the COT. They store in their nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory includes its ten-character *COMMON LANGUAGE CLEI* code readable by using the CIT or a compatible OSS. The following list gives a brief description of each COT coin channel unit:

- **AUA33( ) Single Coin Channel Unit:** This single circuit unit provides the central office end of a 2-wire coin circuit in a universal configuration. This channel unit is compatible with MLT or the Teradyne 4TEL system through the PGTC or XTC in PGTC mode and, in 5ESS switch integrated systems, through the TBCU. (**Data Sheet** : 363-005-103)
- **SPQ333 Dual Coin Channel Unit:** This dual circuit unit provides the central office end of a 2-wire coin circuit in a universal configuration.  
(**Data Sheet** : 363-005-331)
- **SPQ318 Quad Coin Channel Unit:** This quad circuit unit provides the central office end of a 2-wire coin circuit in a universal configuration.  
(**Data Sheet** : 363-005-330)

## **Multiparty Service**

### **AUA55( ) RT Multiparty Channel Unit**

**Data Sheet :** 363-005-116

Multiparty service is provided with the AUA55( ) channel unit in the RT or ONU and compatible equipment in the central office. The AUA55( ) channel unit is designed for 2-wire multiparty service with automatic number identification (ANI) for 2-party lines. The channel unit provides two channels of service for one- to eight-party lines. Four- to eight-party service requires a positive ringing supply at the RT. The channel units have a loop range of 1500 ohms.

The far-end termination can be any of the following:

- SLC Series 5 carrier AUA35 multiparty channel unit
- SLC 96 carrier WP12 multiparty channel unit
- 5ESS switch digital carrier line unit (DCLU) (TR-08)
- 5ESS switch integrated digital carrier unit (IDCU) (TR-08 and TR-303)
- DMS 100 switch integrated TR-08 interface
- DMS 100 switch integrated TR-303 interface with Software Release NA004
- GTD-5 Digital Switch EAX Software Version SVR 1722 (integrated TR-303 only)
- EWSD Digital Switch (integrated TR-303 only).

### **AUA35 COT Multiparty Channel Unit**

**Data Sheet :** 363-005-109

The AUA35 channel unit is designed for 2-wire multiparty service. This channel unit provides two channels of service and is the companion unit to the AUA55( ) channel unit. The AUA35 channel unit is located in the COT of a universal SLC-2000 system.

The AUA35 and AUA55( ) channel units are compatible with MLT or the Teradyne 4TEL system through the PGTC or XTC in PGTC mode and, in 5ESS switch integrated systems, through the TBCU.

The AUA35/AUA55( ) channel unit pair provides the following features/functions:

- Two channels of service for one- to eight-party lines
- Automatic number identification (ANI) for two-party lines
- No option switches
- Faceplate BUSY indicators.



## Direct Inward Dial (DID) Service

### AUA56( ) RT DID Channel Unit

**Data Sheet :** 363-005-115

The AUA56( ) channel unit provides direct inward dial service in the RT or ONU and compatible equipment in the central office. It is used for 2-wire locally switched special services in direct inward dialing applications and provides two channels of service. The AUA56 (current sink) channel unit is compatible with the loop reverse-battery signaling on a DID circuit and provides the dial pulse terminating (DPT) function between the SLC-2000 Access System and the DID trunk circuit of a private branch exchange (PBX). It is designed for CSA range and requires nonloaded cable.

The far-end termination can be any of the following:

- SLC Series 5 carrier AUA36( ) DPO channel unit
- SLC-2000 SPQ443 ESPOTS channel unit provisioned for DPO
- SLC-2000 SPQ336 Quad DPO channel unit
- SLC Series 5 AUA43( ) ESPOTS channel unit provisioned for DPO
- SLC 96 carrier WP42 SPOTS DID channel unit
- D4 J98726BA 2-wire DPO channel unit
- 5ESS switch digital carrier line unit (DCLU)
- 5ESS switch integrated digital carrier unit (IDCU).



**NOTE:**

These channel units are *not* compatible with MLT or the Teradyne 4TEL system.

The AUA56B channel unit stores in nonvolatile memory an inventory record available for reading by a compatible operations support system (OSS). This inventory record includes its 10 character *COMMON LANGUAGE CLEI*<sup>\*</sup> code. For each channel of the AUA56B, you can select the insertion loss to either 0 dB or 2.5 dB by operating a board-mounted switch.

When pairing the AUA56( ) with the AUA36( ) COT channel unit, the pair provides the following features and functions:

- Two channels of DID service with loop pulsing or battery and ground pulsing used for loop-reverse-battery signaling
- INA configuration compatibility

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<sup>\*</sup> COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

- No option switches (AUA56 only)
- Faceplate BUSY indicators
  - **AUA56** — BUSY indicator only
  - **AUA56B** — BUSY indicator for each channel
- Sends reverse battery signal (off-hook) toward the LDS when disconnect is detected toward the PABX, to facilitate facility trouble recognition by the CO (the circuit goes into lockout) (AUA56B only)
- Faceplate test jack access to tip and ring of each channel (AUA56B only)
- Inventory information (AUA56B only).

### **AUA36( ) COT DID Channel Unit**

**Data Sheet :** 363-005-114

The AUA36( ) channel unit is designed for 2-wire DID service. This channel unit provides two channels of service and is the companion unit to the AUA56( ) RT channel unit. The AUA36( ) channel unit is located in the COT of a universal *SLC-2000* system. The AUA36( ) (current feed) channel unit provides the dial pulse originating (DPO) interface to the central office. This channel unit provides test access through the UIP.



**NOTE:**

These channel units are *not* compatible with MLT or the Teradyne *4TEL* system.

When pairing the AUA36( ) with the AUA56( ) RT channel unit, the pair provides the following features and functions:

- Two channels of DID service with loop pulsing or battery and ground pulsing used for loop-reverse-battery signaling
- INA configuration compatibility
- No option switches (AUA36 only)
- Faceplate BUSY indicators
  - **AUA36** — BUSY indicator only
  - **AUA36B** — BUSY indicator for each channel
- Faceplate test jack access to tip and ring of each channel (AUA36B only)
- Inventory information (AUA36B only).

### **SPQ456 RT Quad DID Channel Unit**

**Data Sheet :** 363-005-343

The *SPQ456* channel unit in the RT or ONU is used for 2-wire locally switched special services in direct inward dialing applications and provides four channels of service. It is compatible with reverse-battery signaling on a DID circuit and provides the dial pulse terminating (DPT) function between the *SLC-2000* Access System and the DID trunk circuit of a private branch exchange (PBX). It is designed for CSA range and allows you to provision the transmit and receive loss setting to either 0 dB or 2.5 dB.

The far-end termination can be any of the following:

- *SLC-2000 SPQ336* COT quad DID channel unit
- *SLC-2000 SPQ443 ESPOTS* channel unit provisioned for DPO
- *SLC* Series 5 AUA43( ) *ESPOTS* channel unit provisioned for DPO
- *SLC* Series 5 carrier AUA36( ) DPO channel unit
- *SLC-2000 SPQ443 ESPOTS* channel unit provisioned for DPO
- *SLC* 96 carrier WP42 *SPOTS* DID channel unit
- D4 J98726BA 2-wire DPO channel unit
- *5ESS* switch digital carrier line unit (DCLU)
- *5ESS* switch integrated digital carrier unit (IDCU).

This channel unit provides the following features and functions:

- CIT provisionable transmission loss setting
- Faceplate BUSY indicators for each of the four channels.

### **SPQ336 COT DID Channel Unit**

**Data Sheet :** 363-005-334

The *SPQ336* channel unit is designed for 2-wire DID service. This channel unit provides four channels of service and is located in the COT of a universal *SLC-2000* system. The *SPQ336* channel unit provides the dial pulse originating (DPO) interface to the central office.

This channel unit provides faceplate BUSY indicators for each of the four channels.

## Frequency-Selective Ringing (FSR)

### AUA57 RT FSR Channel Unit

**Data Sheet :** 363-005-122

Frequency-selective ringing (FSR) service is provided with the AUA57 channel unit in the RT or ONU and compatible equipment in the central office.

The AUA57 channel unit is designed for 2-wire FSR service and provides one channel of service. The AUA57 channel unit provides decimonic, harmonic, and synchrononic frequency ringing groups. A three-position switch on the AUA57 channel unit is set to the ringing group that will be applied at the central office. The AUA57 channel unit has a loop range of 900 ohms.

The far-end termination can be any of the following:

- SLC Series 5 carrier AUA37 FSR channel unit — five party
- SLC 96 carrier WP33 FSR channel unit — four party
- 5ESS switch digital carrier line unit (DCLU) — four party
- 5ESS switch integrated digital carrier unit (IDCU) , TR-08, TR-303 — four party.

See Chapter 8 for other applications.

### AUA37 COT FSR Channel Unit

**Data Sheet :** 363-005-121

The AUA37 channel unit is designed for 2-wire FSR service. This unit provides one channel of service and is the companion unit to the AUA57 channel unit. The AUA37 channel unit is located in the COT of a universal SLC-2000 system.

There are no switches to set on the AUA37 channel unit; the ringing group is determined by the setting of the AUA57 channel unit. The AUA37 and AUA57 channel units are compatible with MLT or the Teradyne 4TEL system through the PGTC or XTC in PGTC mode and, in 5ESS switch integrated systems, through the TBCU.

The AUA37/AUA57 channel unit pair provides the following features/functions:

- FSR service with selectable decimonic, harmonic, or synchrononic frequency ringing groups
- Five frequencies per group
- Faceplate BUSY indicator.

## **Special Services (Nonlocally Switched and Nonswitched)**

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### **Private Line Manual Ring**

#### **AUA45( ) Ringing Repeater Channel Unit**

**Data Sheet :** 363-005-123

The AUA45( ) dual ringing repeater channel unit provides 2-wire private-line point-to-point manual ring service. The AUA45( ) channel unit provides two channels of service and can be used in the RT or ONU with compatible equipment in the central office. The channel unit can detect and originate AC ringing on its tip and ring interface and provides a voice-frequency transmission channel. In a typical manual ringing application, pushing a button at the calling station applies an AC ringing voltage to the calling channel unit. The channel unit at the called end sends ringing to the called station.

The far-end termination can be any of the following channel units:

- SLC Series 5 carrier AUA45( ) channel unit
- D4 2RD/PLAR channel unit (J98726SN)
- D4 4RD/PLAR channel unit (J98726SP)
- D3 2RD channel unit (J98718SL)
- D3 4RD channel unit (J98718SM).

The AUA45( ) channel unit is compatible with D3/D4 2- or 4-wire RD/PLAR channel units when used in the *ring/repeat input timing mode*. The AUA45( ) channel unit can be used in certain types of alarm service — those services that use transmission-only supervision and that use voice-frequency (VF) signals within the passband of the channel unit.

The AUA45( ) channel unit provides the following features/functions:

- Manual ringing service - repeat input timing mode
- VF transmission-only service
- Can be used in an INA configuration
- Faceplate test jack access to tip and ring of each channel.

The option switches for the AUA45( ) channel unit are physical switches located on the printed wiring board and must be set manually — they cannot be set electronically using the craft interface terminal (CIT).

Details for the AUA45( ) channel unit are described in the 363-005-123 data sheet; 915-710-116 provides guidelines for selecting option settings for the AUA45( ) channel unit, describes the applications of the unit, and provides channel unit

compatibility information. The AUA45( ) channel unit is NOT supported in TR-08 Mode 2.

The AUA45( ) channel unit is NOT compatible with MLT or the Teradyne *4TEL* system.

## **Private Line Automatic Ring**

### **AUA75 Private Line Automatic Ring (PLAR) Channel Unit**

**Data Sheet :** 363-005-132

The AUA75 PLAR channel unit provides 2-wire private-line point-to-point automatic ring service. The AUA75 channel unit provides two channels of service and can be used in the RT or ONU with compatible equipment in the central office. This channel unit provides a current feed interface to the customer loop. In a typical automatic ring application, signaling begins when the calling station goes off-hook, which automatically causes ringing at the called station. The called station rings at 2 seconds on and 4 seconds off until it is taken off-hook (answered). When the called party answers, ringing is tripped and a talk path is established between the two stations.

The far-end termination can be any of the following channel units:

- SLC Series 5 carrier AUA75 channel unit
- D4 2RD/PLAR channel unit (J98726SN)
- D4 4RD/PLAR channel unit (J98726SP)
- D3 2WPLAR channel unit (J98718SN)
- D3 4WPLAR channel unit (J98718SP).

The AUA75 channel unit provides the following features/functions:

- Private line automatic ring service
- Can be used in an INA configuration
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

The option switches for the AUA75 channel unit are physical switches located on the printed wiring board and must be set manually — they cannot be set electronically using the craft interface terminal (CIT).

Details for the AUA75 channel unit are described in the 363-005-132 data sheet; 915-710-116 provides guidelines for selecting option settings for the AUA75 channel unit, describes the applications of the unit, and provides channel unit compatibility information. The AUA75 channel unit is NOT supported in TR-08 Mode 2.

The AUA75 channel unit is NOT compatible with MLT or the Teradyne 4TEL system.

## 2-Wire Voice-Frequency (VF) Special Services

### SPQ442 2-Wire Current Sink Channel Unit

**Data Sheet :** 363-005-382

The SPQ442 current sink channel unit is used primarily in 2-wire nonlocally switched loop- and ground-start special services, 2-wire nonswitched private lines, and direct-inward-dial (DID) trunks. The channel unit may also be used in locally switched services.

The SPQ442 channel unit may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The SPQ442 channel unit provides four channels of service. Each channel can be used independently of the others to provide any of the following three functions:

- **Foreign exchange - office end (FXO):** The FXO function is used for a nonlocally or locally switched loop- or ground-start application. Typically, nonlocally switched applications are foreign exchange trunks and lines and off-premises PBX station lines. For the FXO function, the SPQ442 channel unit may be used in either the RT, ONU or COT, depending on the application.
- **Dial pulse terminating (DPT) :** The DPT function is used for a DID application only, with either dial pulse or multi-frequency addressing. For this function, the SPQ442 channel unit is located in the RT or ONU.
- **Transmission only (TO) :** The TO function is used for a private line application, with no DC signaling. For this function, the SPQ442 channel unit may be located in the RT, ONU, or COT.

The SPQ442 channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXO, DPT, or TO) for each channel are set by entering commands via the CIT provisioning dialog or X.25 interface to an OSS.

The SPQ442 channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ442* channel unit provides the following features/functions:

- Two-wire special services
  - Loop- or ground-start, local or foreign exchange (FX)
  - Loop reverse battery (DPT)
  - Private line, voice or data (TO).
- Provisionable transmission treatment
- On-hook transmission (OHT), full-time or caller ID only
- Support for *CLASS* services
- Support for line side answer supervision
- Can be used in an INA configuration
- Fast — forward disconnect
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

The *SPQ442* quad channel unit is functionally identical to the dual *AUA42B* channel unit.

Details for the *SPQ442* channel unit are described in the 363-005-382 data sheet. The guidelines given in 915-710-116 for selecting option setting, applications, and compatibility for the *AUA42* channel unit should be used for the *SPQ442* channel unit.

### **AUA42( ) and AUA142 2-Wire Current Sink Channel Units**

**Data Sheets :** 363-005-106 and 363-005-301

The *AUA42( )* and *AUA142* are current sink channel units primarily intended for use in 2-wire nonlocally switched loop- and ground-start special services, 2-wire nonswitched private lines, and direct-inward-dial (DID) trunks. The channel units may also be used in locally switched services.

The *AUA42( )/AUA142* channel unit may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The *AUA42( )/AUA142* channel unit provides two channels of service. Each channel can be used independently of the other to provide any of the following three functions:

- **Foreign exchange-office end (FXO):** The FXO function is used for a non-locally or locally switched loop- or ground-start application. Typically, nonlocally switched applications are foreign exchange trunks and lines and



off-premises PBX station lines. For the FXO function, the AUA42( )/AUA142 channel unit may be used in either the RT, ONU, or COT, depending on the application.

- **Dial pulse terminating (DPT)** : The DPT function is used for a DID application only, with either dial pulse or multifrequency addressing. For this function, the AUA42( )/AUA142 channel unit is located in the RT or ONU.
- **Transmission only (TO)** : The TO function is used for a private line application, with no DC signaling. For this function, the AUA42( )/AUA142 channel unit may be located in the RT, ONU, or COT.

The AUA42( )/AUA142 channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXO, DPT, or TO) for either channel are set by entering commands via the CIT or X.25 interface to an OSS.

The AUA42B channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The AUA42B and AUA142 channel units are functionally identical to the AUA42 channel unit except for an extra level of power line fault protection for both the AUA42B and AUA142 channel units, and less on-hook transmission loss for the AUA42B channel unit. The extra protection feature provides a higher fault tolerance when a power line is accidentally connected across the metallic leads of the AUA42B or AUA142 channel unit.

The AUA42( ) and AUA142 channel units provide the following features/functions:

- Two-wire special services
  - Loop- or ground-start, local or FX
  - Loop reverse battery (DPT)
  - Private line, voice or data (TO)
- Provisionable transmission treatment
- On-hook transmission (OHT), full-time or caller ID only
- Support for *CLASS* services
- Fast — forward disconnect
- Can be used in an INA configuration
- Faceplate test jack access to tip and ring (AUA42B channel unit only) of each channel
- Faceplate BUSY indicators
- Inventory information (*CLEI* code, manufacture date, etc.) (AUA42B channel unit only).

Details for the AUA42( ) and AUA142 channel units are described in 363-005-106 and 363-005-301 data sheets, respectively. Document 915-710-116 provides guidelines for selecting option settings for the AUA42( )/AUA142 channel unit, describes the various applications of this unit, and provides channel unit compatibility information.

## 2-Wire VF Special Services

### SPQ443 2-Wire Current Feed Channel Unit

**Data Sheet :** 363-005-383

The *SPQ443 E SPOTS* channel unit is a current feed unit and is primarily intended for use in 2-wire nonlocally switched loop- and ground-start special services, 2-wire nonswitched private lines, and direct inward dial (DID) trunks. The unit may also be used in locally switched services.

The *SPQ443* channel unit may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The *SPQ443* channel unit provides four channels of service. Each channel can be used independently of the others to provide any of the following three functions:

- **Foreign exchange-station end (FXS) :** The FXS function is used in nonlocally or locally switched loop- or ground-start applications. Typical nonlocally switched applications are foreign exchange trunks and lines and off-premises PBX station lines. For the FXS function, the *SPQ443* channel unit may be used in the RT, ONU, or COT, depending on the application.
- **Dial pulse originating (DPO) :** The DPO function is used for a DID application only, with either dial pulse or multifrequency addressing. For this function, the *SPQ443* channel unit is located in the COT.
- **Transmission only (TO) :** The TO function is used for a private line application, with no DC signaling. For this function, the *SPQ443* channel unit may be located in the RT, ONU, or COT. The channel unit provides sealing current to break down a high-resistance film that may build up at unsoldered, hand-twisted splices.

The *SPQ443* channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches. Instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXS, DPO, or TO) for each channel are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS.

The *SPQ443* channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ443* channel unit provides the following features/functions:

- Two-wire special services
  - Loop- or ground-start, local or FX
  - Loop reverse battery (DPO), local or FX
  - Private line, voice or data (TO)
- Provisionable transmission treatment
- On-hook transmission (OHT), full-time or caller ID only
- Support for *CLASS* services
- Support for line side answer supervision (intelligent pay phone service)
- Can be used in an INA configuration
- Fast — forward disconnect
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Faceplate test jack access to tip and ring of each channel
- Faceplate BUSY indicators.

The *SPQ443* quad channel unit is functionally equivalent to the *AUA43B* dual channel unit.

Details for the *SPQ443* channel unit are described in the 363-205-383 data sheet. The guidelines given in 915-710-116 for selecting option setting, applications, and compatibility for the *AUA43( )* channel unit should be used for the *SPQ443* channel unit.

### ***AUA43( )* 2-Wire Current Feed Channel Unit**

***Data Sheet*** : 363-005-107

The *AUA43( ) E SPOTS* channel unit is a current feed unit and is primarily intended for use in 2-wire nonlocally switched loop- and ground-start special services, 2-wire nonswitched private lines, and direct inward dial (DID) trunks. The channel unit may also be used in locally switched services.

The *AUA43( )* channel unit may interface with a switching machine, other transmission equipment, or cable. The connecting wire or cable must conform to the CSA design rules.

The AUA43( ) channel unit provides two channels of service. Each channel can be used independently of the other to provide any of the following three functions:

- **Foreign exchange-station end (FXS):** The FXS function is used in nonlocally or locally switched loop- or ground-start applications. Typical nonlocally switched applications are foreign exchange trunks and lines and off-premises PBX station lines. For the FXS function, the AUA43( ) channel unit may be used in the RT, ONU, or COT depending on the application.
- **Dial pulse originating (DPO) :** The DPO function is used for a DID application only, with either dial pulse or multifrequency addressing. For this function, the AUA43( ) channel unit is located in the COT.
- **Transmission only (TO):** The TO function is used for a private line application, with no DC signaling. For this function, the AUA43( ) channel unit may be located in the RT, ONU, or COT. The channel unit provides sealing current to break down a high-resistance film that may build up at unsoldered, hand-twisted splices.

The AUA43( ) channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches. Instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXS, DPO, or TO) are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS.

The AUA43B channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The AUA43( ) channel unit provides the following features/functions:

- Two-wire special services
  - Loop- or ground-start, local or FX
  - Loop reverse battery\* (DPO), local or FX
  - Private line, voice or data (TO)
- Provisionable transmission treatment
- On-hook transmission (OHT), full-time or caller ID only
- Support for *CLASS* services
- Can be used in an INA configuration
- Fast — forward disconnect
- Faceplate test jack access to tip and ring (AUA43B channel unit only) of each channel

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\* Except when facing a DID switch with battery and ground pulsing: AUA43 channel unit, local and foreign central office; AUA43B channel unit, foreign central office.

- Faceplate BUSY indicators
- Inventory information (*CLEI* code, manufacture date, etc.) (AUA43B channel unit only).

Details for the AUA43( ) channel unit are described in 363-205-107 data sheet. Document 915-710-116 provides guidelines for selecting option settings for the AUA43( ) channel unit, describes the various applications for the unit, and provides channel unit compatibility.

## DC Alarm Circuits

### MCU-5205 Metallic Channel Unit

**Data Sheet :** TLGD-5205

The *MCU*<sup>\*</sup>-5205 synchronous channel unit enables a variety of DC and AC alarm and telemetry services to be transported over the *SLC*-2000 system. The *MCU*-5205 channel unit can be used in the COT, RT, or NBS. The *MCU*-5205 is end-to-end compatible with another *MCU*-5205 channel unit for universal *SLC*-2000 system applications. It is also end-to-end compatible with the Tollgrade *MCU*-4200, Issue 2 channel unit, which can be used in a *SLC* 96 carrier channel bank or D4 channel bank.

The *MCU*-5205 channel unit enables provisioning of virtually all general purpose alarm and telemetry types of circuits [including those designated by the following regional Bell operating company (RBOC) common language service codes: BA, BL, BS, CI, CP, NT, PA, PM, PR, PV, RT, SG, TC, ZA, ZM, ZQ, ZS, and ZT]. In addition, it is compatible with service observing circuits, telephone answering circuits, and concentrator/identifier circuits.

The *MCU*-5205 channel unit provides a single circuit that uses one DS0 time slot and provides an ADPCM voice channel as well as the alarm channel over the same time slot. Since the *MCU*-5205 channel unit is a synchronous unit and typically extends the alarm circuit across the central office, the central office channel bank must be externally timed via a composite clock signal.

This channel unit is designed, manufactured, and marketed by Tollgrade Communications, Inc. Circuit application and option setting information can be found in the Tollgrade data sheet TLGD-5205.

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\* Trademark of Tollgrade Communications, Inc.

## **Digital By-Pass Pair for MLT**

### **MCU-5405 Metallic Channel Unit**

#### ***Data Sheet*** : TLGD-5405

The *MCU-5405* channel unit provides a mechanized loop testing (MLT)-compatible digital bypass pair for applications where a metallic bypass pair is not available for subscriber loop testing. The *MCU-5405* channel unit allows a full range of MLT tests to be performed with the speed and accuracy typical of a good metallic bypass pair. However, it has a greater operating range (COT to RT) than a metallic pair and is not affected by inductive interference, ground potential problems, or various other environmental conditions.

The *MCU-5405* channel unit can be used in the COT and RT. It is end-to-end compatible with another *MCU-5405* channel unit for universal *SLC-2000* system applications. It is also end-to-end compatible with the Tollgrade *MCU-4496* or *MCU-4496ER* (extended range) channel unit, which can be used in a *SLC 96* carrier channel bank or D4 channel bank.

The *MCU-5405* channel unit provides a single circuit that uses two consecutive channels (DS0 time slots) and provides an ADPCM voice channel as well as the bypass pair function. Since the *MCU-5405* channel unit is a synchronous unit, the central office channel bank must be externally timed via a composite clock signal.

This channel unit is designed, manufactured, and marketed by Tollgrade Communications, Inc. Circuit application and option setting information can be found in the Tollgrade Practice Section TLGD-5405.

See Chapter 8 for other applications.

## 4-Wire VF Special Services

### AUA41B 4-Wire Current Feed Channel Unit

**Data Sheet :** 363-005-105

The AUA41B channel unit is a current feed unit intended for use in nonlocally switched loop- and ground-start special services, nonswitched private lines, and PBX tie trunks. For any of the function modes and depending upon application, the AUA41B channel unit may be used in the RT, ONU, or the COT. It may interface with a switching machine, other transmission equipment, data equipment, or cable.

The AUA41B channel unit has an extra level of power fault protection. This feature provides a higher fault tolerance (than the AUA41 channel unit) when a power line is accidentally connected across the metallic leads.

The AUA41B channel unit, when used in a SLC-2000 COT or RT, has provisionable sealing current (current or no current) in the TO and ETO modes. The AUA41B channel unit has one switch that is used to turn this sealing current on or off.

The AUA41B channel unit is backward compatible with all the features/functions of the AUA41/AUA141 channel unit, including the following:

- Four-wire special services
  - Loop- or ground-start signaling
  - Duplex signaling (DX)
  - Transmission only (TO/ETO)
- Provisionable transmission treatment
- Can be used in an INA configuration.

The AUA41B channel unit is an enhanced version of the AUA41, with the following additional features/functions:

- Optional sealing current in TO and ETO modes
- Faceplate test access to tip and ring and tip1 and ring1
- Inventory information (CLEI code, date of manufacture, etc.).

The AUA41B channel unit provides one channel of service and can function in any of three modes.

- **Foreign exchange-station end (4FXS)** — The 4FXS function is used in nonlocally switched loop- or ground-start applications. Typical applications are foreign exchange trunks and lines and off-premises PBX stations. These applications are generally 2-wire at each end. Therefore, when the AUA41B channel unit is used in the circuit, additional equipment must be used for the 4- to 2-wire conversion at the circuit ends.
- **Duplex (4DX):** The primary application of the 4DX function is in PBX tie trunks. For this application, the AUA41B channel unit is used at the RT/ONU if the RT/ONU faces cable. (Additional equipment at the customer location provides the DX-to-E&M conversion.) If the RT or ONU is at the customer location, the SPQ454/AUA54( ) 4-wire channel unit, which provides an E&M interface, should be used instead. In either case, the AUA41B can be used at the COT, either to face cable or a 4DX channel unit in an interoffice or loop carrier system.
- **Transmission only (4TO) or equalized transmission only (4ETO):** Both the 4TO and 4ETO functions are used in private lines (voice or data). The 4ETO function is used when equalization of cable transmission characteristics is required. Otherwise, the 4TO function is used.

For the 4FXS, 4DX, and 4ETO functions, the AUA41B channel unit may be used with up to 15 dB of nonloaded or loaded cable. The AUA41B channel unit has transmission and signaling options that must be set before service can be provided. The channel unit has one physical option switch that is used to enable or disable the sealing current. The remaining option information is written into memory registers located on the channel unit. These transmission and signaling options are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS. The *CLEI* code for the AUA41 channel unit (5SCU7D) should be used when provisioning the AUA41B channel unit.

Details for the AUA41B channel unit are described in 363-005-105 data sheet. 915-710-116 provides guidelines for selecting option settings for the AUA41B channel unit, describes the various applications of this unit, and provides channel unit compatibility information.

### **AUA41 and AUA141 4-Wire Current Feed Channel Unit**

**Data Sheets :** 363-005-105 and 363-005-300

The AUA41/AUA141 channel unit is a current feed unit intended for use in non-locally-switched loop- and ground-start special services, nonswitched private lines, and PBX tie trunks. For any of the function modes and depending upon application, the AUA41/AUA141 channel unit may be used in the RT, ONU, or the COT. It may interface with a switching machine, other transmission equipment, data equipment, or cable.

The AUA141 and AUA41 4-wire channel units have the same functions, but the AUA141 channel unit has an extra level of power fault protection. This feature



provides a higher fault tolerance when a power line is accidentally connected across the metallic leads of the channel unit. The AUA41/AUA141 channel unit provides one channel of service and can function in any of three modes.

- **Foreign exchange-station end (4FXS):** The 4FXS function is used in nonlocally switched loop- or ground-start applications. Typical applications are foreign exchange trunks and lines and off-premises PBX stations. These applications are generally 2-wire at each end. Therefore, when the AUA41/AUA141 channel unit is used in the circuit, additional equipment must be used for the 4- to 2-wire conversion at the circuit ends.
- **Duplex (4DX):** The primary application of the 4DX function is in PBX tie trunks. For this application, the channel unit is used at the RT/ONU if the RT/ONU faces cable. (Additional equipment at the customer location provides the DX-to-E&M conversion.) If the RT or ONU is at the customer location, the SPQ454/AUA54 4-wire channel unit, which provides an E&M interface, should be used instead. In either case, the AUA41/AUA141 channel unit can be used in the COT, either to face cable or a 4DX channel unit in an interoffice or loop carrier system.
- **Transmission only (4TO) or equalized transmission only (4ETO):** Both the 4TO and 4ETO functions are used in private lines (voice or data). The 4ETO function is used when equalization of cable transmission characteristics is required. Otherwise, the 4TO function is used. Sealing current is provided for both the 4TO and 4ETO functions.

For the 4FXS, 4DX, and 4ETO functions, the channel unit may be used with up to 15 dB of nonloaded or loaded cable. The AUA41/AUA141 channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All transmission and signaling options on the unit are set by entering commands via the CIT provisioning dialog or X.25 interface to an OSS.

The AUA41/AUA141 channel units provide the following features/functions:

- Four-wire special services
  - Loop- or ground-start signaling
  - Duplex signaling (DX)
  - Transmission only (TO/ETO)
- Provisionable transmission treatment
- Can be used in an INA configuration.

Details for the AUA41 and AUA141 channel units are described in 363-005-105 and 363-005-300 data sheets, respectively. 915-710-116 provides guidelines for selecting option settings for the AUA41/AUA141 channel units, describes the various applications of the channel units, and provides channel unit compatibility information.

## SPQ444 4-Wire Current Sink Channel Unit

**Data Sheet :** 363-005-385

The *SPQ444* 4-wire current sink channel unit is intended for use in nonlocally switched loop- and ground-start special services. Applications include metallic range extensions to a foreign CO and back-to-back connections to a D4 4FXS or 4TDM channel unit. The *SPQ444* channel unit is a single-circuit unit that is functionally equivalent to the *AUA44*( ) channel unit except for the channel unit pin-out. The channel unit is designed specifically to be compatible with only the *SLC-2000* COT and RT MDS assembly backplane pin-outs. The *AUA44* channel unit should be used for *SLC-2000* MSDT and *DDM-2000* FiberReach NBS applications.

The *SPQ444* channel unit can function in one of two modes:

- **Foreign exchange - office end (4FXO):** For off-premises station applications, the unit is at the PBX end of the circuit. This application is generally 2-wire at each end. Therefore, when the *SPQ444* channel unit is used in the circuit, additional equipment must be used for the 4- to 2-wire conversion at the PBX. The *SPQ444* channel unit will pass distinctive ringing in the 4FXO mode. For the 4FXO function, the *SPQ444* channel unit may be used with up to 15 dB of nonloaded or loaded cable.
- **Tandem (4TDM):** The TDM function is used in providing back-to-back carrier interface for loop- or ground-start circuits. In this application, the *SPQ444* channel unit equipped RT must be on customer premises.

The *SPQ444* channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ444* channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXO and TDM) are set by entering commands via the CIT provisioning dialog or X.25 interface to an OSS.

The *SPQ444* channel unit provides the following features/functions:

- Four-wire special services
  - Loop- or ground-start signaling
  - Tandem signaling
- Provisionable transmission treatment
- Can be used in an INA configuration
- Inventory information (for example, *CLEI* code, date of manufacture, etc.).

The *SPQ444* channel unit is functionally equivalent to the *AUA44B* channel unit.

Details for the *SPQ444* channel unit are described in 363-005-385 data sheet. The guidelines given in 915-710-116 for selecting option setting, applications, and compatibility for the AUA44 channel unit should be used for the *SPQ444* channel unit.

### **AUA44( ) 4-Wire Current Sink Channel Unit (MSDT/NBS)**

**Data Sheet :** 363-005-108

The AUA44( ) 4-wire current sink channel unit is intended for use in nonlocally switched loop- and ground-start special services. It is used only in the *SLC-2000* MSDT and the *DDM-2000* FiberReach NBS. MSDT and NBS applications include back-to-back connections to a D4 4FXS or 4TDM channel unit. The channel unit may interface with a switching machine, other transmission equipment, or cable. The AUA44( ) channel unit signaling lead pin-out is not compatible with the *SLC-2000* COT or RT (the *SPQ444* channel unit should be used in COT and RT applications).

The AUA44( ) channel unit provides one channel of service, which can function in one of two modes as follows:

- **Foreign exchange-office end (4FXO):** For off-premises station applications, the channel unit is at the PBX end of the circuit. This application is generally 2-wire at each end. Therefore, when the AUA44( ) channel unit is used in the circuit, additional equipment must be used for the 4- to 2-wire conversion at the circuit ends. The AUA44( ) channel unit will pass distinctive ringing in the 4FXO mode. For the 4FXO function, the AUA44( ) channel unit may be used with up to 15 dB of nonloaded or loaded cable. In this application, the tip and ring pairs for the third and fourth channels must be disconnected (at the MSDT/NBS backplane) from the outside cable plant, to assure that the channel unit signaling leads are not exposed to outside plant environment.
- **Tandem (4TDM):** The TDM function is used in providing back-to-back carrier interface for loop- or ground-start circuits. In this application, the AUA44( )-equipped MSDT/NBS must be on customer premises.

The AUA44( ) channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (FXO and TDM) are set by entering commands via the CIT provisioning dialog or X.25 interface to an OSS.

The AUA44( ) channel unit provides the following features/functions:

- Four-wire special services
  - Loop- or ground-start signaling
  - Tandem signaling
- Provisionable transmission treatment
- Can be used in an INA configuration.

Details for the AUA44( ) channel unit are described in 363-005-108 data sheet. Document 915-710-116 provides guidelines for selecting option settings for the AUA44( ) channel unit, describes the various applications of this unit, and provides channel unit compatibility information.

### **SPQ454 4-Wire E&M Channel Unit**

**Data Sheet :** 363-005-386

The *SPQ454* 4-wire channel unit is intended for use in private branch exchange (PBX) tie trunks and can interface with a PBX or other transmission equipment. The *SPQ454* channel unit is a single-circuit unit that is functionally equivalent to the AUA54B channel unit except for the channel unit pin-out. The channel unit is specifically designed to be compatible with only the *SLC*-2000 COT and RT MDS assembly backplane pin-outs. The AUA54( ) channel unit should be used for *SLC*-2000 MSDT and DDM-2000 FiberReach NBS applications.

The *SPQ454* 4-wire channel unit can be used in circuits requiring E&M or pulse link repeater (PLR) type signaling to provide a tie trunk interface to a PBX or a back-to-back carrier arrangement with an interexchange carrier. In tie trunk applications, the E&M function provides the normal tie trunk interface. The PLR function provides the inverted E&M signaling interface required by certain terminal equipment as specified by Part 68 of the FCC Rules. The signaling leads can be connected over a single lead (Type I) or with a looped connection (Type II).

The *SPQ454* channel unit may interface with a PBX, automatic call distributor (ACD), or other transmission or signaling equipment located in the same building.

The *SPQ454* channel unit provides the following functions:

- **4E&M:** The E&M function is used in PBX tie trunks to provide the E&M signaling interface. It converts the DC signal from the PBX M lead into pulse code modulation (PCM) signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the E lead.
- **PLR:** The primary application of the PLR function is in PBX tie trunks. It provides the E&M signaling interface with inverted polarity. The channel unit converts the DC signal from the PBX E lead into PCM signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the M lead.

The *SPQ454* channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches. Instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (E&M or PLR) on the channel unit are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS.

The *SPQ454* channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The *SPQ454* channel unit provides the following features/functions:

- Four-wire special services
  - PBX tie trunk interface with E&M or PLR signaling
  - Interchange carrier interface with E&M or PLR signaling
- Provisionable transmission treatment
- Can be used in an INA configuration
- Inventory information (for example, *CLEI* code, date of manufacture, etc.).

The *SPQ454* channel unit is functionally equivalent to the *AUA54* channel unit.

Details for the *SPQ454* channel unit are described in 363-205-386 data sheet. The guidelines given in 915-710-116 for selecting option setting, applications, and compatibility for the *AUA54* channel unit should be used for the *SPQ454* channel unit.

### **AUA54( ) 4-Wire E&M Channel Unit for the MSDT/NBS**

**Data Sheet :** 363-005-113

The *AUA54( )* 4-wire channel unit is intended for use in private branch exchange (PBX) tie trunks and can interface with a PBX or other transmission equipment. The *AUA54( )* channel unit is used only in customer premises applications of *SLC-2000* MSDT and *DDM-2000* FiberReach NBS. The *SPQ454* unit should be used for RT or COT applications. The *AUA54( )* 4-wire channel unit can be used in circuits requiring E&M or pulse link repeater (PLR) type signaling to provide a tie trunk interface to a PBX or a back-to-back carrier arrangement with an interexchange carrier. In tie trunk applications, the E&M function provides the normal tie trunk interface. The PLR function provides the inverted E&M signaling interface required by certain terminal equipment as specified by Part 68 of the FCC Rules. The signaling leads can be connected over a single lead (Type I) or with a looped connection (Type II).

The *AUA54( )* channel unit may interface with a PBX, automatic call distributor (ACD), or other transmission or signaling equipment located in the same building.

The AUA54( ) channel unit provides the following functions:

- **4E&M:** The E&M function is used in PBX tie trunks to provide the E&M signaling interface. It converts the DC signal from the PBX M lead into pulse code modulation (PCM) signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the E lead.
- **PLR:** The primary application of the PLR function is in PBX tie trunks. It provides the E&M signaling interface with inverted polarity. The channel unit converts the DC signal from the PBX E lead into PCM signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the M lead.

The AUA54( ) channel unit has transmission and signaling options that must be set before service can be provided. The channel unit does not have physical switches. Instead, option information is written into memory registers located on the channel unit. All transmission and signaling options and the function type (E&M or PLR) on the unit are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS.

The AUA54( ) channel unit provides the following features/functions:

- Four-wire special services
  - PBX tie trunk interface with E&M or PLR signaling
  - Interchange carrier interface with E&M or PLR signaling
- Provisionable transmission treatment
- Can be used in an INA configuration.

Details for the AUA54( ) channel unit are described in 363-205-113 data sheet. Document 915-710-116 provides guidelines for selecting option settings for the AUA54 channel unit, describes the various applications for the unit, and provides channel unit compatibility information.

## **Digital Data Services**

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### **Private Line Data Services**

#### **SPQ452 Dual OCU Dataport**

**Data Sheet :** 363-005-341

The SPQ452 dual OCU dataport is primarily used in an end-link of a digital data system (DDS) private line data service. The end-link is the part of the service between a customer and the local central office. It may also be used to provide local data service. This OCU dataport supplies the proper sealing current to the T/R and T1/R1 leads when the external load is less than 5400 ohms, and provides a high fault tolerance if a power line accidentally comes in contact with the metallic leads of the channel unit.

The *SPQ452* channel unit stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its 10 character *COMMON LANGUAGE CLEI* code.

Except where indicated, the *SPQ452* channel unit is backward compatible with all of the following features and functions of the AUA52, AUA152, and AUA52B OCUs:

- Selectable customer data rates of 2.4, 4.8, 9.6, 19.2<sup>\*</sup>, 56, or 64<sup>\*</sup> kb/s
- Error correction (majority vote, 19.2 single time slot<sup>\*</sup>, or second channel error correction)
- All-zero-code allowed
- Secondary channel (a low-speed telemetry channel added to the customer data bits)
- Sealing current
- Higher fault tolerance if a power line accidentally comes in contact with the metallic leads of the channel unit<sup>†</sup>
- Compatible with INA configuration
- Faceplate indicator operates by flashing when loopback is activated
- Faceplate-controlled local loopback occurring at the pulse code modulation (PCM) bit stream<sup>\*</sup>
- Four-wire bridging access faceplate jack that is compatible with channel service unit (CSU) and data service unit (DSU) operation<sup>\*</sup>.

The *SPQ452* OCU dataport is an enhanced version of the AUA52B OCU. It adds the following features and functions:

- A second OCU dataport
- Selectable customer primary data rate of 38.4 kb/s

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\* Backward compatible with the AUA52B only.

† Backward compatible with the AUA152 and AUA52B OCUs only.

- Four-wire switched 56-kb/s (4W SW56) service option compatible with the following AT&T and *US Sprint*<sup>\*</sup> SW56 service:
  - Standard 4W SW56 service option compatible with AT&T *ACCUNET*<sup>†</sup> Switched 56 and Sprint 56 of US Sprint SW56 service
  - Enhanced SW56 (ESW56) service option compatible with US Sprint SW56 as specified in US Sprint Technical Specification TS-0046
  - 4W SW56 A/B signaling option for frame-aligned SW56 configurations
- Quality monitoring (QMON) of the customer loop.

This OCU dataport provides two channels of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire customer loop and the digital line PCM bit stream. The customer digital data rate may be 2.4-, 4.8-, 9.6-, and 19.2-kb/s subrates, and 38.4-, 56-, and 64-kb/s full rates.

The *SPQ452* OCU dataport transmits and receives a bipolar return-to-zero (RZ) signal on the 4-wire loop. The maximum cable loss is 45 dB measured at a frequency equal to one-half of the primary data rate.

The line drivers and receivers present a balanced 135 ohm impedance across the signal frequency range.

The *SPQ452* offers the following options:

- **Error Correction Methods:** There are three error correction methods:
  - Majority vote (MVEC)
  - 19.2 kbs single timeslot (19.2 EC)
  - Second channel (SCEC).

The appropriate method depends on the customer data rate provided. All error correction methods ensure a  $10^{-8}$  error-rate performance for a  $10^{-3}$  error-rate facility. It provides an all-zero-code option to guarantee a sufficient ones density on the DS1 facility.

- **Secondary Channel Option:** When selected, this option provides to the end-user a low-speed telemetry channel. This option is available with all data rates except 64 kbs.
- **SW56 Service Option:** This includes an enhanced SW56 service option, an A/B signaling option for frame-aligned SW56 configurations, and a quality monitoring option for the customer's loop. For SW56 applications, it provides SW56 operation that can be used by local exchange carriers (LEC) to offer dedicated digital access to inter-exchange carriers (IXC) and

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\* Registered trademark of US Sprint Communications Company Limited.

† Service mark of AT&T.



SW56 digital data services such as AT&T *ACCUNET* Switched 56 and Sprint 56 of US Sprint. In SW56 applications, the OCU allows dialing by the 4-wire digital data circuit using control mode idle (CMI) signaling in accordance with AT&T PUB42458. The unit decodes signaling from the network and passes this to the loop as either CMI (idle) or DATA mode (call active). The signaling between the OCU and the network is wink-start, A-bit signaling (an in-bank signaling technique that is the default method of decoding signaling from the network. In-band signaling allows SW56 service over circuit configurations that contain tandemed DS0 dataports. The OCU also provides an AB signaling option for circuit configurations not supporting clear channel nor tandemed DS0 dataports (this signaling option is also referred to as hardware signaling).

When this OCU is used in a *SLC-2000* system, you enter all functions through the CIT provisioning dialog or using the X.25 interface to an OSS.

For details of this channel unit, see 363-005-341. Document 915-710-116 provides guidelines for selecting option settings for the channel unit, describes the various applications of this unit, and provides channel unit compatibility information.

### **AUA252(B) OCU Dataport**

**Data Sheet :** 363-005-212

The AUA252(B) OCU dataport is used primarily in an end-link of a 4-wire, private line, Digital Data System (DDS) circuit or a 4-wire switched 56-kb/s circuit. The end-link is the part of the circuit between the RT or ONU and the customer. The AUA252(B) OCU may also be used to provide local data service.

The AUA252B OCU dataport does provide an inventory record.

The AUA252(B) OCU is an enhanced version of the AUA52B and is backward compatible with all the AUA52, AUA152, and AUA52B OCU features/functions as follows:

- Selectable customer primary data rates of 2.4, 4.8, 9.6, 19.2\*, and 56 kb/s and 64-kb/s clear channel\*
- Error correction (majority vote, 19.2 single time slot\*, or second channel error correction)
- Zero code suppression
- Secondary channel at primary data rates of 2.4, 4.8, 9.6, 19.2\*, and 56 kb/s
- Sealing current

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\* AUA252(B) and AUA52B OCUs only.

- Higher tolerance to power line faults across the metallic transmit and receive pairs\*
- Can be used in an INA configuration
- Faceplate indicators for 19.2-kb/s operation and loopback activation\*
- Four-wire bridging access faceplate jack, compatible with channel service unit (CSU) and data service unit (DSU) operation\*
- Faceplate controlled local loopback occurring at the pulse code modulated (PCM) bit stream\*.

The AUA252(B) OCU provides additional features/functions as follows:

- Selectable customer primary data rate of 38.4 kb/s
- Secondary channel option at 38.4 kb/s
- Four-wire switched 56-kb/s (4W SW56) service option:
  - Standard 4W SW56 service option compatible with AT&T and MCI SW56 service
  - Enhanced (ENH) 4W SW56 service option compatible with Sprint SW56 as specified in *US Sprint Technical Specification*, Issue 4, April 1989
  - 4W SW56 A/B signaling option for frame-aligned SW56 configurations
- QMON option that provides quality monitoring of the customer loop
- Faceplate indicators for 38.4 kb/s, SW56, and QMON operation (QMON indicator flashes when the OCU is looped back).

The AUA252(B) OCU provides one channel of service and serves as the interface between full-duplex synchronous digital data on a 4-wire customer loop and the PCM bit stream. The digital rate may be 2.4, 4.8, 9.6, or 19.2 kb/s (called subrates), or 38.4, 56, or 64 kb/s (called full rates). The AUA252(B) channel unit transmits and receives a bipolar return-to-zero (RZ) signal on the 4-wire loop. The maximum cable loss that can be tolerated is 45 dB measured at a frequency equal to one-half the customer's primary data rate. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range. The AUA252(B) OCU supplies the proper sealing current to the T/R and T1/R1 leads when the external load (loop and termination) is less than 5400 ohms.

The channel unit offers many options. There are seven selectable data rates (2.4, 4.8, 9.6, 19.2, 38.4, 56 kb/s, or 64-kb/s clear channel). Three error correction methods are provided (majority vote, 19.2 single time slot, and second channel). The appropriate method of error correction depends on the customer data rate. All error correction methods ensure a  $10^{-6}$  error-rate performance for a  $10^{-3}$  error rate facility. The AUA252(B) OCU provides a zero-code suppression option to

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\* AUA52B and AUA152 OCUs only.

guarantee a sufficient ones density on the DS1 facility. The secondary channel option, when selected, provides a low-speed telemetry channel to the customer. The AUA252(B) channel unit also provides an SW56 service option, an ENH SW56 service option, an A/B signaling option for frame-aligned SW56 configurations, and a quality monitoring option for the customer's loop.

The AUA252(B) channel unit has options that must be set before service can be provided. The AUA252(B) OCU has physical switches that may be set and option information that is written into memory registers located on the channel unit. The option settings depend on the location of the channel unit.

When the AUA252(B) OCU is used in the metallic distribution shelf at a *SLC-2000* COT or RT, the 19.2 and 64 CLEAR switches on the channel unit are ignored. These options and the other OCU functions must be entered through the craft interface terminal provisioning dialog or via the X.25 interface to an OSS. The 38.4, SW56, ENH SW56, A/B signaling, and QMON options are selected only with the physical option switches located on the channel unit.

When the AUA252(B) OCU is used in the *SLC-2000* MSDT for fiber distribution, the 19.2, 38.4, 64 CLEAR, SW56, ENH SW56, A/B signaling, and QMON options are selected only with the physical option switches located on the channel unit.

Details for the AUA252(B) channel unit are described in the 363-005-212 data sheet. The guidelines given in 915-710-116 for selecting option setting, applications, and compatibility for the AUA52B OCU should be used for the AUA252B OCU dataport.

### **SPQ334 Dual DS0 Dataport (COT Release 3.3 or Later)**

**Data Sheet:** 363-005-332

The *SPQ334* dual DS0 dataport channel unit (CU) is primarily used in the end-link of a digital data system (DDS) private line data service. An end-link is the part of the service between a customer and the local central office. For both DDS and switched 56-kb/s (SW56) applications, the *SPQ334* dual DS0 DP CU is located in the *SLC-2000* Access System central office terminal (COT).

This channel unit includes the following features and functions:

- Two fully functional DS0 dataports per channel card
- 2.4-, 4.8-, 9.6-, 19.2-, 38.4-, 56-, and 64-kb/s primary data rates
- Error correction using MVEC, SCEC, and 19.2-kb/s EC
- Zero code suppression
- Operates in *SLC-2000* COT release R3.3 and later
- Enhanced Inventory
- AB signaling option
- Four-wire switched 56-kb/s (SW56) service capability

- FAIL faceplate indicator (flashes when loopback is active)
- Four-wire bridging access faceplate jack, which also supplies the clock sources necessary to drive DDS-type test sets.

The *SPQ334* dual DS0 DP channel unit provides two channels of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire (4W) tip/ring side of the unit and the pulse code modulation (PCM) bitstream. The digital rate may be 2.4-, 4.8-, 9.6-, or 19.2-kb/s substrates, or 38.4-, 56-, or 64-kb/s full rates. All customer data, even when less than 64kb/s, are embedded in the 64 kb/s bitstream. The unit transmits and receives a bipolar return-to-zero signal on the 4-wire tip/ring interface. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.

For most applications, the 4-wire tip/ring side of the channel unit will face another DS0 dataport channel unit in an interoffice carrier system which connects the DDS end-link to a DDS hub office. The DS0 signal at the T&R interface has a range limitation of 1500 feet because of timing constraints.

The *SPQ334* dual DS0 DP channel unit provides latching loopback capability for fault isolation and DDS-type testing. Splitting test access to the metallic leads is available through the *SLC-2000* user interface panel (UIP).

You can use the *SPQ334* channel unit for the following applications:

- **DDS:** This application provides seven selectable data rates: 2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 (CLEAR) kb/s. It also provides an error correction option to avoid the need to qualify the T-carrier facility for DDS services. There are three error correction methods. The appropriate method depends on the customer data rate. All error correction methods ensure a  $10^{-8}$  error-rate performance for a  $10^{-3}$  error rate facility. The unit provides a zero-code option to guarantee a sufficient ones density on the T-carrier facility.
- **SW56:** Local exchange carriers (LEC) use this application to offer dedicated digital access to interexchange carriers (IXC) and SW56 digital data services, such as AT&T *ACCUNET* Switched 56 service and Sprint 56 of US Sprint. The functions needed in this channel unit located in the COT are dependent on the Switched 56 operating mode provisioned in the OCU DP located in the RT. SW56 provides the following signaling options:
  - **When the OCU DP located in the RT is configured for switched 56 operation and inband signaling,** no special features are required in this channel unit located at the COT. In this case, the *SPQ334* should be set for Switched 56 but not AB signaling (enable SW56 but not ABSIG). Provisioned this way, the *SPQ334* DS0 DP will function as if set for standard 56-kb/s operation with SCEC disabled. When employed, this inband signaling technique allows SW56 service to be provided over circuit configurations that contain tandemed digital signal zero (DS0) dataport units.

- **When the OCU DP located in the RT is configured for switched 56 operation with AB signaling**, you must provision the tandem *SPQ334* DS0 DP at the COT with switched 56 as well as AB signaling (enable SW56 and ABSIG) to enable the signaling information to be transferred between the tandem DS0 DPs. This signaling is known as *hardware signaling* and is not used under most configurations. When this option is enabled, signaling is decoded from the COT backplane. Since this requires that the A & B signaling bits be in frames 6 and 12, respectively, of the incoming DS1 signal, it is not possible to tandem a circuit through standard DS0 DP channel units when this type of signaling is used.

**Exception:** There is one exception to this restriction. When an ADTRAN digital terminal data module (DTDM) D4-type DS0 DP is used in the D4 bank, the AB signaling option can be used.

The *SPQ334* dual DS0 DP supports both latching and nonlatching DDS loopbacks for DDS-type testing. Nonlatching loopbacks are disabled when the 64-k/s data rate is selected. The channel unit provides test access to the metallic test busses. Test access is available through the UIP.

For all applications of the *SPQ334* dual DS0 DP channel unit, the *SLC-2000* Access System must be synchronized to the DDS composite clock. For universal configurations, the interface to the DDS clock is the *SLC -2000* BDK260 system timing unit, which is installed in the COT.

The *SPQ334* dual DS0 DP channel unit has options that you must set before service can be provided. These options may only be set electronically.

## **AUA52B OCU Dataport**

**Data Sheet :** 363-005-111

The AUA52B OCU dataport is primarily used in an end-link of a Digital Data System private line data service. The end-link is the part of the service between a customer and the local central office. The AUA52B OCU may also be used to provide local data service. The AUA52B OCU supplies the proper sealing current to the T/R and T1/R1 leads when the external load is less than 4050 ohms. The AUA52B OCU provides an extra level of power line fault protection. This feature provides a higher fault tolerance (than the AUA52 provides) when a power line is accidentally connected across the metallic leads of the AUA52B channel unit.

The AUA52B OCU dataport stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

The AUA52B OCU is backward compatible with all the features/functions of the AUA52 and AUA152 OCUs as follows:

- Selectable customer data rates of 2.4, 4.8, 9.6, or 56 kb/s
- Error correction (majority vote or second channel)

- All-zero-code allowed
- Secondary channel (a low-speed telemetry channel added to the customer data bits)
- Sealing current
- Higher fault tolerance to power lines accidentally connected across the metallic leads (AUA152 OCU only)
- Can be used in an INA configuration.

The AUA52B OCU is an enhanced version of the AUA52 OCU, with the following additional features/functions:

- 19.2-kb/s data rate
- Single channel error correction for 19.2-kb/s rate
- 64-kb/s clear channel capability
- Dual-function faceplate indicator (19.2-kb/s operation [steady light] or loopback activated [flashing light])
- Faceplate-controlled local loopback occurring at the pulse code modulation (PCM) bit stream
- Four-wire bridging access faceplate jack, compatible with channel service unit (CSU) and data service unit (DSU) operation
- Higher fault tolerance to power lines accidentally connected across the metallic leads
- Inventory information (for example, *CLEI* code, date of manufacture, etc.).

The AUA52B OCU provides one channel of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire customer loop and the PCM bit stream. The digital rate may be 2.4, 4.8, 9.6, or 19.2 kb/s (called subrates), or 56 or 64 kb/s (called full rates). The OCU dataport transmits and receives a bipolar return-to-zero (RZ) signal on the 4-wire loop. The maximum cable loss that can be tolerated is 34 dB measured at a frequency equal to one-half the customer's primary data rate. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.

The AUA52B channel unit offers several options. There are three error correction methods provided (majority vote, single channel, and second channel) — the appropriate method depends on the customer data rate. All error correction methods ensure a  $10^{-8}$  error-rate performance for a  $10^{-3}$  error-rate facility. The channel unit provides a zero-code option to guarantee a sufficient ones density on the T-facility. A secondary channel option, when selected, provides to the end-user a low-speed telemetry channel.

The AUA52B channel unit has options that must be set before service can be provided. The channel unit has physical switches and option information that is written into memory registers located on the channel unit. The option settings depend on the location of the channel unit and the *SLC-2000 RT* software release (see Note).



**NOTE:**

**Release 4.1 and earlier:** When using this channel unit at an ONU hosted by a *SLC-2000 HDT*, you must set the AUA52B physical option switches in conjunction with CIT or X.25 provisioning dialogs to enable some services.

**Release 4.2 and later:** When using this channel unit at an ONU hosted by a *SLC-2000 HDT*, you may ignore the physical option switches.

When the AUA52B OCU is used in the *SLC-2000 MSDT* or *DDM-2000 FiberReach NBS* (see previous Note) for FITL distribution, the two switch options described below must be set to enable or disable the associated option. The switch options are as follows:

- **19.2 (Enable, Disable).** Setting the options for a data rate of 19.2 kb/s requires that the 19.2 option switch on the AUA52B OCU be set to the ENABLE position. This action overrides the subscriber data rate set by the CIT. Other CIT options are set as required. When enabling the 19.2 option, a green faceplate light-emitting diode (LED) lights to indicate the switch setting.
- **CC (Enable, Disable).** Provisioning the unit for 64-kb/s clear channel service requires setting the clear channel (CC) switch to the ENABLE position.

The remaining options must be set using the CIT as follows:

- Subscriber data rate — 64
- Error correction — SCEC, if second channel error correction is desired
- All zero code allowed — YES
- Secondary channel used — YES.

When the AUA52B OCU is used in the metallic distribution shelf at a COT, RT, or at an ONU for FITL distribution (see previous Note for ONU exception), the physical switches on the channel unit are ignored and all functions are entered through the CIT provisioning dialog or via the X.25 interface to an OSS.

Details for the AUA52B channel unit are described in the 363-005-111 data sheet. 915-710-116 provides guidelines for selecting option settings for the AUA52B channel unit, describes the various applications of this unit, and provides channel unit compatibility information.

## **AUA52 and AUA152 OCU Dataports**

**Data Sheets** : 363-005-111 and 363-005-302

The AUA52 and AUA152 office channel unit (OCU) dataports are intended primarily for use in an end-link of a Digital Data System private line data service. The end-link is the part of the service between a customer and the local central office. The AUA52 and AUA152 OCUs may also be used in a local data service. These OCUs supply the proper sealing current to the T/R and T1/R1 leads when the external load is less than 4050 ohms. The AUA52 OCU and the AUA152 OCU are functionally identical, but the AUA152 channel unit provides an extra level of power line fault protection. This feature provides a higher fault tolerance when a power line is accidentally connected across the metallic leads of the AUA152.

The AUA52 and AUA152 OCU dataports provide one channel of service and serve as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire customer loop and the digital line PCM bit stream. The customer data rate may be 2.4, 4.8, or 9.6 kb/s (called subrates) or 56 kb/s.

The OCU dataport transmits and receives a bipolar return-to-zero (RZ) signal on the 4-wire loop. The maximum cable loss that can be tolerated is 34 dB measured at a frequency equal to one-half the customer's primary data rate. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.

The channel unit offers several options. There are two error correction methods provided (majority vote or second channel) — the appropriate method depends on the customer data rate. All error correction methods ensure a  $10^{-8}$  error-rate performance for a  $10^{-3}$  error-rate facility. The OCU dataport provides a zero-code suppression option to guarantee a sufficient ones density on the T-facility. A secondary channel option, when selected, provides to the end-user a low-speed telemetry channel.

The AUA52/AUA152 channel unit has options that must be set before service can be provided. The channel unit does not have physical switches; instead, option information is written into memory registers located on the channel unit. All options for the OCU dataport are set by entering commands via the CIT provisioning dialog or X.25 interface to an OSS.

The AUA52/AUA152 OCU dataport provides the following features/functions:

- Selectable customer data rates of 2.4, 4.8, 9.6, or 56 kb/s
- Error correction (majority vote or second channel)
- All-zero-code allowed
- Secondary channel (a low-speed telemetry channel added to the customer's data bits)
- Sealing current



- Can be used in an INA configuration
- Higher fault tolerance to power lines accidentally connected across the metallic leads (AUA152 channel unit only).

Details for the AUA52 and AUA152 channel units are described in 363-005-111 and 363-005-302 data sheets, respectively. Document 915-710-116 provides guidelines for selecting option settings for the AUA52/AUA152 channel units, describes the various applications of the channel units, and provides channel unit compatibility information.

### **AUA34( ) DS0 Dataport**

**Data Sheet :** 363-005-104

The AUA34( ) digital signal zero (DS0) dataport (DP) channel unit is used in an end-link of a Digital Data System private line data service. An *end-link* is the part of the service between a customer and the local central office. The customer primary data rate can be 2.4, 4.8, 9.6 (subrates), or 56 kb/s (full rate) for the AUA34. In addition to these rates, the AUA34B supports 19.2 kb/s (subrate) and the 64-kb/s clear channel data rate. The AUA34( ) channel unit is always located in the COT.

The AUA34B DS0 dataport is backward compatible with all the features/functions of the AUA34, including the following:

- Selectable customer data rates of 2.4, 4.8, 9.6 (subrate DS0A), or 56 kb/s (full rate DS0B)
- Error correction (majority vote or second channel)
- All-zero-code allowed
- Can be used in an INA configuration.

The AUA34B channel unit is an enhanced version of the AUA34, with the following additional features/functions:

- Inventory information (for example, *CLEI* code, date of manufacture, etc.)
- 19.2-kb/s data rate capability (subrate DS0A)
- Single channel error correction for 19.2-kb/s rate
- 64-kb/s clear channel capability (full rate DS0B)
- Faceplate loopback status indicator
- Four-wire bridging access faceplate jack, which also supplies the clock sources necessary to drive DDS-type test sets.

The AUA34( ) channel unit provides one channel of service and serves as the interface between a synchronous DS0 64-kb/s bit stream (bipolar non-return-to-zero format) on the 4-wire tip/ring side of the unit and the digital line pulse code modulation (PCM) bit stream. The customer data, at a data rate less than or equal to 64 kb/s (AUA34B), is embedded in the 64-kb/s bit stream. For most

applications, the 4-wire tip/ring side of the channel unit will face another DS0 dataport channel unit in an interoffice carrier system, which connects the *SLC-2000* system DDS end-link to a DDS hub office. The DS0 signal at the tip and ring interface has a range limitation of 1,500 feet. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.

The AUA34( ) channel unit provides latching loopback capability for fault isolation and DDS-type testing.

There are three error correction methods (majority vote, single channel for 19.2 kb/s, and second channel) — the appropriate method depends on the customer data rate. All error correction methods ensure a  $10^{-8}$  error-rate performance for a  $10^{-3}$  error-rate facility. The unit also provides a zero-code option to guarantee a sufficient ones density on the T-facility.

For all applications of the AUA34( ) channel unit, the *SLC-2000* system must be synchronized to a DDS-type composite clock.

The AUA34( ) channel unit has options that must be set before service can be provided. All options for the channel unit are set by entering commands via the CIT provisioning dialog or the X.25 interface to an OSS. The physical switch on the AUA34B channel unit is ignored when the unit is used in a *SLC-2000* system.

The AUA34B channel unit stores in nonvolatile memory an inventory record (including its ten-character *CLEI* code) available for reading by a compatible OSS.

Details for the AUA34( ) channel unit are described in the 363-005-104 data sheet. Document 915-710-116 provides guidelines for selecting option settings for the AUA34( ) channel unit, describes the various applications for the channel unit, and provides channel unit compatibility information.

### **AUA200 Channel Unit—Switched 56-kb/s Data Service**

**Data Sheet :** 363-005-313

The AUA200 DPX channel unit is primarily used in a 2-wire end-link of a switched 56-kb/s digital data service. An end-link is the part of the service between a customer and the local central office. The AUA200 DPX is always located in the RT or ONU. The AUA200 DPX is end-to-end compatible with the AUA34( ) DS0 DP located at the *SLC-2000* COT or D4 DS0 DP in a *SLC 96* COT or D4 channel bank.

The AUA200 DPX provides the following features/functions:

- Switched 56-kb/s data operation over a single pair of wires
- Extends *Datapath*<sup>\*</sup> services from a Northern Telecom *DMS 100* or *DMS 10* central office switch

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\* Trademark of CAE Industries Ltd.

- Support for network connectivity to non-*Datapath* 4-wire switched 56-kb/s services
- Integrated *DMS* switch maintenance control
- Support for DDS alternating and latching loopbacks
- Can be used in an INA configuration
- Faceplate mounted status and test indicator
- Faceplate mounted self-test push button.

The AUA200 (DPX) channel unit provides an extension of the Northern Telecom *Datapath* switched 56-kb/s PSDN service offering. The loop interface and data protocols are compatible with the "*Datapath* Network Access Interface Specifications" as described in Bellcore TR-EOP-000277\*.

The AUA200 DPX channel unit is network compatible with the Northern Telecom *Datapath* service and digitally compatible with 4-wire switched 56-kb/s data services such as the AT&T *ACCUNET* digital service. The carrier line side DS0 interface is similar to the 56-kb/s DDS format except that the eighth bit (data/control) is used for call supervision. The unit provides a single subscriber circuit interface between the customer's *Datapath* data unit (DU) and the *SLC-2000* DS0 digital bit stream. The AUA200 DPX channel unit communicates with the customer-located DU via a 2-wire nonloaded loop interface.

The AUA200 DPX channel unit contains many options that are selected using switches on the channel unit.



**NOTE:**

There is no CIT access to the AUA200 channel unit.

Details for the AUA200 channel unit are described in the 363-005-313 data sheet. The data sheet provides guidelines for selecting option settings, describes the various applications for the channel unit, and provides channel unit compatibility information.

### **AUA232—DSU Dataport**

**Data Sheet :** 363-005-312

The AUA232 data service unit (DSU) dataport is primarily used in an end-link of a Digital Data System (DDS) private line data service. An end-link is the part of the service between a customer and the local central office. The AUA232 DSU dataport may also be used to provide local data service. For DDS applications, the AUA232 DSU dataport-equipped RT or ONU is always located on the

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\* Bellcore Technical Reference TR-EOP-000277, Issue 1, September 1985, ***Datapath*** Network Access Interface Specifications, Switched Network Compatibility and Performance Specifications for 2-Wire Connection to the Public Switched Digital Network.

customer's premises. For local data applications, the AUA232 channel unit may be used in the COT, RT, or ONU. The AUA232 DSU dataport is end-to-end compatible with another AUA232 channel unit, an AUA34( ) DS0 DP, *SPQ334* DS0 DP, an AUA52( ) OCU DP, an AUA252( ) OCU DP, an *SPQ452* OCU DP, or D4 dataport channel units in a *SLC 96* COT or D4 channel bank.

The AUA232 DSU dataport has the following features/functions:

- Asynchronous and synchronous data operation
- 1.2 (asynchronous only); 2.4-, 4.8-, 9.6-, 19.2-, and 56- (synchronous only) kb/s data rates
- Error correction, anti-streaming, RTS options
- RS-232 data terminal equipment (DTE) interface
- Can be used in an INA configuration
- Faceplate push button for local test activation
- Faceplate test result/loopback indicator
- Faceplate mounted RJ48 modular jack.

The AUA232 DSU dataport (DP) combines the function of an OCU-DP and a DSU/CSU. The DSU DP allows a DTE device access to the DDS network at rates up to 56 kb/s. It responds to network loopback commands received from the network for fault isolation or verification of T1 circuits. It has test capability for local use and a status LED for test/loopback information. Error correction is optional for all service rates. Asynchronous data operation is supported up to 19.2 k baud. Synchronous data operation is supported from 2.4 to 56 kb/s.

The AUA232( ) DSU DP presents a DDS interface to the network and an eight-wire EIA RS-232 interface to the customer. The AUA232 channel unit provides a single subscriber circuit interface between DTE and the *SLC-2000* digital bit stream.

The AUA232 channel unit contains many options that are selected using switches on the circuit pack.



**NOTE:**

There is no CIT access to the AUA232 channel unit.

Details for the AUA232 DSU DP are described in the 363-005-312 data sheet. The data sheet provides guidelines for selecting option settings, describes the various applications for the channel unit, and provides channel unit compatibility information.

See Chapter 8 for other applications.

## **Basic Rate Interface Transmission Extension and ISDN**

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### **T-Basic Rate Interface Transmission Extension (T-BRITE)**

#### **AUA90 T-BRITE**

**Data Sheet :** 363-005-106

The AUA90 channel unit provides basic rate ISDN service directly to terminal equipment over a 4-wire T-interface from the RT channel bank. It eliminates the need for a network termination (NT1) unit. The AUA90 T-BRITE supplies ISDN 2B+D service requiring three DS0 channels (two B channels and one D channel). It supports point-to-point and point-to-multipoint (switch-dependent) transmission applications.

The AUA90 is automatically programmed for operation at the COT or RT by the metallic distribution controller (MDC). It is always configured for 2B+D service and requires no option switch settings or provisioning through the craft interface terminal (CIT).

The AUA90 T-BRITE is supported only in TR-08 Mode 1 or INA RT or MSDT applications and in TR-08 Mode 1 COT applications. The AUA90 can be used in the COT or RT with no channel unit slot restrictions. In integrated applications or when used with a SLC 96 COT, the time slot allocation and restrictions for the RT and MSDT are listed in Table 4-3 and Table 4-4, respectively.

**Table 4-3. AUA90 T-BRITE in SLC<sup>®</sup>-2000 RT Provisioning and Time Slot Allocation (Note 1)**

| Physical Slot<br>(Note 2)<br>A, B, C, D<br>Digroups | Service | Universal Configuration<br>(AHG13 in SLC 96 COT) |               | Time Slots per TR-08<br>Digroup on the DS1<br>Feeder |
|-----------------------------------------------------|---------|--------------------------------------------------|---------------|------------------------------------------------------|
|                                                     |         | Physical Slot/Digroup                            | Mode Switches |                                                      |
| 1, 7, 13, 19                                        | 2B+D    | 1                                                | CC            | 1 (B1), 3 (D), 5 (B2)                                |
| 2, 8, 14, 20                                        | 2B+D    | 3                                                | CC            | 9 (B1), 11 (D), 13 (B2)                              |
| 3, 9, 15, 21                                        | 2B+D    | 5                                                | OO            | 19 (B1), 21 (D), 23 (B2)                             |
| 4, 10, 16, 22                                       | 2B+D    | 7                                                | CC            | 2 (B1), 4 (D), 6 (B2)                                |
| 5, 11, 17, 23                                       | 2B+D    | 9                                                | CC            | 10 (B1), 12 (D), 14 (B2)                             |
| 6, 12, 18, 24                                       | 2B+D    | 11                                               | OO            | 20 (B1), 22 (D), 24 (B2)                             |

**Notes:**

1. BRITE channel units are supported in TR-08 Mode 1 or INA only.
2. The first pair associated with the physical slot is the Transmit pair (toward the carrier). The second pair associated with the physical slot is the Receive pair.

**Table 4-4. AUA90 T-BRITE in SLC<sup>®</sup>-2000 MSDT Provisioning, Service Restrictions, and Time Slot Allocation (Note 1)**

| Physical Slot<br>in the MSDT<br>(Note 2 ) | Service       | Universal Configuration<br>(AHG13 in SLC 96 COT) |                  | Time Slots per TR-08<br>Digroup on the DS1<br>Feeder |
|-------------------------------------------|---------------|--------------------------------------------------|------------------|------------------------------------------------------|
|                                           |               | Physical Slot/<br>Digroup                        | Mode<br>Switches |                                                      |
| 1                                         | 2B+D          | 1                                                | CC               | 1 (B1), 3 (D), 5 (B2)                                |
| 2                                         | Not Supported |                                                  |                  |                                                      |
| 3                                         | 2B+D          | 5                                                | OO               | 19 (B1), 21 (D), 23 (B2)                             |
| 4                                         | 2B+D          | 7                                                | CC               | 2 (B1), 4 (D), 6 (B2)                                |
| 5                                         | Not Supported |                                                  |                  |                                                      |
| 6                                         | 2B+D          | 11                                               | OO               | 20 (B1), 22 (D), 24 (B2)                             |

**Notes:**

1. T-BRITE channel units are supported in TR-08 Mode 1 or INA only.
2. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair.

Table 4-5 and Table 4-6 show ISDN services and related physical drop AIDs used for cross-connections to INA digroups in the RT and MSDT/V-MSDT/V-DT, respectively. The following examples show how to use the tables:

- **Table 4-5 (RT):** To access the channel unit in shelf 1, slot 3, for the purpose of making the cross-connections to INA logical DS0s, the physical AIDs would be *drop-1-3-2*, *drop-1-3-3*, and *drop-1-3-4*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0s are determined by the placement and provisioning of the ISDN card in the D4 bank.
- **Table 4-6 (MSDT/V-MSDT/V-DT):** To access the channel unit in shelf 1, server 1, MSDT slot 3, for the purpose of making the cross-connections to INA logical DS0s, the physical AIDs would be *dtdp-1-1-3-2*, *dtdp-1-1-3-3*, and *dtdp-1-1-3-4*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0s are determined by the placement and provisioning of the ISDN card in the D4 bank.

Applications for the AUA90 channel unit are described in 363-205-106, *SLC Series 5 Carrier System, AUA90 T-BRITE Channel Unit for ISDN, Installation and Maintenance*.



**Table 4-5. AUA90 T-BRITE in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups**

| <b>SLC<sup>®</sup>-2000 RT Slot Number (Note 1)</b> | <b>Channels Used for ISDN Service</b> | <b>2B+D Service AIDs (Channels) (x=shelf # 1-8) (Note 2)</b> |
|-----------------------------------------------------|---------------------------------------|--------------------------------------------------------------|
| 1                                                   | 1<br>2<br>3                           | drop-x-1-1 (B1)<br>drop-x-1-2 (D)<br>drop-x-1-3 (B2)         |
| 2                                                   | 5<br>6<br>7                           | drop-x-2-1 (B1)<br>drop-x-2-2 (D)<br>drop-x-2-3 (B2)         |
| 3*                                                  | 10<br>11<br>12                        | drop-x-3-2 (B1)<br>drop-x-3-3 (D)<br>drop-x-3-4 (B2)         |
| 4                                                   | 13<br>14<br>15                        | drop-x-4-1 (B1)<br>drop-x-4-2 (D)<br>drop-x-4-3 (B2)         |
| 5                                                   | 17<br>18<br>19                        | drop-x-5-1 (B1)<br>drop-x-5-2 (D)<br>drop-x-5-3 (B2)         |
| 6*                                                  | 22<br>23<br>24                        | drop-x-6-2 (B1)<br>drop-x-6-3 (D)<br>drop-x-6-4 (B2)         |
| 7                                                   | 25<br>26<br>27                        | drop-x-7-1 (B1)<br>drop-x-7-2 (D)<br>drop-x-7-3 (B2)         |
| 8                                                   | 29<br>30<br>31                        | drop-x-8-1 (B1)<br>drop-x-8-2 (D)<br>drop-x-8-3 (B2)         |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

*Continued on next page*

**Table 4-5. AUA90 T-BRITE in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups (Continued)**

| <b>SLC-2000 RT Slot Number<br/>(Note 1)</b> | <b>Channels Used for ISDN Service</b> | <b>2B+D Service AIDs (Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> |
|---------------------------------------------|---------------------------------------|----------------------------------------------------------------------|
| 9*                                          | 34<br>35<br>36                        | drop-x-9-2 (B1)<br>drop-x-9-3 (D)<br>drop-x-9-4 (B2)                 |
| 10                                          | 37<br>38<br>39                        | drop-x-10-1 (B1)<br>drop-x-10-2 (D)<br>drop-x-10-3 (B2)              |
| 11                                          | 41<br>42<br>43                        | drop-x-11-1 (B1)<br>drop-x-11-2 (D)<br>drop-x-11-3 (B2)              |
| 12*                                         | 46<br>47<br>48                        | drop-x-12-2 (B1)<br>drop-x-12-3 (D)<br>drop-x-12-4 (B2)              |
| 13                                          | 49<br>50<br>51                        | drop-x-13-1 (B1)<br>drop-x-13-2 (D)<br>drop-x-13-3 (B2)              |
| 14                                          | 53<br>54<br>55                        | drop-x-14-1 (B1)<br>drop-x-14-2 (D)<br>drop-x-14-3 (B2)              |
| 15*                                         | 58<br>59<br>60                        | drop-x-15-2 (B1)<br>drop-x-15-3 (D)<br>drop-x-15-4 (B2)              |
| 16                                          | 61<br>62<br>63                        | drop-x-16-1 (B1)<br>drop-x-16-2 (D)<br>drop-x-16-3 (B2)              |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

*Continued on next page*

**Table 4-5. AUA90 T-BRITE in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups (Continued)**

| <b>SLC-2000 RT Slot Number (Note 1)</b> | <b>Channels Used for ISDN Service</b> | <b>2B+D Service AIDs (Channels) (x=shelf # 1-8) (Note 2)</b> |
|-----------------------------------------|---------------------------------------|--------------------------------------------------------------|
| 17                                      | 65<br>66<br>67                        | drop-x-17-1 (B1)<br>drop-x-17-2 (D)<br>drop-x-17-3 (B2)      |
| 18*                                     | 70<br>71<br>72                        | drop-x-18-2 (B1)<br>drop-x-18-3 (D)<br>drop-x-18-4 (B2)      |
| 19                                      | 73<br>74<br>75                        | drop-x-19-1 (B1)<br>drop-x-19-2 (D)<br>drop-x-19-3 (B2)      |
| 20                                      | 77<br>78<br>79                        | drop-x-20-1 (B1)<br>drop-x-20-2 (D)<br>drop-x-20-3 (B2)      |
| 21                                      | 82<br>83<br>84                        | drop-x-21-2 (B1)<br>drop-x-21-3 (D)<br>drop-x-21-4 (B2)      |
| 22                                      | 85<br>86<br>87                        | drop-x-22-1 (B1)<br>drop-x-22-2 (D)<br>drop-x-22-3 (B2)      |
| 23                                      | 89<br>90<br>91                        | drop-x-23-1 (B1)<br>drop-x-23-2 (D)<br>drop-x-23-3 (B2)      |
| 24                                      | 94<br>95<br>96                        | drop-x-24-2 (B1)<br>drop-x-24-3 (D)<br>drop-x-24-4 (B2)      |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair (from the carrier).
  2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).
- \* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

**Table 4-6. AUA90 T-BRITE in SLC-2000 MSDT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups**

| <b>SLC-2000 MSDT Slot Number (Note 1)</b> | <b>Channels Used for ISDN Service</b> | <b>2B+D Service AIDs (Channels) (x=shelf # 1-8) (y=server #) (Note 2)</b> |
|-------------------------------------------|---------------------------------------|---------------------------------------------------------------------------|
| 1                                         | 1<br>2<br>3                           | dt dp-x-y-1-1 (B1)<br>dt dp-x-y-1-2 (D)<br>dt dp-x-y-1-3 (B2)             |
| 2                                         | Not supported                         |                                                                           |
| 3*                                        | 10<br>11<br>12                        | dt dp-x-y-3-2 (B1)<br>dt dp-x-y-3-3 (D)<br>dt dp-x-y-3-4 (B2)             |
| 4                                         | 13<br>14<br>15                        | dt dp-x-y-4-1 (B1)<br>dt dp-x-y-4-2 (D)<br>dt dp-x-y-4-3 (B2)             |
| 5                                         | Not supported                         |                                                                           |
| 6*                                        | 22<br>23<br>24                        | dt dp-x-y-6-2 (B1)<br>dt dp-x-y-6-3 (D)<br>dt dp-x-y-6-4 (B2)             |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows::  
dt dp-shelf#(1-8)server#(1,3,5,7,13,15,17,19)-slot#(1-6)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

## Basic Rate Interface Transmission Extension II (BRITE II)

### AUA92 BRITE II

**Data Sheet :** 363-005-130

The AUA92 channel unit provides one circuit of second generation basic rate ISDN service using *ANSI*\* standard LT-mode U-interface for full duplex transmission. The U-interface 2 binary 1 quaternary (2B1Q) signal provides a four-level line coding format at a data rate of 160 kb/s (80 k baud). Each AUA92 occupies one physical slot in a COT channel bank and uses up to three DS0 time slots depending on service selection (2B+D, B1+D, B2+D, or D-only). Service selection is provisioned with the **ENT - T0** command from the CIT. In the COT bank, an AUA92 may be used in any channel unit slot.

The AUA92 BRITE II channel unit is supported only in TR-08 Mode 1 COT. The corresponding RT or ONU channel unit is the AUA93 channel unit.

## Basic Rate Interface Transmission Extension II

### AUA93 BRITE II

**Data Sheet :** 363-005-131

The AUA93 channel unit provides second generation basic rate ISDN service using *ANSI* standard LT-mode U-interface for full duplex transmission. The U-interface 2 binary 1 quaternary (2B1Q) signal provides a four-level line coding format at a data rate of 160 kb/s (80 k baud). Each AUA93 occupies one physical slot in an RT channel bank or MSDT and uses up to three DS0 time slots depending on service selection (2B+D, B1+D, B2+D, or D-only). Service selection for RT or ONU applications (see Note) is provisioned with the **ENT - T0** command from the CIT (the switches on the channel unit are ignored). In ONU applications (see Note), service selection is provisioned using the on-board channel unit switches.



**NOTE:**

When the host digital terminal (HDT) is hosting an ONU, provision the channel unit as follows depending on the *SLC-2000* software release:

**Release 4.1 and earlier:** Provision the service selection using the physical option switches.

**Release 4.2 and later:** Provision the service selection using the **ENT - T0** command from the CIT. Ignore the AUA93's physical option switches.

The AUA93 BRITE II is supported in TR-08 Mode 1 or INA only in RT or MSDT shelves. The AUA93 can be used in the RT or MSDT with no *channel unit* slot

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\* Registered trademark of American National Standards Institute, Inc.

restrictions. Time slot allocation and restrictions for the RT and MSDT are listed in Table 4-7 and Table 4-8, respectively.

**Table 4-7. AUA93/AUA293 BRITE II in SLC<sup>®</sup>-2000 RT Provisioning, Service Restrictions, and Time Slot Allocation (Note 1)**

| Physical Slot<br>Slot A, B, C, D<br>Digroups | Service<br>(Note 2) | Universal Configuration<br>(AHG18 in SLC 96 COT) |                | Time Slots per TR-08<br>Digroup on the DS1<br>Feeder |
|----------------------------------------------|---------------------|--------------------------------------------------|----------------|------------------------------------------------------|
|                                              |                     | Physical Slot/Digroup                            | Switch S1, 1-4 |                                                      |
| 1, 7, 13, 19                                 | D-Only              | 1                                                | OC CC          | 1 (D)                                                |
|                                              | B1+D                |                                                  | OC CO          | 1 (B1), 3 (D)                                        |
|                                              | B2+D                |                                                  | OC OC          | 1 (B2), 3 (D)                                        |
|                                              | 2B+D                |                                                  | OC OO          | 1 (B1), 3 (D), 5 (B2)                                |
| 2, 8, 14, 20                                 | D-Only              | 3                                                | OC CC          | 9 (D)                                                |
|                                              | B1+D                |                                                  | OC CO          | 9 (B1), 11 (D)                                       |
|                                              | B2+D                |                                                  | OC OC          | 9 (B2), 11 (D)                                       |
|                                              | 2B+D                |                                                  | OC OO          | 9 (B1), 11 (D), 13 (B2)                              |
| 3, 9, 15, 21                                 | D-Only              | 5                                                | OC CC          | 17 (D)                                               |
|                                              | B1+D                |                                                  | OC CO          | 17 (B1), 19 (D)                                      |
|                                              | B2+D                |                                                  | OC OC          | 17 (B2), 19 (D)                                      |
|                                              | 2B+D                |                                                  | OO OO          | 19 (B1), 21 (D), 23 (B2)                             |
| 4, 10, 16, 22                                | D-Only              | 7                                                | OC CC          | 2 (D)                                                |
|                                              | B1+D                |                                                  | OC CO          | 2 (B1), 4 (D)                                        |
|                                              | B2+D                |                                                  | OC OC          | 2 (B2), 4 (D)                                        |
|                                              | 2B+D                |                                                  | OC OO          | 2 (B1), 4 (D), 6 (B2)                                |
| 5, 11, 17, 23                                | D-Only              | 9                                                | OC CC          | 10 (D)                                               |
|                                              | B1+D                |                                                  | OC CO          | 10 (B1), 12 (D)                                      |
|                                              | B2+D                |                                                  | OC OC          | 10 (B2), 12 (D)                                      |
|                                              | 2B+D                |                                                  | OC OO          | 10 (B1), 12 (D), 14 (B2)                             |
| 6, 12, 18, 24                                | D-Only              | 11                                               | OC CC          | 18 (D)                                               |
|                                              | B1+D                |                                                  | OC CO          | 18 (B1), 20 (D)                                      |
|                                              | B2+D                |                                                  | OC OC          | 18 (B2), 20 (D)                                      |
|                                              | 2B+D                |                                                  | OO OO          | 20 (B1), 22 (D), 24 (B2)                             |

**Notes:**

1. BRITE II channel units are supported in TR-08 Mode 1 and INA only.
2. Service choices for the AUA93/AUA293 BRITE II channel unit in a SLC<sup>®</sup>-2000 Access System remote terminal are provisioned using the craft interface terminal (CIT). The switches on the channel unit are ignored.

**Table 4-8. AUA93/AUA293 BRITE II in SLC®-2000 MSDT/V-MSDT/V-DT, Provisioning, Service Restrictions, and Time Slot Allocation (Notes 1 and 4)**

| AUA93/AUA293<br>Physical Slot in<br>MSDT/V-MSDT/<br>V-DT (Notes 2<br>and 3) | Service<br>(Note 4) | Universal Configuration<br>(AHG18 in SLC 96 COT) |                | Time Slots per TR-08<br>Digroup on the DS1<br>Feeder |
|-----------------------------------------------------------------------------|---------------------|--------------------------------------------------|----------------|------------------------------------------------------|
|                                                                             |                     | Physical Slot/Digroup                            | Switch S1, 1-4 |                                                      |
| 1                                                                           | D-Only              | 1                                                | OC CC          | 1 (D)                                                |
|                                                                             | B1+D                |                                                  | OC CO          | 1 (B1), 3 (D)                                        |
|                                                                             | B2+D                |                                                  | OC OC          | 1, 3 (D)                                             |
|                                                                             | 2B+D                |                                                  | OC OO          | 1 (B1), 3 (D), 5                                     |
| 2                                                                           | D-Only              | 3                                                | OC CC          | 9 (D)                                                |
|                                                                             | B1+D                |                                                  | OC CO          | 9 (B1), 11 (D)                                       |
|                                                                             | B2+D                |                                                  | OC OC          | 9 (B2), 11 (D)                                       |
|                                                                             | 2B+D                |                                                  | Not Supported  |                                                      |
| 3                                                                           | D-Only              | 5                                                | OC CC          | 17 (D)                                               |
|                                                                             | B1+D                |                                                  | OC CO          | 17 (B1), 19 (D)                                      |
|                                                                             | B2+D                |                                                  | OC OC          | 17 (B2), 19 (D)                                      |
|                                                                             | 2B+D                |                                                  | OO OO          | 19 (B1), 21 (D), 23 (B2)                             |
| 4                                                                           | D-Only              | 7                                                | OC CC          | 2 (D)                                                |
|                                                                             | B1+D                |                                                  | OC CO          | 2 (B1), 4 (D)                                        |
|                                                                             | B2+D                |                                                  | OC OC          | 2 (B2), 4 (D)                                        |
|                                                                             | 2B+D                |                                                  | OC OO          | 2 (B1), 4 (D), 6 (B2)                                |

*Continued on next page*

**Table 4-8. AUA93/AUA293 BRITE II in SLC®-2000 MSDT/V-MSDT/V-DT, Provisioning, Service Restrictions, and Time Slot Allocation (Notes 1 and 4) (Continued)**

| AUA93/AUA293<br>Physical Slot in<br>MSDT/V-MSDT/<br>V-DT (Notes 2<br>and 3) | Service<br>(Note 4) | Universal Configuration<br>(AHG18 in SLC 96 COT) |                | Time Slots per TR-08<br>Digroup on the DS1<br>Feeder |
|-----------------------------------------------------------------------------|---------------------|--------------------------------------------------|----------------|------------------------------------------------------|
|                                                                             |                     | Physical Slot/<br>Digroup                        | Switch S1, 1-4 |                                                      |
| 5                                                                           | D-Only              | 9                                                | OC CC          | 10 (D)                                               |
|                                                                             | B1+D                |                                                  | OC CO          | 10 (B1), 12 (D)                                      |
|                                                                             | B2+D                |                                                  | OC OC          | 10 (B2), 12 (D)                                      |
|                                                                             | 2B+D                |                                                  | Not Supported  |                                                      |
| 6                                                                           | D-Only              | 11                                               | OC CC          | 18 (D)                                               |
|                                                                             | B1+D                |                                                  | OC CO          | 18 (B1), 20 (D)                                      |
|                                                                             | B2+D                |                                                  | OC OC          | 18 (B2), 20 (D)                                      |
|                                                                             | 2B+D                |                                                  | OO OO          | 20 (B1), 22 (D), 24 (B2),                            |

**Notes:**

1. BRITE II channel units are supported in TR-08 Mode 1 and INA only.
2. The 24-line MSDT/V-MSDT/V-DT is shown. For a 12-line MSDT/V-MSDT, use Slots 1, 2, and 3.
3. For a definition of V-MSDT/V-DT, see Chapter 3.
4. When the HDT is hosting an ONU, provision the channel unit as follows depending on the SLC-2000 software release:  
**Release 4.1 and earlier:** Provision the service selection using the physical option switches.  
**Release 4.2 and later:** Provision the service selection using the ent - t0 command from the CIT. Ignore the AUA93/AUA293's physical option switches.

Table 4-9 and Table 4-10 show ISDN services and related physical drop AIDs used for cross-connections to INA digroups in the RT and MSDT/V-MSDT/V-DT, respectively. The following examples show how to use the tables:

- **Table 4-9 (RT):** To access the channel unit in shelf 5, slot 7, for the purpose of making D-only cross-connections to INA logical DS0s, the physical AIDs would be *drop-5-7-1*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0 is determined by the placement and provisioning of the ISDN card in the D4 bank.
- **Table 4-10 (MSDT/V-MSDT/V-DT):** To access the channel unit in shelf 1, server 1, MSDT slot 3, for the purpose of making the cross-connections to INA logical DS0s, the physical AIDs would be *dt dp-1-1-3-1*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0 is determined by the placement and provisioning of the ISDN card in the D4 bank.



Applications and prescription setting (provisioning) for the AUA93 channel unit are described in 363-205-107, *SLC Series 5 Carrier System, AUA93 BRITE II Channel Unit for ISDN, Installation and Maintenance*.

**Table 4-9. AUA93/AUA293 BRITE II in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups**

| <b>SLC-2000<br/>RT Slot<br/>Number<br/>(Note 1)</b> | <b>Channels<br/>Used for<br/>ISDN<br/>Service</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> | <b>Bn+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(n = 1 or 2)<br/>(Note 2)</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> |
|-----------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1                                                   | 1<br>2<br>3                                       | drop-x-1-1 (B1)<br>drop-x-1-2 (D)<br>drop-x-1-3 (B2)                         | drop-x-1-1 (Bn)<br>drop-x-1-2 (D)                                                             | drop-x-1-1 (D)                                                               |
| 2                                                   | 5<br>6<br>7                                       | drop-x-2-1 (B1)<br>drop-x-2-2 (D)<br>drop-x-2-3 (B2)                         | drop-x-2-1 (Bn)<br>drop-x-2-2 (D)                                                             | drop-x-2-1 (D)                                                               |
| 3*                                                  | 9<br>10<br>11<br>12                               | drop-x-3-2 (B1)<br>drop-x-3-3 (D)<br>drop-x-3-4 (B2)                         | drop-x-3-1 (Bn)<br>drop-x-3-2 (D)                                                             | drop-x-3-1 (D)                                                               |
| 4                                                   | 13<br>14<br>15                                    | drop-x-4-1 (B1)<br>drop-x-4-2 (D)<br>drop-x-4-3 (B2)                         | drop-x-4-1 (Bn)<br>drop-x-4-2 (D)                                                             | drop-x-4-1 (D)                                                               |
| 5                                                   | 17<br>18<br>19                                    | drop-x-5-1 (B1)<br>drop-x-5-2 (D)<br>drop-x-5-3 (B2)                         | drop-x-5-1 (Bn)<br>drop-x-5-2 (D)                                                             | drop-x-5-1 (D)                                                               |
| 6*                                                  | 21<br>22<br>23<br>24                              | drop-x-6-2 (B1)<br>drop-x-6-3 (D)<br>drop-x-6-4 (B2)                         | drop-x-6-1 (Bn)<br>drop-x-6-2 (D)                                                             | drop-x-6-1 (D)                                                               |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier). The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

*Continued on next page*

**Table 4-9. AUA93/AUA293 BRITE II in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups (Continued)**

| <b>SLC-2000<br/>RT Slot<br/>Number<br/>(Note 1)</b> | <b>Channels<br/>Used for<br/>ISDN<br/>Service</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> | <b>Bn+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(n = 1 or 2)<br/>(Note 2)</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> |
|-----------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 7                                                   | 25<br>26<br>27                                    | drop-x-7-1 (B1)<br>drop-x-7-2 (D)<br>drop-x-7-3 (B2)                         | drop-x-7-1 (Bn)<br>drop-x-7-2 (D)                                                             | drop-x-7-1 (D)                                                               |
| 8                                                   | 29<br>30<br>31                                    | drop-x-8-1 (B1)<br>drop-x-8-2 (D)<br>drop-x-8-3 (B2)                         | drop-x-8-1 (Bn)<br>drop-x-8-2 (D)                                                             | drop-x-8-1 (D)                                                               |
| 9*                                                  | 33<br>34<br>35<br>36                              | drop-x-9-2 (B1)<br>drop-x-9-3 (D)<br>drop-x-9-4 (B2)                         | drop-x-9-1 (Bn)<br>drop-x-9-2 (D)                                                             | drop-x-9-1 (D)                                                               |
| 10                                                  | 37<br>38<br>39                                    | drop-x-10-1 (B1)<br>drop-x-10-2 (D)<br>drop-x-10-3 (B2)                      | drop-x-10-1 (Bn)<br>drop-x-10-2 (D)                                                           | drop-x-10-1 (D)                                                              |
| 11                                                  | 41<br>42<br>43                                    | drop-x-11-1 (B1)<br>drop-x-11-2 (D)<br>drop-x-11-3 (B2)                      | drop-x-11-1 (Bn)<br>drop-x-11-2 (D)                                                           | drop-x-11-1 (D)                                                              |
| 12*                                                 | 45<br>46<br>47<br>48                              | drop-x-12-2 (B1)<br>drop-x-12-3 (D)<br>drop-x-12-4 (B2)                      | drop-x-12-1 (Bn)<br>drop-x-12-2 (D)                                                           | drop-x-12-1 (D)                                                              |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier). The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

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**Table 4-9. AUA93/AUA293 BRITE II in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups (Continued)**

| <b>SLC-2000<br/>RT Slot<br/>Number<br/>(Note 1)</b> | <b>Channels<br/>Used for<br/>ISDN<br/>Service</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> | <b>Bn+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(n = 1 or 2)<br/>(Note 2)</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> |
|-----------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 13                                                  | 49<br>50<br>51                                    | drop-x-13-1 (B1)<br>drop-x-13-2 (D)<br>drop-x-13-3 (B2)                      | drop-x-13-1 (Bn)<br>drop-x-13-2 (D)                                                           | drop-x-13-1 (D)                                                              |
| 14                                                  | 53<br>54<br>55                                    | drop-x-14-1 (B1)<br>drop-x-14-2 (D)<br>drop-x-14-3 (B2)                      | drop-x-14-1 (Bn)<br>drop-x-14-2 (D)                                                           | drop-x-14-1 (D)                                                              |
| 15*                                                 | 57<br>58<br>59<br>60                              | drop-x-15-2 (B1)<br>drop-x-15-3 (D)<br>drop-x-15-4 (B2)                      | drop-x-15-1 (Bn)<br>drop-x-15-2 (D)                                                           | drop-x-15-1 (D)                                                              |
| 16                                                  | 61<br>62<br>63                                    | drop-x-16-1 (B1)<br>drop-x-16-2 (D)<br>drop-x-16-3 (B2)                      | drop-x-16-1 (Bn)<br>drop-x-16-2 (D)                                                           | drop-x-16-1 (D)                                                              |
| 17                                                  | 65<br>66<br>67                                    | drop-x-17-1 (B1)<br>drop-x-17-2 (D)<br>drop-x-17-3 (B2)                      | drop-x-17-1 (Bn)<br>drop-x-17-2 (D)                                                           | drop-x-17-1 (D)                                                              |
| 18*                                                 | 69<br>70<br>71<br>72                              | drop-x-18-2 (B1)<br>drop-x-18-3 (D)<br>drop-x-18-4 (B2)                      | drop-x-18-1 (Bn)<br>drop-x-18-2 (D)                                                           | drop-x-18-1 (D)                                                              |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier). The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

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**Table 4-9. AUA93/AUA293 BRITE II in SLC-2000 RT — ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups (Continued)**

| <b>SLC-2000<br/>RT Slot<br/>Number<br/>(Note 1)</b> | <b>Channels<br/>Used for<br/>ISDN<br/>Service</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> | <b>Bn+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(n = 1 or 2)<br/>(Note 2)</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(Note 2)</b> |
|-----------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 19                                                  | 73<br>74<br>75                                    | drop-x-19-1 (B1)<br>drop-x-19-2 (D)<br>drop-x-19-3 (B2)                      | drop-x-19-1 (Bn)<br>drop-x-19-2 (D)                                                           | drop-x-19-1 (D)                                                              |
| 20                                                  | 77<br>78<br>79                                    | drop-x-20-1 (B1)<br>drop-x-20-2 (D)<br>drop-x-20-3 (B2)                      | drop-x-20-1 (Bn)<br>drop-x-20-2 (D)                                                           | drop-x-20-1 (D)                                                              |
| 21*                                                 | 81<br>82<br>83<br>84                              | drop-x-21-2 (B1)<br>drop-x-21-3 (D)<br>drop-x-21-4 (B2)                      | drop-x-21-1 (Bn)<br>drop-x-21-2 (D)                                                           | drop-x-21-1 (D)                                                              |
| 22                                                  | 85<br>86<br>87                                    | drop-x-22-1 (B1)<br>drop-x-22-2 (D)<br>drop-x-22-3 (B2)                      | drop-x-22-1 (Bn)<br>drop-x-22-2 (D)                                                           | drop-x-22-1 (D)                                                              |
| 23                                                  | 89<br>90<br>91                                    | drop-x-23-1 (B1)<br>drop-x-23-2 (D)<br>drop-x-23-3 (B2)                      | drop-x-23-1 (Bn)<br>drop-x-23-2 (D)                                                           | drop-x-23-1 (D)                                                              |
| 24*                                                 | 93<br>94<br>95<br>96                              | drop-x-24-2 (B1)<br>drop-x-24-3 (D)<br>drop-x-24-4 (B2)                      | drop-x-24-1 (Bn)<br>drop-x-24-2 (D)                                                           | drop-x-24-1 (D)                                                              |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier). The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows: drop-shelf#(1-8)-slot#(1-24)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

**Table 4-10. AUA93/AUA293 BRITE II in SLC-2000 MSDT or V-MSDT— ISDN Services and Related Physical Drop AIDs Used for Cross-Connections to INA Digroups**

| <b>SLC-2000<br/>MSDT or<br/>V-MSDT<br/>Slot Number<br/>(Note 1)</b> | <b>Channels<br/>Used for<br/>ISDN<br/>Service</b> | <b>2B+D Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(y=server #)<br/>(Note 2)</b> | <b>Bn+D Service<br/>AIDs<br/>(Channels) (n=<br/>1 or 2)<br/>(x=shelf # 1-8)<br/>(y=server #)<br/>(Note 2)</b> | <b>D-Only Service<br/>AIDs<br/>(Channels)<br/>(x=shelf # 1-8)<br/>(y=server #)<br/>(Note 2)</b> |
|---------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1                                                                   | 1<br>2<br>3                                       | dtdp-x-y-1-1 (B1)<br>dtdp-x-y-1-2 (D)<br>dtdp-x-y-1-3 (B2)                                    | dtdp-x-y-1-1 (Bn)<br>dtdp-x-y-1-2 (D)                                                                         | dtdp-x-y-1-1 (D)                                                                                |
| 2                                                                   | 5<br>6                                            | Not supported                                                                                 | dtdp-x-y-2-1 (Bn)<br>dtdp-x-y-2-2 (D)                                                                         | dtdp-x-y-2-1 (D)                                                                                |
| 3*                                                                  | 10<br>11<br>12                                    | dtdp-x-y-3-2 (B1)<br>dtdp-x-y-3-3 (D)<br>dtdp-x-y-3-4 (B2)                                    | dtdp-x-y-3-1 (Bn)<br>dtdp-x-y-3-2 (D)                                                                         | dtdp-x-y-3-1 (D)                                                                                |
| 4                                                                   | 13<br>14<br>15                                    | dtdp-x-y-4-1 (B1)<br>dtdp-x-y-4-2 (D)<br>dtdp-x-y-4-3 (B2)                                    | dtdp-x-y-4-1 (Bn)<br>dtdp-x-y-4-2 (D)                                                                         | dtdp-x-y-4-1 (D)                                                                                |
| 5                                                                   | 17<br>18                                          | Not supported                                                                                 | dtdp-x-y-5-1 (B1)<br>dtdp-x-y-5-2 (D)                                                                         | dtdp-x-y-5-1 (D)                                                                                |
| 6*                                                                  | 21<br>22<br>23<br>24                              | dtdp-x-y-6-2 (B1)<br>dtdp-x-y-6-3 (D)<br>dtdp-x-y-6-4 (B2)                                    | dtdp-x-y-6-1 (B1)<br>dtdp-x-y-6-2 (D)                                                                         | dtdp-x-y-6-1 (D)                                                                                |

**Notes:**

1. The first pair associated with the physical slot is the Transmit pair (toward the carrier).  
The second pair associated with the physical slot is the Receive pair (from the carrier).
2. The physical line AID is formatted as follows:  
dtdp-shelf#(1-8)server#(1,3,5,7,13,15,17,19)-slot#(1-6)-channel#(1-4).

\* This slot uses the second, third, and fourth drop AIDs to provide 2B+D service. All other slots use the first, second, and third drop AIDs for 2B+D service.

## AUA293 BRITE II

**Data Sheet :** 363-005-347

The AUA293 ISDN BRITE-II CU provides one ANSI standard digital subscriber line (U-DSL) over a nonloaded 2-wire loop. When installed in an RT, MSDT, or NBS, the AUA293 CU provides one channel of service in the line unit termination (LULT) mode. When installed in a COT, the AUA293 CU provides the line-unit network-termination (LUNT) function.

The AUA293 CU may be used on nonloaded loops up to 18 kft. in length (26 awg.).

The AUA293 CU uses the U-interface 2B1Q signal to provide a 4-level line code at a data rate of 160 kb/s (80k baud), comprising two B channels and one D channel, plus overhead. The D channel is used for signaling and low-speed packet data. The B channels may be used for circuit-switched voice, circuit-switched data, or packet data. The unit complies with the *ANSI* standard for a U-interface digital subscriber line.

A microcontroller performs on-board processing and contains the remote inventory data. Channel Unit timing is derived from the system clock.

The AUA293 channel unit stores a plug-in inventory record in nonvolatile memory available for reading by an inventory compatible host (e.g., *SLC-2000* Access System). The inventory record includes 10-character *COMMON LANGUAGE CLEI*, *COMCODE*, *ECl*, *Function*, and *ID* codes.

Service selection for RT or ONU applications (see Note) is provisioned with the **ENT - T0** command from the CIT (the switches on the channel unit are ignored). In ONU applications (see Note), service selection is provisioned using the on-board channel unit switches.



**NOTE:**

When the host digital terminal (HDT) is hosting an ONU, provision the channel unit as follows depending on the *SLC-2000* software release:

**Release 4.1 and earlier:** Provision the service selection using the physical option switches.

**Release 4.2 and later:** Provision the service selection using the **ENT - T0** command from the CIT. Ignore the AUA293's physical option switches.

The AUA293 BRITE II is supported in TR-08 Mode 1 or INA only in RT or MSDT shelves. The AUA293 can be used in the RT or MSDT with no *channel unit* slot restrictions. Time slot allocation and restrictions for the RT and MSDT are listed in Table 4-7 and Table 4-8, respectively.

Table 4-9 and Table 4-10 show ISDN services and related physical drop AIDs used for cross-connections to INA digroups in the RT and MSDT/V-MSDT/V-DT, respectively. The following examples show how to use the tables:

- **Table 4-9 (RT):** To access the channel unit in shelf 5, slot 7, for the purpose of making D-only cross-connections to INA logical DS0s, the physical AIDs would be *drop-5-7-1*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0 is determined by the placement and provisioning of the ISDN card in the D4 bank.
- **Table 4-10 (MSDT/V-MSDT/V-DT):** To access the channel unit in shelf 1, server 1, MSDT slot 3, for the purpose of making the cross-connections to INA logical DS0s, the physical AIDs would be *dtdp-1-1-3-1*. The INA logical AID format is *inads0-feeder#(1-28)-ds0#(1-24)*. The INA logical DS0 is determined by the placement and provisioning of the ISDN card in the D4 bank.

## ANSI U-Interface ISDN

### SPQ494 Quad ISDN BRI Channel Unit (Release 4.1 and Later)

**Data Sheet:** 363-005-388

The SPQ494 quad ISDN basic rate interface (BRI) channel unit provides four circuits of BRI ISDN service using the ANSI\* standard line terminating (LT) U-interface for full duplex transmission.

The U-interface 2 binary 1 quaternary (2B1Q) signal provides a four-level line coding format at a data rate of 160 kb/s (80 K baud). This data rate consists of two 64 kb/s clear B-channels for voice or data, and one 16 kb/s D-channel for message signaling and low-speed packet-switched data, plus some overhead. This is then transmitted and received over a single nonloaded metallic pair.



**NOTE:**

Another name for the U-interface circuit providing this service is a digital subscriber line (DSL), or U-DSL.

The SPQ494 quad ISDN channel unit is an expanded version of the AUA94( ) dual ISDN channel unit. It is backward compatible with all the AUA94( ) features and functions. Each SPQ494 occupies one physical slot in the SLC-2000 RT or NBS. It provides four full ISDN BRI 2B+D customer services instead of two as provided by the AUA94( ).

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\* Registered trademark of American National Standards Institute, Inc.

You can use this channel unit in any TR-303 VRT providing the *SLC-2000* software release is 4.1 or later. You can install it in any (or all) physical channel slots in the MDS assemblies.



**NOTE:**

Lucent Technologies recommends the use of Software Release 4.2 or later if you are equipping more than 200 ISDN lines.

When using the channel unit at an ONU, you must observe the following restrictions depending on the ONU type and the HDT software release:

- ***SLC-2000 MSDT:*** The *SPQ494* ISDN channel unit is not supported in the software of any *SLC-2000* MSDT host. For BRI 2B+D services, use the *AUA94( )* U-ISDN dual unit.
- ***DDM-2000 FiberReach Narrowband Shelf:***
  - ***Release 4.3:*** This channel unit is not supported in this software release. [Use the *AUA94( )* for BRI 2B+D services. When using the *AUA94( )*, remember to observe the unique slot restrictions.]
  - ***Release 4.4 or Later:*** You can install this channel unit in any V-DT served by a DSX-1 provisioned for the *octet* mode. However, you can only install the *SPQ494* in slots 1 and 2 of a three-slot V-DT. See Table 4-11 for slot restrictions when using the *SPQ494* in the three-slot V-DT operating in the *octet* mode. See Chapter 2 for a definition of the V-DT concept and the *octet* mode. See Chapter 7 for provisioning information.



**Table 4-11. Channel Unit Slot Restriction When Using an *SPQ494* in a Three-Slot V-DT**

| Slot 1 can contain a ...                                                                                                                                             | Slot 2 can contain a ...                                                                                                                                             | Slot 3 can contain a...                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <i>SPQ494</i></li> <li>or</li> <li>• AUA94( )</li> <li>or</li> <li>• Any other channel unit supported by the NBS</li> </ul> | <ul style="list-style-type: none"> <li>• <i>SPQ494</i></li> <li>or</li> <li>• AUA94( )</li> <li>or</li> <li>• Any other channel unit supported by the NBS</li> </ul> | <ul style="list-style-type: none"> <li>• AUA94( )</li> <li>or</li> <li>• Any other channel unit supported by the NBS (except the <i>SPQ494</i> channel unit)</li> </ul> |

When installing the *SPQ494* channel unit, you must semipermanently *nail-up* the D-channels to the host LDS in one-quarter time slots using the embedded operations channel (EOC) assignments. Four D-channels may occupy a single feeder DS0 time slot. You may also optionally assign the B-channels to feeder DS0 time slots on a semipermanent basis using EOC assignments.

**NOTE:**

You can provision the *SPQ494* channel unit cross-connections over the LDS EOC only.

Document 363-205-113, *SLC Series 5 Carrier System, AUA94 U-DSL ISDN Channel Unit, Installation and Maintenance*, describes the applications and provisioning including the prescription settings.

## AUA94( ) ANSI U-Interface Channel Unit

**Data Sheet:** 365-005-135

The AUA94( ) dual U ISDN channel unit provides two circuits of second generation basic rate ISDN service using the *ANSI* standard LT-mode U-interface for full duplex transmission.

The U-interface 2 binary 1 quaternary (2B1Q) signal provides a four-level line coding format at a data rate of 160 kb/s (80 K baud). This data rate consists of two 64 kb/s clear B-channels for voice or data, and one 16 kb/s D-channel for message signaling and low-speed packet-switched data, plus some overhead. This is then transmitted and received over a single nonloaded metallic pair.



**NOTE:**

Another name for the U-interface circuit providing this service is a digital subscriber line (DSL), or U-DSL.

The AUA94B channel unit adds a sealing current option switch, enhanced inventory, and full ANSI loop range. It also stores a plug-in inventory record in nonvolatile memory available for reading by an inventory compatible host (e.g., *SLC-2000* Access System). The inventory record includes ten-character *COMMON LANGUAGE*<sup>\*</sup> *CLEI*, *COMCODE*, *ECI*, *Function*, *Loss*, and *ID* codes.

You must use the AUA94 channel unit in loops that meet carrier serving area (CSA) design rules (up to 12 kft.). You may use the AUA94B on loops up to 18 kft. in length (26 awg.)

You can use this channel unit in any TR-303 VRT providing the *SLC-2000* software release is 4.0 or later. You can install it in any (or all) physical channel slots in the MDS assemblies. However, when using the channel unit at an ONU, you must observe the following restrictions depending on the ONU type and the HDT software release:

- ***SLC-2000 MSDT:*** You may use this channel unit in any MSDT hosted by a *SLC-2000* HDT running Software Release 4.0 or later. However, you must observe the MSDT channel unit slot restrictions shown in Table 4-12.
- ***DDM-2000 FiberReach Narrowband Shelf:***
  - ***Release 4.3:*** You may use this channel unit in any V-MSDT shelf of the NBS hosted by a *SLC-2000* HDT. However, you must observe the channel unit slot restrictions shown in Table 4-13. In the table, slots 1 through 6 denote the upper set of channel unit slots in the NBS (upper V-MSDT), and slots 7 through 12 denote the lower set of channel unit slots in the NBS (lower V-MSDT).

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\* *COMMON LANGUAGE* is a registered trademark and *CLEI*, *CLLI*, *CLCI*, and *CLFI* are trademarks of Bell Communications Research, Inc.

- **Release 4.4 or Later (Quad Mode):** You may use this channel unit in any V-DT shelf of the NBS hosted by a *SLC-2000* HDT. However, you must observe the channel unit slot restrictions shown in Table 4-13. In the table, slots 1 through 6 denote the upper set of channel unit slots in the NBS (upper V-DT) and slots 7 through 12 denote the lower set of channel unit slots in the NBS (lower V-DT).
- **Release 4.4 or Later (Octet Mode):** No restrictions.

When installing the AUA94( ) channel unit, you must semipermanently *nail-up* the D-channels to the host LDS in one-quarter time slots using the EOC assignments. Four D-channels may occupy a single feeder DS0 time slot. You may also optionally assign the B-channels to feeder DS0 time slots on a semipermanent basis using EOC assignments.

**NOTE:**

You can provision the AUA94( ) channel unit cross-connections over the LDS EOC only.

Document 363-205-113, *SLC Series 5 Carrier System, AUA94 U-DSL ISDN Channel Unit, Installation and Maintenance*, describes the applications and provisioning including the prescription settings.

**Table 4-12. ISDN BRI 2B+D AUA94( ) Channel Unit Locations for the MSDT**

| MSDT Line Size Configuration | MSDT Channel Unit Slot Number (Note) |        |        |        |        |        |
|------------------------------|--------------------------------------|--------|--------|--------|--------|--------|
|                              | Slot 1                               | Slot 2 | Slot 3 | Slot 4 | Slot 5 | Slot 6 |
| 12-line MSDT                 | P                                    | P      | I/P    | n/a    | n/a    | n/a    |
| 24-line MSDT                 | I/P                                  | I/P    | I/P    | I/P    | P      | P*     |

**Note:** The following list shows the meaning of the symbols in the body of the table:

- **P** — This slot supports up to four POTS lines with a quad POTS-type channel unit. You can also use single or dual POTS-type channel units in this slot.
- **I** — This slot supports the AUA94( ) dual ISDN BRI 2B+D channel unit. The *SPQ494* quad ISDN unit is not allowed in the MSDT.
- **n/a** — This slot is not available when the MSDT Server is optioned for lines = 12.

\* **Slot 6:** This slot supports up to four POTS lines unless the ISDN feature is being used. If the ISDN feature is being used, observe the following restrictions when using slot 6 in the MSDT:

- **If any ISDN BRI service is provided from the MSDT,** this slot can provide POTS lines to the first two channels (or lines) of the slot. This will allow this slot to contain either a single or dual channel unit. The second two channels of this slot are unavailable since the system uses these channels to support ISDN D channels. Therefore, quad channel units are not allowed in slot 6.
- **If the MSDT provides ISDN service in slots 1 through 4,** quad channel units, T-BRITE (AUA90) channel units, BRITE II (AUA93) channel units, and dual OCU dataport (*SPQ452*) channel units are not allowed in slot 6.
- **If there is a quad channel unit, T-BRITE (AUA90), BRITE II (AUA93), dual OCU dataport (SPQ452) channel unit in slot 6,** ISDN channel units are not allowed in any other slot of the MSDT.

**Table 4-13. ISDN BRI 2B+D AUA94( ) Channel Unit Locations for the DDM-2000 FiberReach NBS Slot Numbers (Quad Mode)**

| V-MSDT or V-DT Line<br>Size Configuration | NBS Channel Unit Slot Number (Note) |                     |                     |                      |                      |                      |
|-------------------------------------------|-------------------------------------|---------------------|---------------------|----------------------|----------------------|----------------------|
|                                           | Slot 1 or<br>Slot 7                 | Slot 2 or<br>Slot 8 | Slot 3 or<br>Slot 9 | Slot 4 or<br>Slot 10 | Slot 5 or<br>Slot 11 | Slot 6 or<br>Slot 12 |
| 12-line V-MSDT or V-DT                    | P                                   | P                   | I/P                 | n/a                  | n/a                  | n/a                  |
| 24-line V-MSDT or V-DT                    | I/P                                 | I/P                 | I/P                 | I/P                  | P                    | P*                   |

**Note:** The following list shows the meaning of the symbols in the body of the table:

- **P** — These slots supports up to four POTS lines with a quad POTS-type channel unit. You can also use single or dual POTS-type channel units in these slots.
- **I** — These slots support the AUA94( ) dual ISDN BRI 2B+D channel unit. The SPQ494 quad ISDN unit is not allowed in the NBS V-MSDT or V-DT when provisioned in the quad mode.
- **n/a** — These slots are not available when the Server is optioned for lines =12.

\* **Slots 6 and 12:** These slots support up to four POTS lines unless the ISDN feature is being used in the V-MSDT or V-DT containing the slot. If the ISDN feature is being used in the V-MSDT or V-DT, observe the following restrictions when using slots 6 and 12:

- **If any ISDN BRI service is provided from the V-MSDT or V-DT**, these slots can provide POTS lines to the first two channels (or lines) of the slots. This will allow these slots to contain a single or dual channel unit. The second two channels of each of these slots are unavailable since they are used to support ISDN D channels. Therefore, quad channel units are not allowed in slots 6 or 12.
- **If the V-MSDT or V-DT provides ISDN service in slots 1 through 4 or slots 7 through 10**, quad channel units, BRITE II (AUA93) channel units, and dual OCU dataport (SPQ452) channel units are not allowed in last slot of the V-MSDT or V-DT (slot 6 or 12).
- **If there is a quad channel unit, BRITE II (AUA93), or dual OCU dataport (SPQ452) channel unit in last slot of the V-MSDT or V-DT (slot 6 or 12)**, ISDN channel units are not allowed in any other slot of the V-MSDT or V-DT.

### **Enhanced Business Service (EBS) (COT Release 3.3 or Later, RT Release 4.2 or Later)**

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Enhanced Business Service (EBS) is a Centrex-CO feature offered to customers served by a *DMS-100*\* switch. It is frequently referred to as *P-Phone* service. This service uses a pair of channel units to provide enhanced local service using a proprietary protocol of *Nortel*®. The channel unit pair is installed at the following locations:

- **Central Office Terminal (COT):** *SPQ328* Quad EBS Channel Unit
- **Remote Terminal (RT/NBS/MSDT):** *SPQ429* Quad EBS Channel Unit.

#### **SPQ328 Quad EBS Channel Unit**

**Data Sheet:** 363-005-397

This quad channel unit supports the *Nortel* Enhanced Business Service (EBS) (P-Phone) application. It provides four customer circuits, each of which includes a voice channel and an 8-kHz amplitude-shift-keyed (ASK) secondary channel used in the P-Phone service. This channel unit is intended for COT use only. You must option the system for B8ZS line coding.

#### **SPQ429 Quad EBS Channel Unit**

**Data Sheet:** 363-005-398

The *SPQ429* channel unit provides four channels of service, acting as the current feed interface between a *SLC-2000* RT, NBS, or MSDT and a *Nortel* EBS (P-Phone) station set.

The *SPQ429* channel unit stores in nonvolatile memory an inventory record available for reading by a compatible OSS. This inventory record includes its ten-character *COMMON LANGUAGE CLEI* code.

This channel unit provides the following features and functions:

- Four channels of voice service
- No option switches
- Faceplate test jack access to tip and ring of each channel
- Inventory information.

The *SPQ429* channel unit is supported in TR-08 Mode 1 or INA only in the RT, NBS, and MSDT. The service can be set to B8ZS or ZCS.

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\* Trademark of Northern Telecom Limited.

**Wideband Audio Service (COT Release 3.3 or Later, RT Release 4.2 or Later)**

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The *PGM*<sup>\*</sup>-2000 program channel unit provides wide band audio service for broadcasters through dedicated (nonswitched) circuits. The *SLC*-2000 COT and RT can both contain the *PGM*-2000 channel unit.

***PGM*-2000 Program Channel Unit**

**Data Sheet:** Tollgrade TLGD-2000

The *PGM*-2000 program channel unit provides the following four grades of wideband audio service:

- 5 kHz
- 8 kHz
- 15 kHz
- 20 kHz (proprietary).

Each service uses multiple time slots in the feeder. Table 4-14 shows the time slots required for each bandwidth grade and the valid MDS channel unit slots for monaural programming. For 15-kHz and 20-kHz applications, you cannot install any channel unit in the slots to the right of the slots containing the *PGM*-2000 channel units.

**Table 4-14. *PGM*-2000 Channel Unit Slot Restrictions (Monaural Programming)**

| <b>Bandwidth</b> | <b>Time Slots Required</b> | <b>Valid MDS Channel Unit Slots</b> |
|------------------|----------------------------|-------------------------------------|
| 5 kHz            | 2                          | any                                 |
| 8 kHz            | 3                          | any                                 |
| 15 kHz           | 6                          | 1, 2, 3, 5, 7, 9, 10, 11            |
| 20 kHz           | 8                          | 1, 2, 3, 5, 7, 9, 10, 11            |

Refer to the Tollgrade Data Sheet for additional slot restrictions for stereo programming. Obtain the data sheet by contacting Tollgrade Communications by dialing 1-800-878-3399.

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\* Trademark of Tollgrade Communications, Inc.

The *PGM-2000* channel unit has a 4-wire interface with no sealing current or battery voltage. Switches on the printed wiring board control the bandwidth and other transmission parameters. You can use this channel unit in any of the following configurations:

- An INA configuration
- A universal TR-08 Mode 1 configuration
- Hairpinned in an integrated TR-08 Mode 1 or TR-303 configuration.

You must option the feeder for B8ZS.

## **Recent Change Activities**

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Administration and maintenance of an integrated *SLC-2000* Access System can be done from a master control center (MCC). The MCC is a video display terminal that provides access to the *5ESS* switch for system messages, configuration control, and data base changes. Data base changes are made using the recent change and verify (RC/V) access function. The RC/V function allows a query of the *5ESS* switch data base to determine its content and to make changes. Growth procedures (to add/change assignment of *SLC-2000* Access System equipment, channels, or services in the *5ESS* switch data base) are done in RC/V menus. The RC/V function may be accessed from the MCC, trunk line work station (TLWS), or a supplementary TLWS.

For more detail on recent change, see 363-200-010, *DCLU Integrated SLC Carrier System, General Information Manual*. For DCLU and IDCU recent change information, see 235-118-244, *5ESS Switch Recent Change Procedures* (for software generic 5E9.1 or later). Other recent change procedures for software generics are provided in 235-118-242 (5E8), and 235-118-240.

The central office termination for a *SLC-2000* RT channel unit may be on a *SLC-2000* COT channel unit, a *SLC 96* COT channel unit, or *5ESS* switch DCLU or IDCU. The *SLC-2000* Access System also is compatible with any *DMS 100* switch that provides a TR-08 interface. INA DS1 channels are terminated on digital channel bank (D-bank) or any other D4-compatible interface (such as DACS II or DACS IV-2000) for the transport of special services.

## Fiber-in-the-Loop Servers in the Metallic Distribution Shelf

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In *SLC-2000* Access Systems configured for fiber-in-the-loop (FITL) distribution, the channel units terminating the digital portion of the loop are located in an optical network unit (ONU) located at or near the customer premises. The ONUs currently available from Lucent Technologies include the following:

- The *SLC-2000* Multi-Services Distant Terminal (MSDT)
- The *DDM-2000* FiberReach Narrowband Shelf (Release 4.3 and later).



**NOTE:**

Chapter 2 describes the details of the *DDM-2000* FiberReach Narrowband shelf and the V-MSDT or V-DT concept.

The ONU interfaces to the *SLC-2000* RT using an MSDT or DT Server that plugs into the RT metallic distribution shelf and extends the digital backplane signals to the ONU with either an optical or metallic link as follows:

- ***SLC-2000 MSDT.*** The downstream electrical interface of the MSDT or DT Server is normally comprised of 1.544 Mb/s Electronic Industries Association (EIA) standard RS-422 signals appearing on the T-R and T1-R1 pairs of the backplane connector. Bay cabling connects these signals to the RT high density optics shelf (HDOS) optical unit (OU) serving the MSDT. The OU provides the interface between the electrical signals of the MSDT or DT Server and the optical signals of the outside plant fiber. When using a metallic interface between the HDT and MSDT, the signal uses a T1 facility.
- ***DDM-2000 FiberReach NBS.*** The MSDT or DT Server sends a DSX-1 signal to the multiplexer where it is multiplexed into an optical signal. At the ONU, a *DDM-2000* FiberReach Wideband shelf demultiplexes the optical signal back into a DSX-1 electrical signal. This signal is then conditioned by a DSXBIU for the channel unit slots of the NBS.

The MSDT or DT Servers, the *SPQ811*, *SPQ810*, *SPQ809*, and *SPQ808* units, have been designed for use with the *SLC-2000* Access System and are described in the following sections.



## ***SPQ811 DT Server Description***

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The *SPQ811 DT* Server supports all the features of the *SPQ810* Server and allows the system to support the Voice Frequency Data Enhancement (VFDE) feature in Software Release R4.6 when used to host an ONU containing VFDE channel units.

This Server supports 0, 12, or 24 DS0 rate services when installed in a *SLC-2000* system hosting the following ONU types:

- *DDM-2000* FiberReach NBS (Release 4.4 or later) — you must provision the DSX-1 signals feeding the NBS for either quad or octet mode operations
- *SLC-2000* MSDT (Release 4.5 or later).

The *SPQ811* Server provides the following basic functions:

- The primary interface between the ONU and the *SLC-2000* HDT
- Terminations for the DS1 rate transmission link to the HDT
- Terminations for the Extended Superframe Format (ESF) data link between the HDT and the ONU.

When the server is installed in an HDT serving an NBS, you can provision the *SPQ811* Server at the HDT to serve the following number of lines depending on the mode of operation of its DSX-1 signal:

- **Quad Mode:** 0, 12, or 24 lines (DS0 rate services)
- **Octet Mode:** 0 or 24 lines (DS0 rate services).

The Server transfers or extends the respective time slots between the HDT backplane bus and the ONU over the DS1 rate link. By using an *SPQ811* Server with Software Release 4.4 or later, you can provision the DSX-1 to host an NBS provisioned for either the quad or octet mode of operation. This permits the use of *SPQ494* Quad ISDN Channel Units at the NBS when provisioned in the octet mode.

The *SPQ811* Server transfers alarm and other event indications received from the ONU to the HDT. The faceplate contains the following indicators:

- **FAIL:** Indicates an internal failure
- **CLF:** Indicates a failure of the HDT-NBS DS1 rate link (carrier line failure)
- **DT:** Indicates an alarm or failure occurring at the ONU
- **CONFIG:** Indicates a configuration error or incompatibility.

All communications between the HDT and ONU processors pass through the Server. The Server performs special functions in support of loop testing. Since metallic test access to the drop is not available from the HDT, the Server triggers the channel and drop test unit (CDTU) in the ONU to perform the following:

- The channel test termination sequencing for channel testing (normally a PGTC function)
- Metallic drop tests.

When the tests are completed, the results are passed to the Server over the DS1 data link, and the Server generates a three-terminal DC signature that identifies the test result for Mechanized Loop Testing (MLT).



**NOTE:**

This signature is presented for measurement over the same test paths used for metallic test access to channel units, making FITL loop tests identical to metallic loop tests from the perspective of the test system.

*SLC-2000* Software Release 4.6 or later requires the use of the *SPQ811* Server to support the VFDE feature. Also, for all the features of the *SPQ811* Server to operate properly, the *SLC-2000* HDT must be hosting an NBS equipped with a DSXBIU with the correct software load.

As with the *SPQ810*, *SPQ809*, and *SPQ808* Server, the *SPQ811* DT Server occupies two physical channel unit slots in the MDS assembly. It also supports the enhanced FITL features — in Software Release R4.5 or later — in a TR-303 configuration.

The *SPQ811* Server stores an inventory record (including the ten-character *CLEI* code) in nonvolatile memory that is available for reading by a compatible OSS.

The *SPQ811* Server is also equipped with an on-board option switch that allows you to select a DSX-1 compliant electrical signal format for the downstream interface or a RS-422 signal that is necessary for the optical unit (OU) in the high density optics shelf (HDOS). The positions on this switch are selected as follows:

- **OU (*Release 4.5 or later*):** Place the switch in the OU position when the HDT is feeding an MSDT using an OU in the HDOS.
- **DSX:** Place the switch in the DSX position when the HDT is feeding the ONU using the following configurations:
  - When feeding an MSDT using a metallic facility such as a T1 facility (*Release 4.5 or later*).
  - When feeding an NBS either with a metallic facility such as a T1 facility or through a DDM-2000 FiberReach wideband shelf (WBS) (when using the WBS, the DSX-1 signal from the Server is multiplexed onto an OC-1 transport facility to feed the NBS).



**NOTE:**

In Software Release 4.4 or earlier, the *SPQ811* Server does not support the MSDT. Therefore, you should always set the option switch in the DSX position. Use the *SPQ809* Server to host the MSDT with Release 4.4.



**NOTE:**

See the data sheet (363-005-390) or the *SLC-2000 Access System User/Service Manual* (363-208-001) for the switch locations.

The following summarizes the features and functions of the *SPQ811* DT Server:

- TR-08/TR-303 basic service
- DSXBIU software downloading
- Support of TR-303 ISDN-BRI (2B+D) services
- Enhanced NBS system alarms
- TR-08/TR-303 metallic circuit testing
- TR-303 ISDN metallic circuit testing
- NBS inventory retrieval
- DT Server inventory information (for example, CLEI code, date of manufacture, etc.)
- Server/ONU link performance monitoring
- VFDE Feature.

Details for the *SPQ811* DT Server are described in 363-005-390 data sheet.

## ***SPQ810 DT Server Description***

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The *SPQ810* Server supports 0, 12, or 24 DS0 rate services when installed in a *SLC-2000* system hosting the following ONU types:

- DDM-2000 FiberReach NBS (Release 4.4 or later) — you must provision the DSX-1 signals feeding the NBS for either quad or octet mode operations
- *SLC-2000* MSDT (Release 4.5 or later).

The *SPQ810* Server provides the following basic functions:

- The primary interface between the ONU and the *SLC-2000* HDT
- Terminations for the DS1 rate transmission link to the HDT
- Terminations for the Extended Superframe Format (ESF) data link between the HDT and the ONU.

When the server is installed in an HDT serving a NBS, you can provision the *SPQ810* Server at the HDT to serve the following number of lines depending on the mode of operation of its DSX-1 signal:

- **Quad Mode:** 0, 12, or 24 lines (DS0 rate services)
- **Octet Mode:** 0 or 24 lines (DS0 rate services).

The Server transfers or extends the respective time slots between the HDT backplane bus and the ONU over the DS1 rate link. By using an *SPQ810* Server with Software Release 4.4 or later, you can provision the DSX-1 to host an NBS provisioned for either the quad or octet mode of operation. This permits the use of *SPQ494* Quad ISDN Channel Units at the NBS when provisioned in the octet mode.

The *SPQ810* Server transfers alarm and other event indications received from the ONU to the HDT. The faceplate contains the following indicators:

- **FAIL:** Indicates an internal failure
- **CLF:** Indicates a failure of the HDT-NBS DS1 rate link (carrier line failure)
- **DT:** Indicates an alarm or failure occurring at the ONU
- **CONFIG:** Indicates a configuration error or incompatibility.

All communications between the HDT and ONU processors pass through the Server. The Server performs special functions in support of loop testing. Since metallic test access to the drop is not available from the HDT, the Server triggers the channel and drop test unit (CDTU) in the ONU to perform the following:

- The channel test termination sequencing for channel testing (normally a PGTC function)
- Metallic drop tests.

When the tests are completed, the results are passed to the Server over the DS1 data link, and the Server generates a three-terminal DC signature that identifies the test result for Mechanized Loop Testing (MLT).

**NOTE:**

This signature is presented for measurement over the same test paths used for metallic test access to channel units, making FITL loop tests identical to metallic loop tests from the perspective of the test system.

*SLC-2000* Software Release 4.4 and later requires the use of the *SPQ810* Server to support the enhanced octet mode features when the system hosts a DDM-2000 FiberReach NBS. Also, for all the features of the *SPQ810* Server to operate properly, the *SLC-2000* HDT must be hosting a NBS equipped with a DSXBIU.

As with the *SPQ809* and *SPQ808* Server, the *SPQ810* DT Server occupies two physical channel unit slots in the MDS assembly. It also supports the enhanced FITL features in a TR-303 configuration.

The *SPQ810* Server stores an inventory record (including the ten-character CLEI code) in nonvolatile memory that is available for reading by a compatible OSS.

The *SPQ810* Server is also equipped with an on-board option switch that allows you to select a DSX-1 compliant electrical signal format for the downstream interface or an RS-422 signal that is necessary for an optical unit (OU) in the high density optics shelf (HDOS). The positions on this switch are selected as follows:

- **OU (*Release 4.5 or later*):** Place the switch in the OU position when the HDT is feeding an MSDT using an OU in the HDOS.
- **DSX:** Place the switch in the DSX position when the HDT is feeding the ONU using the following configurations:
  - When feeding an MSDT using a metallic facility such as a T1 facility (*Release 4.5 or later*).
  - When feeding an NBS either with a metallic facility such as a T1 facility or through a DDM-2000 FiberReach wideband shelf (WBS) (when using the WBS, the DSX-1 signal from the Server is multiplexed onto an OC-1 transport facility to feed the NBS).

**NOTE:**

In Software Release 4.4 or earlier, the *SPQ810* Server does not support the MSDT. Therefore, you should always set the option switch in the DSX position. Use the *SPQ809* Server to host the MSDT with Release 4.4.

**NOTE:**

See the data sheet (363-005-389) or the *SLC-2000 Access System User/Service Manual* (363-208-001) for the switch locations.

The following summarizes the features and functions of the *SPQ810* DT Server:

- TR-08/TR-303 basic service
- DSXBIU software downloading
- Support of TR-303 ISDN-BRI (2B+D) services
- Enhanced NBS system alarms
- TR-08/TR-303 metallic circuit testing
- TR-303 ISDN metallic circuit testing
- NBS inventory retrieval
- DT Server inventory information (for example, CLEI code, date of manufacture, etc.)
- Server/ONU link performance monitoring.

Details for the *SPQ810* DT Server are described in 363-005-389 data sheet.

### ***SPQ809* MSDT or DT Server Description**

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The *SPQ809* Server supports 0, 12, or 24 DS0 rate services on a *SLC-2000* MSDT or DDM-2000 FiberReach Narrowband shelf (*SLC-2000* Software Release 4.3). The *SPQ809* Server provides the following basic functions:

- The primary interface between the ONU and the *SLC-2000* HDT
- Terminations for the DS1 rate transmission link to the HDT
- Terminations for the Extended Superframe Format (ESF) data link between the HDT and the ONU.

You can provision the *SPQ809* Server at the HDT to serve either 12 or 24 lines (DS0 rate services). The Server transfers or extends the respective time slots between the HDT backplane bus and the ONU over the DS1 rate link. The *SPQ809* unit transfers alarm and other event indications received from the ONU to the HDT. The faceplate contains the following indicators:

- **FAIL:** Indicates an internal failure
- **CLF:** Indicates a failure of the HDT-ONU DS1 rate link (carrier line failure)
- **DT:** Indicates an alarm or failure occurring at the ONU
- **CONFIG:** Indicates a configuration error or incompatibility.

All communications between the HDT and ONU processors pass through the Server. The Server performs special functions in support of loop testing. Since metallic test access to the drop is not available from the HDT, the Server triggers the channel and drop test unit (CDTU) in the ONU to perform the following:

- The channel test termination sequencing for channel testing (normally a PGTC function)
- Metallic drop tests.

When the tests are completed, the results are passed to the Server over the DS1 data link, and the Server generates a three-terminal DC signature that identifies the test result for Mechanized Loop Testing (MLT).



**NOTE:**

This signature is presented for measurement over the same test paths used for metallic test access to channel units making FITL loop tests identical to metallic loop tests from the perspective of the test system.

As with the *SPQ808* and *SPQ810* Servers, the *SPQ809* Server occupies two physical channel unit slots in the MDS assembly.

An HDT running Software Release 4.0 and later requires the use of the *SPQ809* unit when hosting an MSDT ONU. This allows the system to support the enhanced FITL features in a TR-303 configuration. You also must use the *SPQ809* Server if the HDT is running Software Release 4.3 and hosting NBS ONU. If the HDT is running Software Release 4.4 and later, use the *SPQ810* Server to host the NBS. The *SPQ810* allows you to provision the DSX-1 signals feeding the NBS to either the quad or octet mode.

The *SPQ809* unit stores in nonvolatile memory an inventory record (including its ten-character CLEI code) available for reading by a compatible OSS.

The *SPQ809* unit is also equipped with an on-board option switch that allows you to select a DSX-1 compliant electrical signal format for the downstream interface or a RS-422 signal that is necessary for an optical unit (OU) in the high density optics shelf (HDOS). The positions on this switch are selected as follows:

- **OU:** Place the switch in the OU position when the HDT is feeding an MSDT using an OU in the HDOS.
- **DSX:** Place the switch in the DSX position when the HDT is feeding the ONU using the following configurations:
  - When feeding an MSDT using a metallic facility such as a T1 facility.
  - When feeding an NBS either with a metallic facility such as a T1 facility or through a collocated DDM-2000 FiberReach WBS (when using the WBS, the DSX-1 signal from the Server is multiplexed onto an OC-1 transport facility to feed the NBS).



**NOTE:**

See the data sheet (363-005-387) or the *SLC-2000 Access System User/Service Manual* (363-208-001) for the switch positions.

The *SPQ809* MSDT or DT Server provides the following features/functions:

- TR-08/TR-303 basic service
- BIU/DSXBIU downloading
- Support of TR-303 ISDN-BRI (2B+D) services
- Enhanced MSDT/ONU system alarms
- TR-08/TR-303 metallic circuit testing
- TR-303 ISDN metallic circuit testing
- MSDT/ONU inventory retrieval
- MSDT or DT Server inventory information (for example, *CLEI* code, date of manufacture, etc.)
- Server/ONU link performance monitoring.

For all the features of the *SPQ809* to operate properly, you must install one of the following BIUs at the ONU:

- ***SLC-2000 MSDT.*** The downloadable BIU (MC97793A1) is required to support these features of the *SPQ809* Server. If a BIU other than the MC97793A1 is installed in the MSDT, the *SPQ809* unit will operate as an *SPQ808* unit. Refer to 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service and Ordering Manual*, for details regarding the MSDT configuration.
- ***DDM-2000 FiberReach Narrowband Shelf.*** The DSXBIU is downloadable and operates like the MC97793A1 BIU.



Details for the *SPQ809* MSDT or DT Server are described in 363-005-387 data sheet.

### ***SPQ808* MSDT or DT Server Description**

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The *SPQ808* MSDT or DT Server provides Release 3.1 and 3.2 services. It also supports TR-303 basic POTS and locally switched services in Software Release 4.0. Each Server occupies only two channel unit slots in the HDT and supports both 12- and 24-line MSDTs. You can also option it for 0 lines.

The *SPQ808* Server cannot be used to serve a V-MSDT or V-DT in the DDM-2000 FiberReach NBS.

Details for the *SPQ808* MSDT or DT Server are described in 363-005-288 data sheet.

## **Services Provided by Function Group C**

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### **DS1 Digital Services**

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#### **DS1 Pipes at a DSX-1 Interface**

The *SLC-2000* Access System supports up to 28 DS1 pipes without using an external multiplexer. These DS1 pipes can be used in a variety of applications such as ISDN PRI transport, video, etc., requiring 1.544-Mb/s digital service.

#### **DS1 Optical and Metallic Extensions**

The *SLC-2000* Access System supports both optical and metallic DS1 extensions using the DDM-Plus system (see 363-206-150, *DDM-Plus System, User Service Manual*, for more details). For optical configurations, the DDM-Plus provides quad optical extensions on multimode or single mode fiber at 5- and 33-km transmission ranges with enhanced testing capabilities. For metallic extensions, the DDM-Plus system functions as a repeater shelf for T1 extensions.

### **Other SONET Subsystem Services From Function Group C**

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Function Group C can also provide other SONET subsystem services normally associated with the DDM-2000 OC-3 multiplexer. This section lists a few of these services commonly used in the *SLC-2000* system. For a complete list of services, see 363-206-200, *DDM-2000 OC-3 and OC-12 Multiplexers, Applications, Planning and Ordering Guide*.

### **EC-1 Electrical Multiplexer**

EC-1 electrical interfaces provide interworking between the ARM shelf and other SONET systems. The EC-1 high-speed interface lets the ARM shelf function as a SONET electrical multiplexer between 28 DS1 signals and an EC-1.

To provide EC-1 service, function group C must contain BBG6 circuit packs.

### **DS3 Low-Speed Interface**

The DS3 low-speed interface circuit pack provides mapping between the DS3 low-speed signal and the internal STS-1 signal.

To provide a DS3 low-speed interface, function group C must contain BBG4/BBG4B circuit packs.

### **Services Provided by SONET Subsystem Software Release R11 and R13 or Later**

Table 8-8 on page 8-57 lists other services provided by function group C when the SONET subsystem of the ARM shelf contains R11 or R13 or later software.

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### System Architecture

The *SLC*<sup>®</sup>-2000 Access System is based on a modular architecture for cost-effective start-up that expands to support final configurations. A system may provide metallic distribution, fiber distribution, or a mixture of both.

- **Basic Metallic Distribution:** A basic metallic distribution system consists of the access resource manager (ARM) shelf assembly and up to four metallic distribution shelf (MDS) assemblies. This arrangement serves a maximum of 768 lines for metallic distribution and supports up to 28 DS1 "pipes." An example of a metallic distribution configuration for a remote terminal (RT) bay is shown in Figure 5-1.
- **Basic Fiber Distribution:** A basic fiber distribution system (called fiber in the loop) consists of the ARM shelf assembly, up to four MDS assemblies equipped with Multi-Services Distant Terminal (MSDT) or Distant Terminal (DT) Servers. The system then interfaces with the optical network unit (ONU) depending on the type of ONU and the software release. A typical fiber-in-the-loop (FITL) configuration is shown in Figure 5-2 on page 5-4. Table 5-1 (Release 4.4 or earlier) and Table 5-2 on page 5-5 (Release 4.5 or later) show the service capacities for the FITL distribution. The following lists the configurations depending on the software release:
  - **Release 2.0 and later.** These systems support the *SLC*-2000 MSDT only as the ONU. Besides the ARM shelf and the MDS assemblies, the system can include up to two high-density optics shelves (HDOSs). One HDOS serves two MDS assemblies. The MSDT or DT Servers send an electrical signal to optical units (OUs) in the HDOS. The OU then interfaces with the ONU over an optical facility.

- **Release 4.3 and later.** In Software Release 4.3 and later, the MSDT or DT Server can feed a collocated DDM-2000 wideband shelf (WBS) with a DSX-1 signal. The wideband shelf multiplexes the DSX-1 signal into an OC-1 distribution system that interfaces with a DDM-2000 FiberReach Terminal as the ONU. At the DDM-2000 FiberReach Terminal, another WBS demultiplexes the DSX-1 signal from the OC-1 signal and sends it to the DSXBIU in the Narrowband shelf (NBS). The DSXBIU then *conditions* the DSX-1 for the twelve channel unit slots that interface with the customer lines. Release 4.3 or later also supports the SLC-2000 MSDT as an ONU.
- **Release 4.4 or later:** You can eliminate the collocated WBS with one of the following configurations:
  - **27G2-U OLIUs in the Main Slots:** If your system uses DSX-1 metallic CO interfaces, your host digital terminal (HDT) can host a NBS ONU through Function Group C of the ARM shelf along with 27G2-U OLIUs in the MAIN slots. This eliminates the need — and expense — for a collocated WBS with the HDT. The 27G2-U OLIUs multiplex the DSX-1 signals onto an OC-1 optical ring and sends it to the ONU as described above.
  - **26G2-U OLIU in Function Group C and a J1C265AA-1, L4 ARM Shelf:** If you are using a J1C265AA-1, L4 ARM shelf and SONET subsystem R13 or later software, your host digital terminal (HDT) can host a NBS ONU through Function Group C of the ARM shelf containing 26G2-U OLIUs. This eliminates the need — and expense — for a collocated WBS with the HDT. The 26G2-U OLIUs multiplex the DSX1 signals onto an OC-1 optical ring and sends it to the ONU as described above. Any WBSs in the OC-1 optical ring must contain FiberReach software release R3.0 or later.

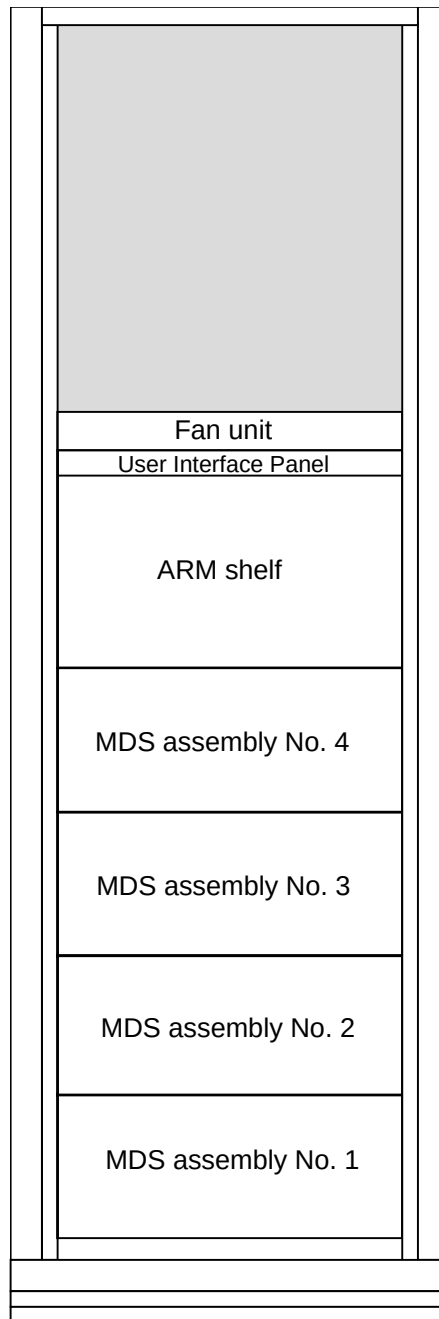


**NOTE:**

For a detailed description of the HDT-to-ONU feature, see Chapter 2.

The modular architecture of the SLC-2000 Access System allows customers to add MDS assemblies as needed for DS0 services.

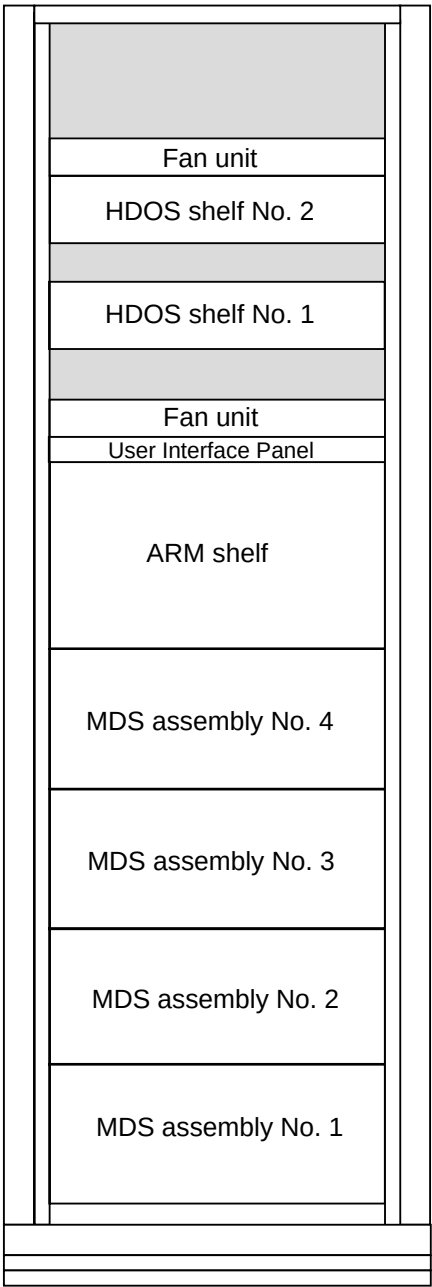
The MDS assembly provides a wide range of DS0-based metallic and/or fiber optic services using the existing SLC Series 5 Carrier System channel units and the new SPQ<sup>®</sup>-type family of channel units. Chapter 4, "Services," presents a list of the services supported by the SLC-2000 system.



rtbaymtl.ps

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**Figure 5-1. SLC-2000 Access System Metallic Distribution Configuration**



rtbayfitl.ps

**Figure 5-2. SLC-2000 Access System FITL Distribution Configuration**



**Table 5-1. SLC-2000 Access System Multi-Services Distant Terminal (MSDT), Virtual-MSDT (V-MSDT), or Virtual-DT (V-DT) Service Capacities (Release 4.4 or Earlier)**

| <b>Configuration</b>                                 | <b>Number of<br/>MSDTs/V-MSDTs/V-DT* Per System (Maximum)</b> |                                      |
|------------------------------------------------------|---------------------------------------------------------------|--------------------------------------|
|                                                      | <b>12-Line<br/>MSDT/V-MSDT/V-DT*</b>                          | <b>24-Line<br/>MSDT/V-MSDT/V-DT*</b> |
| All Virtual Remote Terminals (VRTs) are TR-08 Mode 1 | 56                                                            | 28                                   |
| All VRTs are TR-08 Mode 2                            | 64                                                            | 32                                   |
| TR-303 VRT                                           | 64                                                            | 32                                   |
| No. of HDOSs <sup>†</sup>                            | 2                                                             | 2                                    |

\* For a description of the V-MSDT or V-DT concept, see Chapter 2.

† HDOSs not needed when host digital terminal (HDT) is hosting a DDM-2000 FiberReach Narrowband shelf (NBS) ONU in Release 4.3 and later.

---

**Table 5-2. SLC-2000 Access System Multi-Services Distant Terminal (MSDT) or Virtual-DT (V-DT) Service Capacities (Release 4.5 or Later)**

| <b>Configuration</b>                                 | <b>Number of<br/>MSDTs/V-DTs* Per System (Maximum)</b> |                               |
|------------------------------------------------------|--------------------------------------------------------|-------------------------------|
|                                                      | <b>12-Line<br/>MSDT/V-DT*</b>                          | <b>24-Line<br/>MSDT/V-DT*</b> |
| All Virtual Remote Terminals (VRTs) are TR-08 Mode 1 | 56                                                     | 28                            |
| All VRTs are TR-08 Mode 2                            | 64                                                     | 32                            |
| TR-303 VRT                                           | 64 <sup>†</sup>                                        | 48                            |
| No. of HDOSs <sup>†‡</sup>                           | 2                                                      | 2                             |

\* For a description of the V-DT concept, see Chapter 2.

† For Software Release R4.5 or later, the number of servers hosting ONUs through HDOS assemblies can not exceed 64 (the standard configuration contains 2 HDOS assemblies that provides optical units for only 64 servers).

‡ HDOSs not needed when host digital terminal (HDT) is hosting a DDM-2000 FiberReach NBS ONU.

## **SLC-2000 Access System Signal Flow for TR-08 Applications**

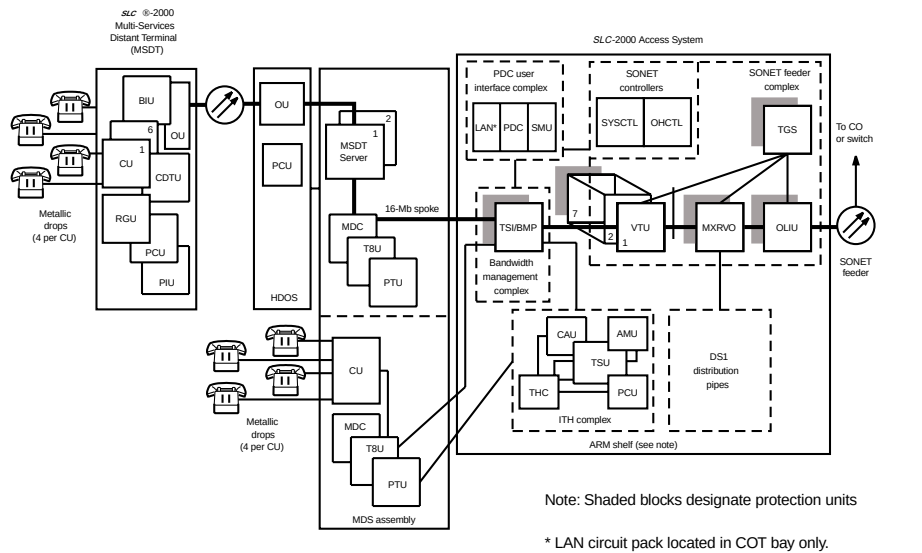
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Figure 5-3 shows the basic system elements that support a typical signal flow through the *SLC-2000* Access System for a synchronous optical network (SONET) feeder with TR-08 for both metallic and FITL distribution. It shows how each circuit pack is related to the signal path. The figure also shows the major building blocks of a complete typical digital loop carrier (DLC) system.

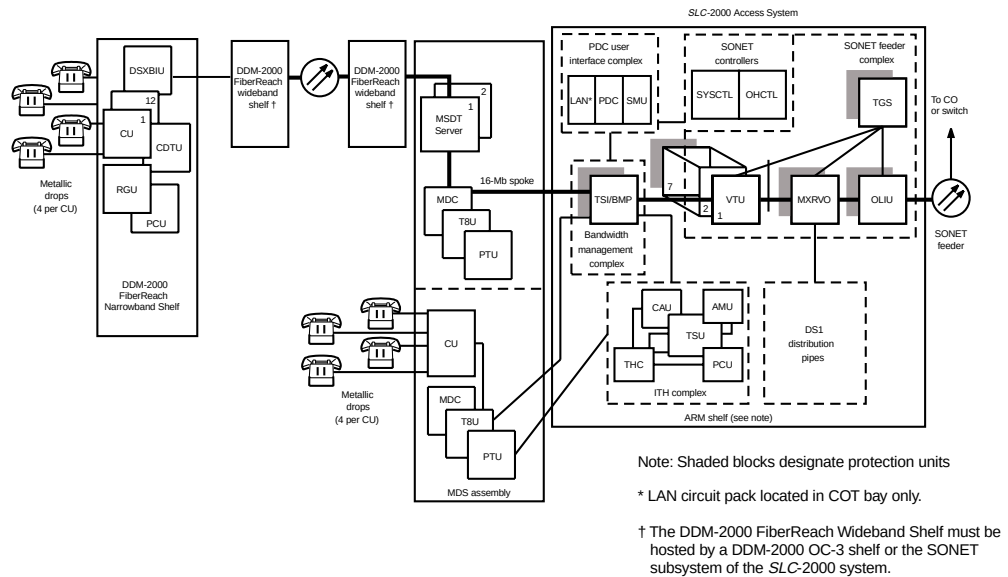
Figure 5-3A shows the *SLC-2000* system hosting an MSDT as an ONU.  
Figure 5-3B shows the *SLC-2000* system hosting a DDM-2000 FiberReach Terminal NBS as the ONU.

The following sections will trace the signal path from the central office interface to the channel unit slots for the different feeders and customer distributions of the *SLC-2000* Access System.

Detailed explanations of each circuit pack in the ARM shelf, MDS assembly, HDOS, user interface panel (UIP), and other equipment are given later in this chapter.



#### A. System Hosting a SLC-2000 MSDT



#### B. System Hosting a DDM-2000 FiberReach Narrowband Shelf

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Figure 5-3. SLC-2000 Access System Elements

## Signal Flow for Systems with an OC-3 Feeder

Figure 5-4 shows the signal flow for systems fed with an OC-3 feeder. The *SLC-2000* system receives an OC-3 optical signal at the ARM shelf from the central office (CO) interface. It progresses through the system to the channel unit slots in the MDS assembly as follows:

- **OLIU circuit pack:** The optical line interface unit (OLIU) receives the optical OC-3 signal. Using the OLIU's TSI cross connection circuitry, each node allows access to 3 STS-1s or 84 VT1.5s within those 3 STS-1s contained in the OC-3. The *SLC-2000* ARM shelf uses up to one STS-1 or 28 VT1.5s for Function Group A to provide DLC services. Signals are fed to the MXRVO circuit packs in the function groups as shown in Figure 5-4. The other STS-1s are available for Function Group C. The use of Function Group C is explained later in this chapter ("Signal Flow for Systems Passing DS1 Pipes"). In linear configurations, each OLIU is protected with a *backup* OLIU in case of circuit pack failure. In ring configurations, both OLIUs are used to support the ring, with protection provided at the path level (DS1) rather than the line level.



### NOTE:

Any cross-connections of VT1.5 signals between STS-1 signals and the OC-3 (for rings and linear networking) are done by an 84 x 84 VT1.5 time slot assignment fabric in the OLIU.

- **MXRVO circuit pack (function group A):** The MXRVO in function group A receives the STS-1 signal from the OLIU and converts it to seven VT-G signals each containing four VT1.5 signals. It then sends one VT-G signal to each of the seven virtual tributary units (VTUs). Each MXRVO is protected with a *backup* MXRVO in case of circuit pack failure.
- **VTU circuit packs:** From the MXRVO, each VTU receives a VT-G signal that contains four VT1.5 signals. From the four VT1.5 signals, the VTU extracts the four DS1 signals and sends them to the time slot interchange (TSI).
- **TSI circuit packs:** The TSI receives the DS1 signals from the VTUs and performs any needed DS1 or DS0 cross-connections so the correct signal will go to the correct customer. The TSI then sends the signals to the MDC circuit packs in each MDS assembly shelf. Each MDS assembly shelf will handle 96 lines using two MDC circuit packs to interface with the signals from the TSI.
- **MDC circuit packs:** Each MDC receives the signals from the TSI. The MDC passes the signals to the T8U circuit pack (TR-08 systems only). The MDC also has control interfaces to the PTU, T8U, and channel units that support channel maintenance, provisioning, alarming, and enhanced inventory.
- **T8U circuit pack:** For Mode 1 operation, the T8U provides a "pass-through" function to allow the two signals to feed the 48 DS0s assigned to the 12 channel unit slots. For Mode 2 operation, the T8U provides the time slot assignment function for 2:1 concentration of 48 time slots from the

**Twelve channel units slots:** The 12 channel unit slots contain the channel units that provide access to the customer. Each channel unit selects the appropriate number of DS0s from the available bandwidth depending on the service being provided in the slot containing the channel unit.

- **Twelve channel units slots:** The 12 channel unit slots contain the channel units that provide access to the customer. Each channel unit selects the appropriate number of DS0s from the available bandwidth depending on the service being provided in the slot containing the channel unit.



**Figure 5-4. Signal Flow in Systems Using an OC-3 Feeder (TR-08)**

## Signal Flow for Systems with an OC-12 Feeder (SONET Subsystem Software R11 or Later)

Figure 5-5 shows the signal flow for systems fed with an OC-12 feeder. This feeder will typically be a part of a path switched ring. The *SLC-2000* system receives an OC-12 optical signal at the ARM shelf from the central office (CO) interface. It progresses through the system to the channel unit slots in the MDS assembly as follows:

- **OLIU circuit packs:** The optical line interface unit (OLIU) receives the optical OC-12 signal. Using the OLIU's TSI cross-connection circuitry, each node allows access to 3 user selectable STS-1s or 84 VT1.5s within those 3 STS-1s. The *SLC-2000* ARM shelf uses up to one STS-1 or 28 VT1.5s for Function Group A to provide DLC services. Signals are fed to the MXRVO circuit packs in the function groups as shown in Figure 5-5. The other STS-1s are available for Function Group C. The use of Function Group C is explained later in this chapter ("Signal Flow for Systems Passing DS1 Pipes"). The OLIU passes through the other 9 STS-1s contained in the OC-12 using a faceplate ribbon connector for use by other network elements in the ring.



### NOTE:

Any cross-connections of VT1.5 signals between STS-1 signals and the OC-12 (for rings and linear networking) are done by an 84 x 84 VT1.5 time slot assignment fabric in the OLIU.

- **MXRVO circuit packs (function group A):** The MXRVO in function group A receives the STS-1 signal from the OLIU and converts it to seven VT-G signals each containing four VT1.5 signals. It then sends one VT-G signal to each of the seven virtual tributary units (VTUs). Each MXRVO is protected with a *backup* MXRVO in case of circuit pack failure.
- **VTU circuit packs:** From the MXRVO, each VTU receives a VT-G signal that contains four VT1.5 signals. From the four VT1.5 signals, the VTU extracts the four DS1 signals and sends them to the time slot interchange (TSI). This system contains one protection VTU to protect up to 7 VTUs installed.
- **TSI circuit packs:** The TSI receives the DS1 signals from the VTUs and performs any needed DS1 or DS0 cross-connections so the correct signal will go to the correct customer. The TSI then sends the signals to the MDC circuit packs in each MDS assembly shelf. Each MDS assembly shelf will handle 96 lines using two MDC circuit packs to interface with the signals from the TSI. The TSI is protected by a *standby* TSI (see Chapter 5).
- **MDC circuit packs:** Each MDC receives the signals from the TSI. The MDC passes the signals to the T8U circuit pack. The MDC also has control interfaces to the PTU, T8U (TR-08 systems only), and channel units that support channel maintenance, provisioning, alarming, and enhanced inventory.
- **T8U circuit pack:** For Mode 1 operation, the T8U provides a "pass-through" function to allow the two signals to feed the 48 DS0s assigned to the 12 channel unit slots. For Mode 2 operation, the T8U provides the time

slot assignment function for 2:1 concentration of 48 time slots from the channel unit backplane onto 24 feeder time slots. The T8U also terminates the TR-08 data link for alarm, testing, and maintenance for Modes 1 and 2, and call processing for Mode 2. For Mode 2 operation, the T8U responds to time slot assignment requests from the central office and assigns one of 24 feeder time slots to one of the 48 distribution time slots.

- **Twelve channel units slots:** The 12 channel unit slots contain the channel units that provide access to the customer. Each channel unit selects the appropriate number of DS0s from the available bandwidth depending on the service being provided in the slot containing the channel unit.

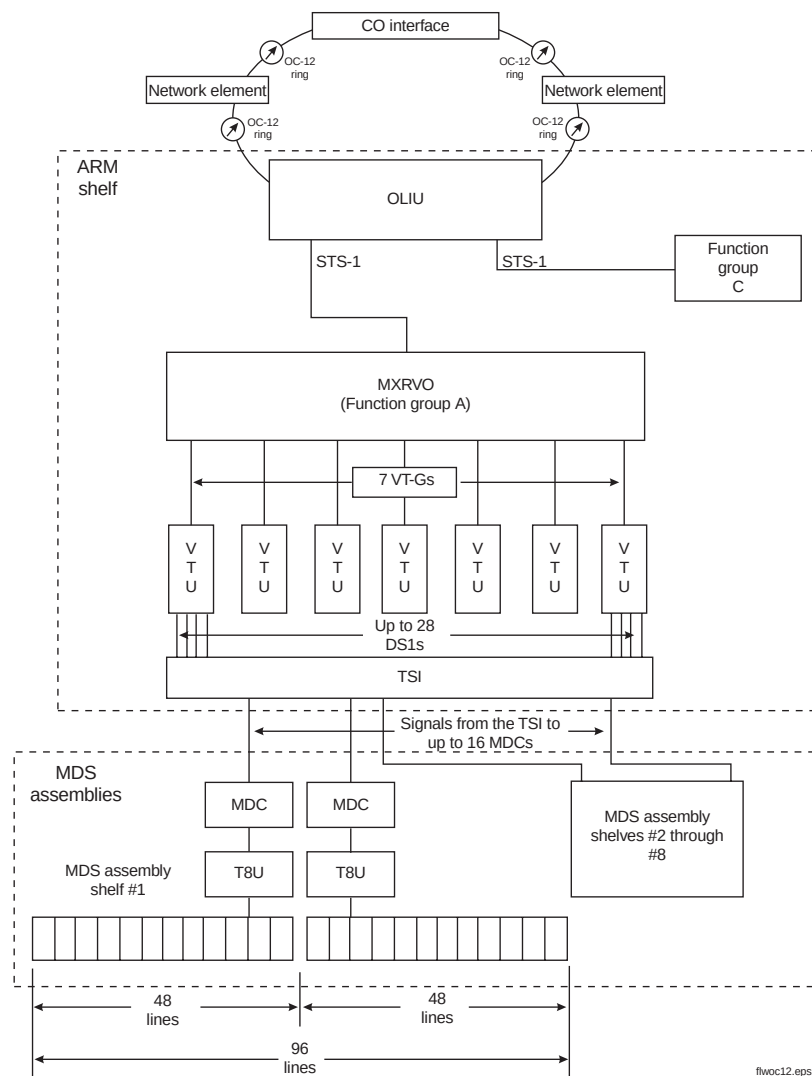


**Figure 5-5. Signal Flow in Systems Using an OC-12 Feeder (TR-08) (SONET Subsystem Software Release R11 or Later)**

## Signal Flow for Systems with Metallic Feeders (Release 3.2 and Later)

Figure 5-6 shows the signal flow for systems fed with DSX-1 metallic feeders. The SLC-2000 system receives metallic feeders (DSX-1 signals) at the ARM shelf from the CO interface. It progresses through the system to the channel unit slots in the MDS assembly as follows:

- **LIU circuit packs:** Up to 28 metallic DSX-1 feeder signals terminate in the ARM shelf on up to seven LIU circuit packs (four DSX-1s for each LIU). The LIU then sends the four DS1 signals to the TSI. The LIUs are physically located in the same slots as the VTUs (the VTUs are used when the system is fed with a SONET feeder). If your system contains less than seven LIU circuit packs, you must install a retainer card in the empty slots.
- **TSI circuit packs:** The TSI receives the DS1 signals from the VTUs and performs any needed DS1 or DS0 cross-connections so the correct signal will go to the correct customer. The TSI then sends the signals to the MDC circuit packs in each MDS assembly shelf. Each MDS assembly shelf will handle 96 lines using two MDC circuit packs to interface with the signals from the TSI.
- **MDC circuit packs:** Each MDC receives the signals from the TSI. The MDC passes the signals to the T8U circuit pack. The MDC also has control interfaces to the PTU, T8U (TR-08 systems only), and channel units that support channel maintenance, provisioning, alarming, and enhanced inventory.
- **T8U circuit pack:** For Mode 1 operation, the T8U provides a “pass-through” function to allow the two signals to feed the 48 DS0s assigned to the 12 channel unit slots. For Mode 2 operation, the T8U provides the time slot assignment function for 2:1 concentration of 48 time slots from the channel unit backplane onto 24 feeder time slots. The T8U also terminates the TR-08 data link for alarm, testing, and maintenance for Modes 1 and 2, and call processing for Mode 2. For Mode 2 operation, the T8U responds to time slot assignment requests from the central office and assigns one of 24 feeder time slots to one of the 48 distribution time slots.
- **Twelve Channel Unit Slots:** The 12 channel unit slots contain the channel units that provide access to the customer. Each channel unit selects the appropriate number of DS0s from the available bandwidth depending on the service being provided in the slot containing the channel unit.



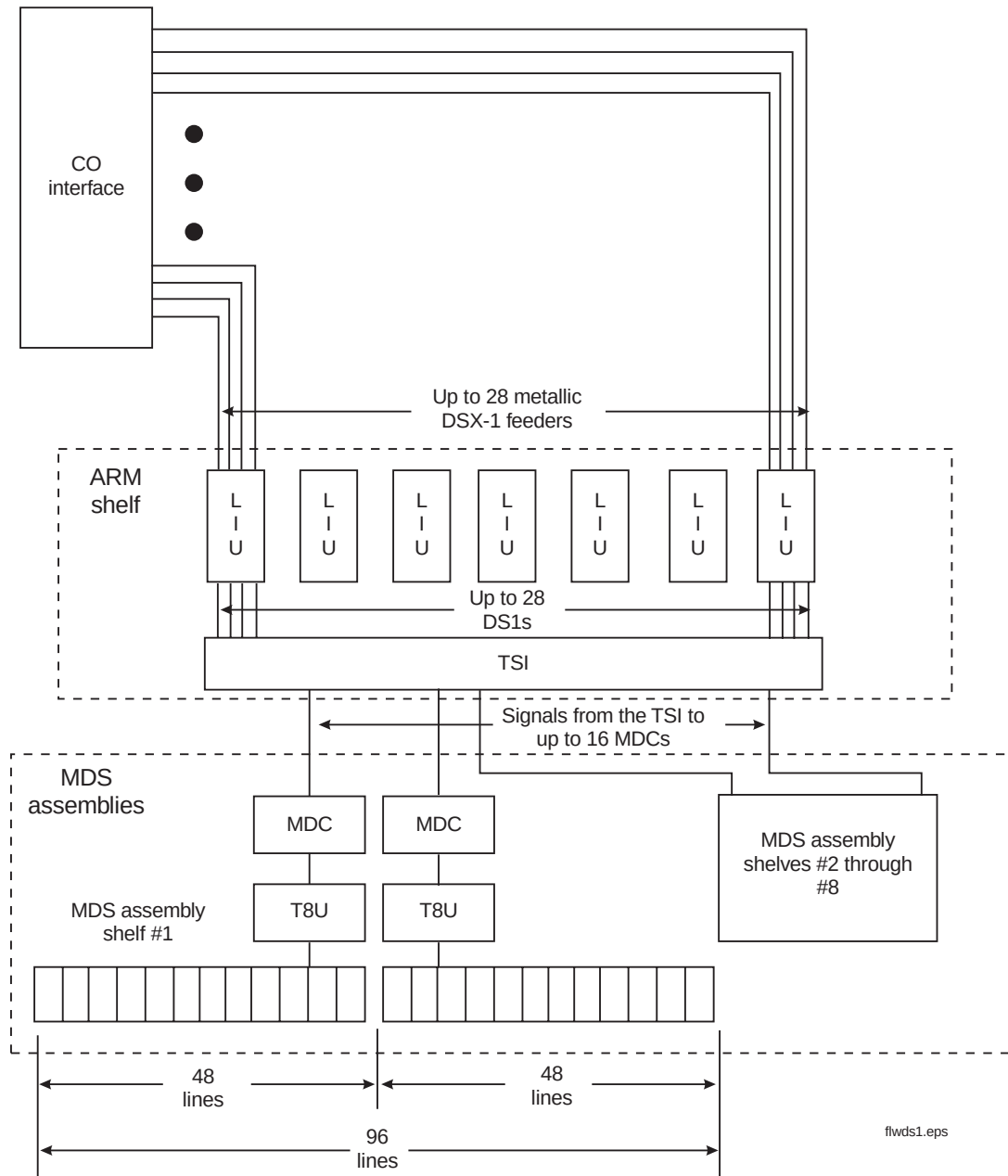


**Figure 5-6. Signal Flow in Systems Using Metallic Feeders (TR-08)**

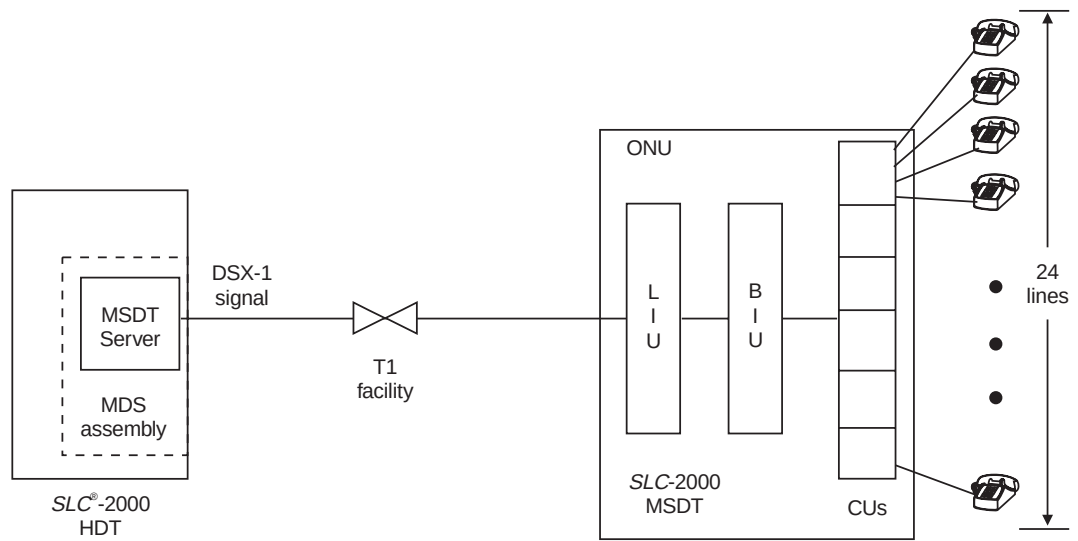
## Signal Flow for Systems Feeding the SLC-2000 MSDT ONU

Figure 5-7 shows the signal flow from the MSDT or DT Server in the MDS assembly shelf to the MSDT. The MDS assembly shelf channel unit slots receive their DS0 signals using either of the methods described earlier (SONET feeders or DSX-1 Metallic feeders). Typically, the system then extends the DS0s to the MSDT as follows:

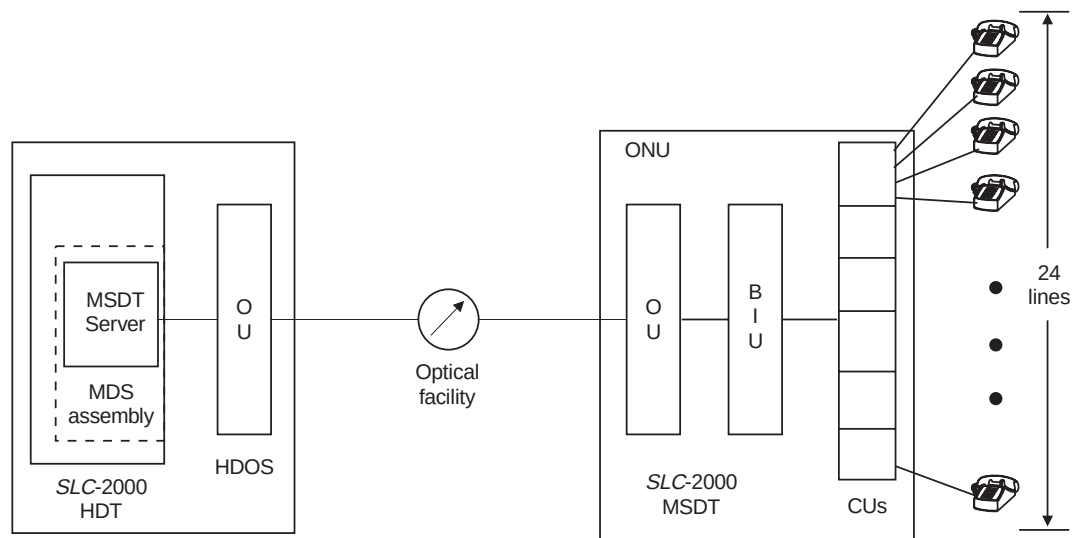
- **MSDT or DT Server:** The MSDT or DT Server is a two-slot wide circuit pack that is located in the MDS assembly. It is restricted to specific slots in the shelf depending on whether it is conditioned for a 12-line MSDT or a 24-line MSDT. Slot restriction information is given later in this chapter. The MSDT or DT Server takes 12 or 24 DS0s and converts them into a DSX-1 signal. It then sends the DSX-1 to a T1 facility or an optical unit (OU) in the HDOS depending on the transmission system being used to interface with the ONU.
- **T1 Facility Transmission:** Figure 5-7A shows a T1 facility transmitting the signal between the HDT and the MSDT.
  - **LIU:** The signal enters the MSDT on an LIU. The LIU sends the signal to the BIU.
  - **BIU:** The BIU receives the signal from the LIU and conditions it for the six channel unit slots.
  - **Channel Unit Slots:** The six channel unit slots contain the channel units that interface with the customer lines. The type of channel unit located in each slot depends on the service required by the customer.
- **Optical Transmission:** Figure 5-7B shows an optical facility transmitting the signal between the HDT and the MSDT:
  - **HDOS OU:** An OU in the HDOS receives the electrical DSX-1 signal from the MSDT or DT Server and converts it into an optical 1.544 MB/s signal for transport to the MSDT.
  - **MSDT OU:** At the MSDT, an OU receives the optical signal and converts to an electrical signal. It then sends the signal to the BIU.
  - **BIU:** The BIU receives the signal from the OU and conditions it for the six channel unit slots.
  - **Channel Unit Slots:** The six channel unit slots contain the channel units that interface with the customer lines. The type of channel unit located in each slot depends on the service required by the customer.

**NOTE:**

See Chapter 2 for a definition of the FITL feature and a detailed explanation of HDT-to-ONU signal path.



**A. Basic 24-Line MSDT Configuration With Metallic Feeder**



**B. Basic 24-Line MSDT FITL Configuration**

msdt.eps

**Figure 5-7. Signal Flow from the MDS Assembly to the MSDT**

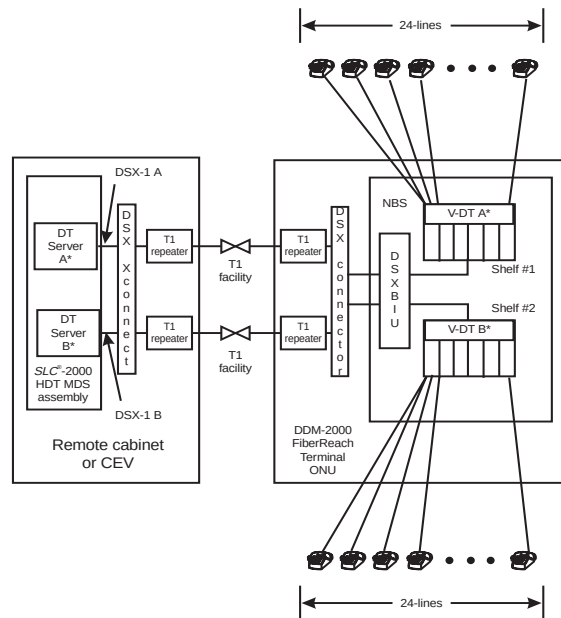
## Signal Flow for Systems Feeding the DDM-2000 FiberReach Terminal ONU

Figure 5-8 shows the signal flow from the MSDT or DT Servers in the MDS assembly shelf to the DDM-2000 FiberReach Terminal ONU. The MDS assembly shelf channel unit slots receive their DS0 signals using either of the methods described earlier (OC-3 feeders or DSX-1 Metallic feeders). Typically, the system then extends the DS0s to the ONU as follows:

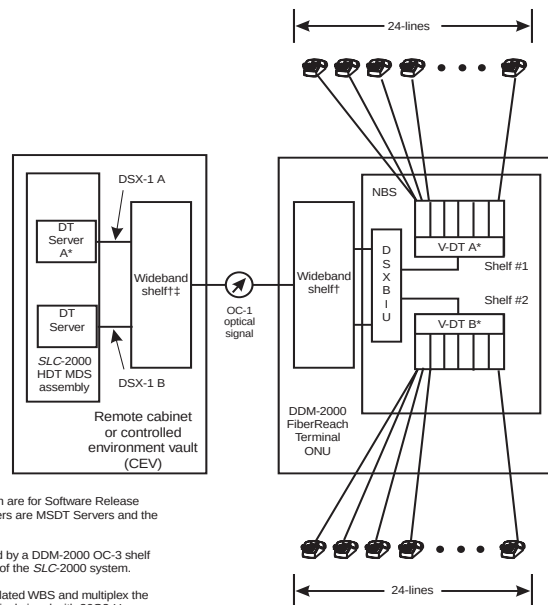
- **MSDT or DT Server:** The MSDT or DT Server is a two-slot wide circuit pack that is located in the MDS assembly. It is restricted to specific slots in the shelf depending on whether it's conditioned for a 12-line V-MSDT/V-DT or a 24-line V-MSDT/V-DT. Slot restriction information is given later in this chapter. The MSDT or DT Server takes 12 or 24 DS0s and converts them into a DSX-1 signal. It then sends the DSX-1 to a collocated WBS, Function Group C containing 26G2-U OLIUs or MAIN slots containing 27G2-U OLIUs, or to a T1 facility depending on the transmission system being used to interface with the ONU.
- **T1 Facility Transmission:** Figure 5-8A shows a T1 facility transmitting the signal between the HDT and the ONU. The MSDT or DT Server sends the DSX-1 signal to the ONU using a T1 facility where it enters the NBS on the DSXBIU.
  - **DSXBIU:** The DSXBIU receives the DSX-1 signal from the T1 facility and conditions it for one of the V-MSDT or V-DT channel unit slots.
  - **Channel Unit Slots:** The V-MSDT or V-DT channel unit slots contain the channel units that interface with the customer lines. The type of channel unit located in the slot depends on the service required by the customer.
- **Optical Transmission:** Figure 5-8B shows an optical facility transmitting the signal between the HDT and the ONU. The MSDT or DT Server sends the DSX-1 signal to be multiplexed into an OC-1 optical signal then sent to the channel units as follows:
  - **DSX-1s Multiplexed onto an OC-1 at the HDT:** As shown in Figure 5-8, a collocated WBS can receive the electrical DSX-1s from the MSDT or DT Server and multiplex them into an OC-1 optical signal for transport to the ONU. Chapter 2 describes other methods of using the SONET subsystem in the ARM shelf to multiplex the DSX-1s onto the OC-1 ring.
  - **DDM-2000 FiberReach WBS:** At the ONU, a WBS receives the optical signal and demultiplexes it back into a DSX-1 electrical signal. It then sends the signal to the DSXBIU in the NBS.
  - **DSXBIU:** The DSXBIU receives the signal from the WBS and conditions it for the V-MSDT or V-DT channel unit slots.
  - **Channel Unit Slots:** The V-MSDT or V-DT channel unit slots contain the channel units that interface with the customer lines. The type of channel unit located in the slot depends on the service required by the customer.

**NOTE:**

See Chapter 2 for a definition of the FITL feature and a detailed explanation of HDT-to-ONU signal path.



A. Systems using a T1 Facility



\* The configurations shown are for Software Release 4.4. In R4.3, the DT Servers are MSDT Servers and the V-DTs are V-MSDTs.

†The WBS must be hosted by a DDM-2000 OC-3 shelf or the SONET subsystem of the SLC-2000 system.

‡You can eliminate the collocated WBS and multiplex the DSX-1s into an OC-1 optical signal with 26G2-U OLIUs and DS1 low-speed circuit packs in Function Group C of the ARM shelf. To eliminate the collocated WBS, you must be using a J1C265AA-1, L4 ARM shelf containing SONET subsystem software release R13 or later. Other WBSs in the OC-1 ring must contain FiberReach software release 3.0 or later.

B. Systems using an OC-1 Facility

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Figure 5-8. Signal Flow from the MDS Assembly to the DDM-2000 FiberReach Terminal ONU

## Signal Flow for Systems Passing DS1 Pipes

Figure 5-9 shows the signal flow for systems passing DS1 pipes to the customer using function group C. This configuration uses a SONET feeder to feed the *SLC-2000* system. The system receives an optical signal from the Central Office (CO) SONET interface at the ARM shelf. It progresses through the system to the channel unit slots in the MDS assembly as follows:

- **OLIU circuit pack:** The OLIU receives the SONET optical signal. Using the OLIU's TSI cross connection circuitry, each node allows access to 3 STS-1s or 84 VT1.5s within those 3 STS-1s. The *SLC-2000* ARM shelf uses up to one STS-1 or 28 VT1.5s for Function Group A to provide DLC services. Signals are fed to the MXRVO circuit packs in the function groups as shown in Figure 5-9. The other STS-1s are available for Function Group C. Function Group C passes the DS1 pipes on to the customer.



### NOTE:

Any cross-connections of VT1.5 signals between STS-1 signals and the OC-3 (for rings and linear networking) are done by an 84 x 84 VT1.5 time slot assignment fabric in the OLIU.

- **MXRVO circuit pack (function group C) :** The MXRVO in function group C receives the STS-1 signal from the OLIU and converts it to seven VT-G signals each containing four VT1.5 signals. It then sends one VT-G signal to each of the seven DS1 low-speed circuit packs.
- **DS1 low-speed interface packs:** Each of the DS1 low-speed interface packs takes a VT-G signal from the MXRVO and converts it into four DS1 signals for customer use. The seven DS1 interface packs will provide 28 DS1 signals for the customer.

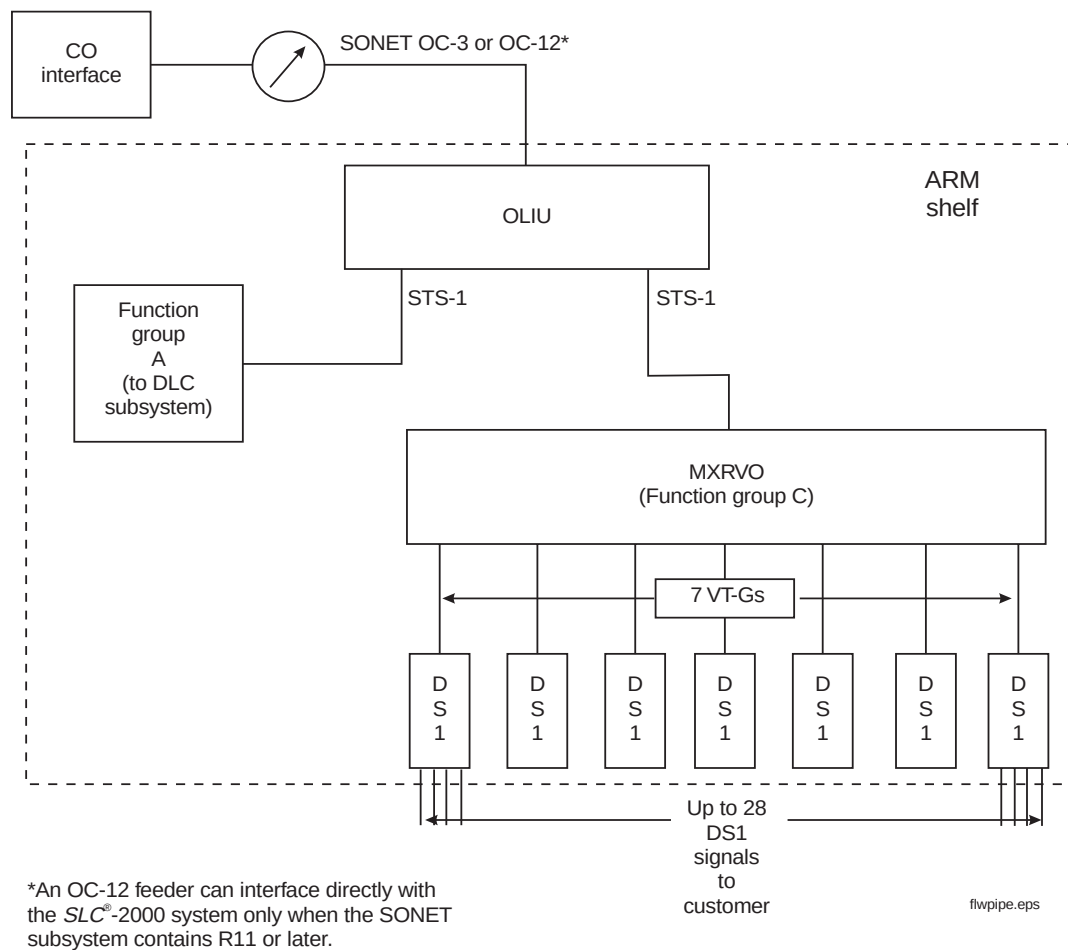


**Figure 5-9. Signal Flow in Systems Providing DS1 Pipes for Customer Use**

### SLC-2000 Access System Signal Flow for TR-303 Applications

As with the TR-08 applications, the bandwidth for the TR-303 application is received at the TSI via the SONET subsystem and VTUs. However, in TR-303 applications, this bandwidth terminates at the TSI where per call and nailed connections are made under the control of the local digital switch (LDS) via the time slot management channel (TMC) and embedded operations channel (EOC) channels on the bandwidth management processor (BMP) circuit pack. Full access concentration occurs at the TSI. For the TMC and EOC primary and secondary data links, the TSI provides connections to route these channels to the BMP circuit pack.

In TR-303 operation, the MDCs are programmed to route the channel unit bandwidth directly to the TSI, thus the T8U is not required for TR-303 operation. At the customer's option, the T8U may be used with TR-303 operation. This shelf can be TR-08 Mode 1 or Mode 2. Using checkerboarding, the subscriber lines can be cross-connected from this shelf to a TR-303 VRT. This routes the customer bandwidth via the T8U.



**NOTE:**

See Chapter 3 for cross-connect (checkerboarding) restrictions when using the Enhanced FiberReach/MSDT feature with Release R4.5.

## **Access Resource Manager (ARM) Shelf**

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There are two ARM shelves usable in the *SLC-2000* system and described in the following items:

- **J1C265AA-1, L3:** This ARM shelf is no longer available from Lucent Technologies and is rated "discontinued availability" (DA). However, if existing in the field, it still provides all the basic function unless otherwise specified in this document.
- **J1C265AA-1, L4:** This ARM shelf replaces the J1C265AA-1, L3 and includes a new backplane. Its advantage is that it allows you to use the system in the FITL mode as an HDT hosting a NBS without the need for a collocated WBS. It does this by using 26G2-U OLIUs in Function Group C. The SONET subsystem must contain software release R13 or later to perform this function.

The ARM shelf assembly (Figure 5-10) contains the common equipment for the system that provides the following:

- **Control function (PDC complex):** The ARM shelf assembly serves as the point of central control for the *SLC-2000* Access System ("PDC complex" in Figure 5-10).
- **Bandwidth management functions (bandwidth management complex):** This complex provides a direct link between the ARM shelf assembly and the MDS assemblies and supports features such as variable concentration for TR-303 configurations, electronic grooming, bandwidth shedding, and virtual remote terminals (VRTs).
- **SONET feeder function:** The ARM shelf assembly supports an integral SONET complex ("SONET feeder" and "DS1/VT feeder" in Figure 5-10).
- **DS1/VT feeder interfaces:** The ARM shelf assembly provides the interfaces between the bandwidth management complex and the SONET feeder or DS1 feeder (DSX-1) interfaces ("DS1/VT feeder" in Figure 5-10).



- **Integral test function (Integral Test Head):** The ARM shelf assembly supports an optional built-in loop testing function: the integral test head (ITH). The ITH routes signals from the internal system access points to the test access jacks on the user interface panel (UIP) for special services local test access.
- **DS1 distribution:** The ARM shelf assembly supports up to 28 DS1 signals for clear channel transport. These circuit packs, along with other packs in the SONET subsystem, can also be used to interface DSX-1 signals from the Server and multiplex them onto an OC-1 ring. This eliminates the need for a collocated WBS at the HDT. See Chapter 2 for an explanation of this multiplex feature.

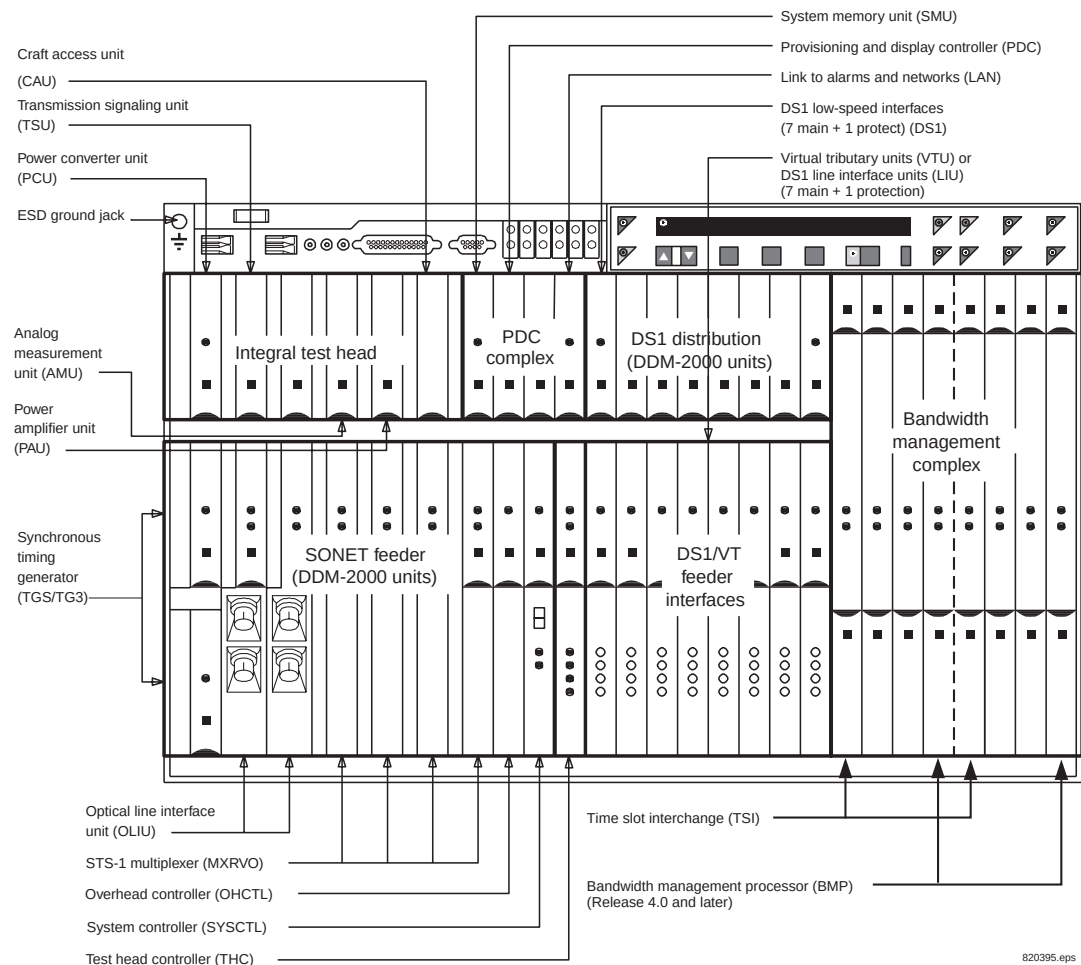


**Figure 5-10. Access Resource Manager Shelf Assembly — Major Functions**

## **Synchronous Optical Network (SONET) Feeder Section**

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The SONET feeder section (Figure 5-11) contains the DDM-2000 multiplexer units that terminate the SONET feeder. These units demultiplex the optical SONET signal into three synchronous transport signal level 1 (STS-1) signals and then into virtual tributary groups (VT-Gs). The SONET feeder section contains the following slots:

- Two controller slots (SYSCTL and OHCTL)
- Two timing and synchronization slots (TGS)
- Two optical line interface unit (OLIU) slots (MAIN)
- Four multiplexer slots (FUNCTION A and FUNCTION C).

All circuit packs in the SONET feeder section are identical to the circuit packs found in the DDM-2000 OC-3 shelf.



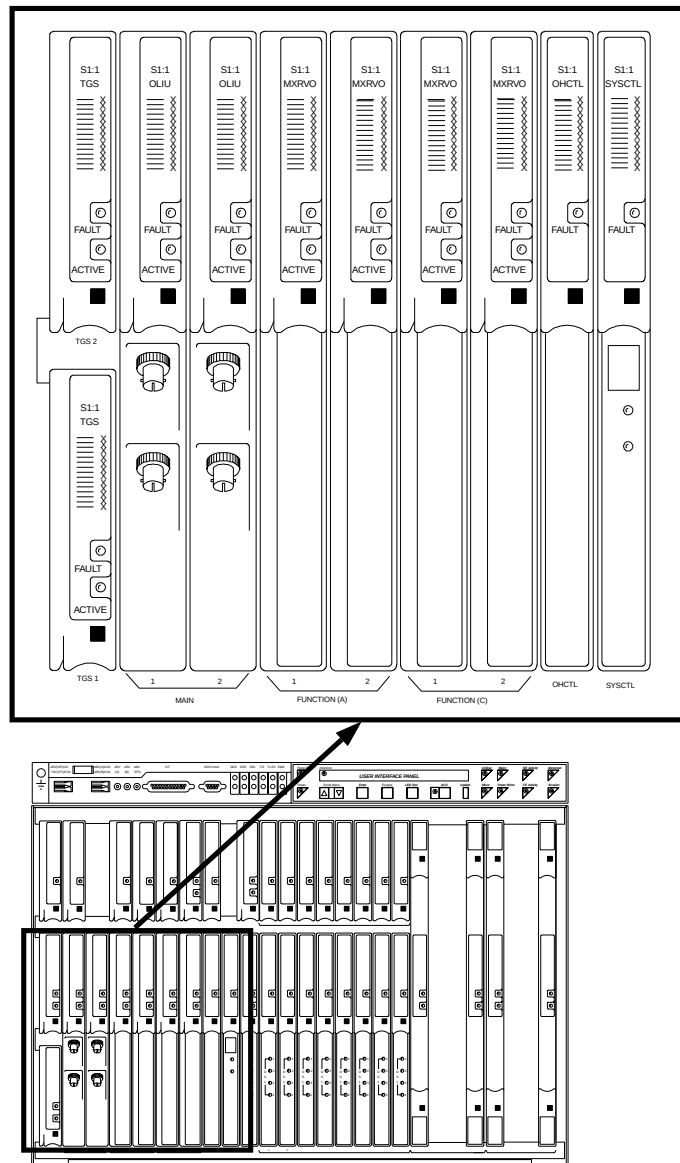
**NOTE:**

In a DSX-1 feeder configuration using LIUs, the system controller (SYSCTL), overhead controller (OHCTL), and DDM-2000 software are required to support the following:

- Software download
- CIT access
- TL1 interface
- CIT security
- Miscellaneous discrete alarm inputs.

The other SONET feeder slots do not need to be equipped.

**Slot Protection.** The controller slots (SYSCTL and OHCTL) do not affect service and are not protected. The transmission slots (TGS, MAIN, and FUNCTION) are protected automatically.



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**Figure 5-11. SONET Feeder Section**

### System Controller (SYSCTL) Slot

The system controller (SYSCTL) and the overhead controller (OHCTL) supervise the circuit packs in the SONET feeder and DS1 distribution sections of the ARM shelf. Failure of the system controller does not affect service. However, while the

system controller is in a failed condition or has been removed from the shelf, do not remove other circuit packs from the SONET subsystem.

The system controller handles part of the user interface to the SONET circuit packs, including VTU/LIU protection switching and control of the craft interface terminal (CIT) dialog (shared with the PDC). Also, the system controller terminates the alarm inputs for the power minor (PMN) alarm, external minor, and 14 miscellaneous alarms.

There are two versions of the SYSCTL depending on the SONET subsystem software release:

- ***SONET Subsystem Software Release 7.2 and earlier:*** These releases use the BBG5 SYSCTL. It has option switches that set system parameters and identification. The user may override some switch settings with the UIP and/or CIT. Default settings are provided. Refer to the SYSCTL description in 363-206-280 for details on switch settings and faceplate features.
- ***SONET Subsystem Software Release 9.0 and later:*** These software releases use the BBG8 SYSCTL. Unlike the BBG5, this controller only has two sets of option switches that set the following:
  - Product identification
  - Telemetry byte-oriented serial (TBOS) termination.

All other parameters normally set by hardware switches on the BBG5 are now set using the CIT on the BBG8.



**NOTE:**

Never update the system with the UPD/INT button on the SYSCTL circuit pack. To update the system, use the ***Update*** button on the UIP.

## **Overhead Controller (OHCTL) Slot**

The overhead controller (OHCTL) and the system controller provide control and interface functions for the SONET subsystem. Failure of the overhead controller does not affect service. However, while the overhead controller is in a failed condition or has been removed from the shelf, do not remove other circuit packs from the SONET subsystem. The overhead controller terminates the overhead channel from the MAIN slots (and the FUNCTION slots when OC-3 extensions are used). The SONET overhead channel includes a 19.2-kb/s data communications channel (DCC) and 64-kb/s order-wire channel.

There are two versions of the OHCTL depending on the SONET subsystem software release:

- ***SONET Subsystem Software Release 7.2 and earlier:*** BBG7
- ***SONET Subsystem Software Release 9.0 and later:*** BBG9.

## Synchronous Timing Generator (TGS) Slots

The BBF2( ) (BBF2 or BBF2B) TGS circuit pack or the BBF4 TG3 circuit pack (SONET Subsystem software release R13 or later) provides loop-timing, external timing, or free-running synchronization for the SONET feeder. The circuit pack is protected using a 1 × 1 configuration (TGS 1 and TGS 2).

## MAIN and Function Unit Slots

The MAIN slots provide the SONET interface for the SONET feeder in linear, ring, and add/drop applications. The function unit slots provide two multiplexer groups.

- **The "A" SONET multiplexer group (FUNCTION A)** — interfaces with the DLC subsystem
- **The "C" SONET multiplexer group (FUNCTION C)** — supports the following:
  - Digital services (DS1, DS3, etc.)
  - Optical extensions (OC-3, IS-3, OC-1)
  - Electrical extensions (EC-1).

The FUNCTION A slots are equipped with MXRVO (VT to STS-1) multiplexer units that interface the DLC subsystem.

The FUNCTION C slots support MXRVO multiplexer units for DS1 distribution applications or OLIU units for linear drop applications. In VT1.5 path switched ring applications, the FUNCTION C slots may be equipped with MXRVO multiplexer units. FUNCTION C slots also support DS3 and STS1E (EC-1) circuit packs.

In *SLC-2000* Software Release 4.3 and later, FUNCTION C can contain 27G-U OLIUs. These OLIUs can provide a "host" for the DDM-2000 FiberReach WBS OC-1 ring (SONET Subsystem Software Release 9.0 and later). When used in this configuration, the WBS uses FUNCTION C for an X.25 interface. It also derives its timing from the TGS circuit packs in the ARM shelf. If using a J1C265AA-1, L4 ARM shelf and SONET subsystem software release R13 or later, FUNCTION C can eliminate the need for a collocated WBS when the *SLC-2000* HDT hosts a NBS in a FITL configuration. In this application, the DS1 circuit packs receive DSX-1 signals from the Servers in the MDS assembly and multiplex them into VT-Gs. The DS1 circuit packs send the VT-Gs to 26G2-U OLIUs to be multiplexed onto an OC-1 signal. This also allows the ARM shelf to host any other WBSs in the connection with the ONU.

Since they affect service, the MAIN, FUNCTION A, and FUNCTION C slots are protected using a 1 × 1 configuration.

## Optical Line Interface Unit (OLIU) Operation

**Transmit Direction.** The STS-1 router selects three of the STS-1 signals received from other Main and function unit slots or from the VT1.5 cross-connection,

depending on the application. In VT1.5 cross-connect applications, SONET *path* overhead is added before the STS-1 signals are sent to the multiplexer. The multiplexer circuitry takes the three STS-1 signals from the output of the router, adds SONET *transport* overhead, then byte-interleaves and scrambles the signal in a frame synchronous scrambler. The output from the multiplexer is an STS-3 format and is used to amplitude modulate the laser or light-emitting diode (LED) transmitter, which converts the electrical signal to an NRZ-encoded OC-3 or IS-3 optical signal, respectively.



**NOTE:**

For the operational description of the 24G-U OLIU when interfacing an OC-12 signal, see "**24G-U Optical Line Interface Unit (24G-U OLIU).**" on page 5-32.

**Receive Direction.** In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-3/OC-12 or IS-3 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock (155.520 MHz) and uses it to re-time the received data. The demultiplexer circuit accepts the re-timed STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes SONET transport overhead. The overhead information is sent to the SYSCTL via the intrashelf control bus and the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the pointer processor that performs pointer interpretation and generation on each received STS-1 using the local timing signals. The output of the pointer processor is three STS-1 signals, frame synchronous to each other. The STS-1 router sends each of the three STS-1 signals to the Main or function unit slots or VT1.5 pointer processor on the OLIU, as appropriate.

In VT1.5 cross-connect applications, VT1.5 pointer processing is done on each STS-1 that is to be VT1.5 cross-connected. STS-1 path overhead termination is also done on these VT1.5 based signals. STS-1s that do not require VT1.5 cross-connections are passed through without VT1.5 pointer processing or STS-1 path overhead termination. The output from the VT1.5 pointer processor is sent to the STS-1/VT1.5 router. The router cross-connects the appropriate VT1.5 tributaries and sends each of the three STS-1 signals to the appropriate Main or function unit slots.

**Control Functions.** The OLIUs provide maintenance elements for reporting circuit pack status, status of the incoming optical and electrical signals, as well as inventory information (*CLEI*<sup>\*</sup> code, date of manufacture, etc.). The OLIUs also process transport overhead and respond to control signals from the SYSCTL for functions such as STS-1 routing, protection switching, and LED lighting. If VT1.5

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\* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

cross-connected, the 22-type OLIUs also process path overhead and provide VT1.5 routing functions.

**Maintenance Signal Functions.** The OLIU circuit pack provides maintenance signaling for the STS-1 path alarm indication signal (AIS), OC-3 line AIS, STS-1 path unequipped, and line far-end-receive failure (FERF) signals. The 22-type OLIUs (if VT1.5 cross-connected) also provide maintenance signaling for VT1.5 path AIS and STS-1 path yellow signals.

### OLIU Applications

The code of the OLIUs used in the Main or function slots generally depends on several factors, as follows:

- System application (linear, ring, add/drop)
- Fiber mode (singlemode or multimode)
- Fiber connection (*ST*<sup>®</sup> lightguide cable connectors or universal optical connectors).

Table 5-3 highlights the differences between each code of OLIU.

**Table 5-3. Optical Line Interface Unit (OLIU) Comparison**

| <b>OLIU Code</b> | <b>System Applic.</b> | <b>Reach</b> | <b>Fiber Mode</b>    | <b>Connector</b>                  | <b>Typical<br/>SLC<sup>®</sup>-2000<br/>Slot Location</b> |
|------------------|-----------------------|--------------|----------------------|-----------------------------------|-----------------------------------------------------------|
| 21D              | OC-3 Linear           | Short        | Multimode            | <i>ST</i> <sup>®</sup> lightguide | Main                                                      |
| 21D-U            | OC-3 Linear           | Short        | Multimode            | Universal optical                 | Main                                                      |
| 21G              | OC-3 Linear           | Long         | Single- or multimode | <i>ST</i> lightguide              | Main                                                      |
| 21G-U            | OC-3 Linear           | Long         | Single- or multimode | Universal optical                 | Main                                                      |
| 22D-U            | OC-3 Linear or ring   | Short        | Multimode            | Universal optical                 | Main                                                      |
| 22F              | OC-3 Linear or ring   | Intermediate | Single- or multimode | <i>ST</i> lightguide              | Main                                                      |
| 22G-U/22G2-U     | OC-3 Linear or ring   | Long         | Single- or multimode | Universal optical                 | Main                                                      |
| 24G-U            | OC-12 Ring            | Long         | Single-mode          | Universal optical                 | Main                                                      |
| 26G2-U           | OC-1 Ring             | Intermediate | Single- or multimode | Universal optical                 | Function C                                                |
| 27G2-U           | OC-1 Ring             | Long         | Single- or multimode | Universal optical                 | Main or Function C                                        |

For details of any of the above OLIUs, see one of the following documents depending on the SONET subsystem software release:

- **SONET Software Release 7.2 and earlier:** 363-206-202, *DDM-2000 Multiplexer User/Service Manual*
- **SONET Software Release 9.0 and later:** 363-206-280, *DDM-2000 Multiplexer User/Service Manual, Releases 8 and Higher.*
- **SONET Software Release 13.0 and Later:** 363-206-285, *DDM-2000 Multiplexer, Releases 13 and Higher User/Service Manual.*

**21D/21D-U Optical Line Interface Unit (21D/21D-U OLIU).** The 21D/21D-U OLIU circuit pack multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives an LED transmitter to create the IS-3 output.

The received IS-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. The STS-1 signals go through a pointer processor to guarantee frame alignment to the local system clock before being routed to the other Main and function unit slots.

The 21D/21D-U OLIU circuit pack provides timing signals to and receives timing signals from the TGS circuit packs.

Fiber access for the 21D OLIU is via a pair of *ST* lightguide cable connectors from the 21D OLIU circuit pack faceplate. A faceplate-mounted universal optical connector allows the 21D-U OLIU to accept fiber terminated with TBOS, SC, or FC connectors. The 21D-U OLIU comes with a 0 dB *ST* buildout. Various combinations of buildouts and connectors are also available. The 21D/21D-U OLIU circuit pack provides cost effective interconnect for intraoffice applications and is used only for DDM-2000 OC-3 and OC-12 interworking over multimode fiber.



**21G/21G-U Optical Line Interface Unit (21D/21G-U OLIU).** The 21G/21G-U OLIU multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. The STS-1 signals go through a pointer processor to guarantee frame alignment to the local system clock before being routed to the other Main and function unit slots.

The 21G/21G-U OLIU provides timing signals to and receives timing signals from the TGS circuit packs.

Fiber access for the 21G OLIU is using a pair of *ST* lightguide cable connectors from the OLIU faceplate. A faceplate-mounted universal optical connector allows the 21G-U OLIU to accept fiber terminated with *ST*, *SC*, or *FC* connectors. Various combinations of buildouts and connectors are also available. The 21G/21G-U OLIU photonics comply with SONET long-reach specifications. While singlemode fiber is suggested for optimum performance, multimode facilities are also supported.

**22D-U Optical Line Interface Unit (22D-U OLIU).** The 22D-U OLIU circuit pack multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives an LED transmitter to create the IS-3 output.

The received IS-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. The STS-1 signals go through a pointer processor to guarantee frame alignment to the local system clock before being routed to the other Main and Function Unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a VT1.5 cross-connection.

The 22D-U OLIU circuit pack provides timing signals to and receives timing signals from the TGS circuit packs.

**22F Optical Line Interface Unit (22F OLIU).** The 22F OLIU multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed into three STS-1 signals, and transport/path overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other Main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a VT1.5 cross-connection.

Each 22F OLIU provides timing signals to and receives timing signals from the TGS circuit packs.

Fiber access is by a pair of *ST* lightguide cable connectors from the OLIU faceplate. The 22F OLIU photonics comply with SONET intermediate-reach specifications. While single-mode fiber is suggested for optimum performance, multimode facilities are also supported as long as a singlemode jumper is placed between the 22F OLIU optical output connector and the multimode fiber. The 22F OLIU provides full VT1.5 and STS-1 add/drop capability. If the VT1.5 signals in an incoming STS-1 are to be cross-connected, the 22F OLIU pack provides VT1.5 pointer processing and STS-1 path termination for that STS-1 signal. All VT1.5 signals that enter the 22F OLIU, whether from the backplane or the optical interface, may be cross-connected to STS-1 signals.

The 22F OLIUs cannot be mixed with 21G or 21D OLIUs within a *SLC-2000* ARM shelf. The 22F and 21G OLIUs are compatible, however, at opposite ends of a point-to-point system. The 22F OLIU supports shorter optical span lengths than the 21G OLIU.

**22G-U Optical Line Interface Unit (22G-U OLIU).** The 22G-U OLIU/22G2-U multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed into three STS-1 signals, and transport/path overhead is accessed. Some of the overhead (for example, section data communications channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other Main and function unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a limited VT1.5 cross-connection.

Each 22G-U/22G2-U OLIU provides timing signals to and receives timing signals from the TGS circuit packs.

**24G-U Optical Line Interface Unit (24G-U OLIU).** The 24G-U OLIU circuit pack used in the SONET subsystem of the ARM shelf interfaces with a 1310 nm OC-12 optical line in the transmit and receive directions. The 24G-U has the following similar functions with the 22-type OLIU circuit packs except that it supports OC-12 long reach applications:

- Add/Drop configurations
- Ring Configurations with its VT1.5 and STS-1 capabilities.

The distributed feedback laser supplies an NRZ-coded signal. Optical transmit power is monitored by a companion device to the laser transmitter that monitors the backface diode current and adjusts the laser diode bias current to maintain a constant average optical power output. This mechanism corrects any power variations because of laser aging or environmental conditions.

A pair of *ST*, *SC*, or *FC-PC* universal optical connectors on the faceplate provide access to the fiber. Because of the increased data rates, this OLIU interfaces with single-mode fiber only.

The 24G-U OLIU's TSI performs cross-connections from the MAIN slot and it has access to the entire capacity of the OC-12 signal. Up to 3 of the 12 STS-1s in the OC-12 are available to the TSI, but the other STS-1s are passed through a faceplate connector to the 24G-U in the other MAIN slot for ring functionality. The 3 STS-1s are user selectable.

The TSI function for a given STS-1 channel is provisionable for VT1.5 or STS-1 operations. When VT1.5 cross-connections are performed, STS-1 path overhead is inserted and accessed. In addition to these cross-connect functions, the TSI provides VT1.5 and STS-1 path selection (protection switching) between MAIN slots 1 and 2 for self-healing ring applications. This path selection is based on hard failures as well as VT1.5/STS-1 signal BER degradation.

In the transmit direction, STS-1 signals from the backplane first encounter the TSI function. In the MAIN slot, the TSI is controlled by user provisioning. It connects time slots from function group A toward the MAIN fiber, or back to function group C. Incoming time slots from function group C may be connected back out to A (dropped traffic) or connected to the MAIN OC-12 transmitter.

The three STS-1 outputs of the TSI are cross-connected with the 12 STS-1s from the companion 24G-U passed in from the faceplate connector. The pointers are aligned and transport overhead is inserted. Finally, these 12 STS-1 signals are multiplexed to an STS-12 signal (622 Mb/s), that is converted to the transmitted OC-12 optical signal.

In the receive direction, the incoming OC-12 optical signal is converted to an electrical STS-12 signal and demultiplexed to 12 STS-1 signals, and the transport overhead bytes are extracted. After pointers are realigned to the local system clock, three of the 12 STS-1s are selected for input to the TSI and all 12 STS-1s are passed through the faceplate connector to the companion 24G-U in the other

MAIN slot. The TSI cross-connects time slots from the fiber to the Function unit time slots.

**26G2-U Optical Line Interface Unit (26G2-U OLIU).** The 26G2-U OLIU circuit pack interfaces with a 1310 nm OC-1 optical line in the transmit and receive directions and supports SONET subsystem self-healing ring configurations through its VT1.5/STS-1 TSI capabilities. The 26G2-U OLIU circuit pack photonics exceed the SONET span lengths specified for the intermediate reach requirements. Fiber access is via a pair of universal optical connectors. While a single mode fiber is suggested for optimum performance, multimode facilities are also supported.

The 26G2-U OLIU is installed in Function Unit C of the ARM shelf. It provides an interface between an OC-1 optical line and electrical VT-G signals. In the Transmit direction, it multiplexes up to seven VT-G signals from the low-speed slots into an STS-1 signal. VT1.5 signals can be cross-connected and switched as needed. The SONET path overhead, as well as transport overhead bytes, are added on this circuit pack. The STS-1 signal is then scrambled and converted to an OC-1 optical signal.

In the receive direction, the 26G2-U OLIU terminates an OC-1 signal, converts it into an electrical signal, recovers timing, unscrambles the signal, synchronizes with the incoming SONET STS-1 frame, and processes the overhead. Then the signal goes through STS-1 pointer interpretation and the path overhead is removed and processed. The VT-G signals are removed from the STS-1 payload and transmitted via backplane to the low-speed or function slots.

**27G-U Optical Line Interface Unit (27G-U OLIU).** The 27G-U OLIU, for each STS-1, inserts SONET transport overhead bytes (line and section), and for VT1.5 applications, inserts STS path overhead bytes and scrambles the resulting signal. Each STS-1 signal drives a separate laser transmitter to create the two OC-1 outputs.

A received OC-1 signal is converted back to an electrical STS-1. This STS-1 is descrambled and demultiplexed and transport/path overhead is accessed. Some of the overhead (for example, section data communications channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on board. The STS-1 signals go through a pointer processor to guarantee STS-1 frame alignment to the local system clock before being routed to the other Main and Function Unit slots.

If an incoming STS-1 signal from the fiber is to be VT1.5 cross-connected, VT1.5 pointer-processing is performed on this pack and STS-1 path overhead termination is performed on these signals. All signals entering this pack from either the backplane or from the optical interface may be routed as STS-1s. If appropriate, VT1.5 routings may be established between STS-1s using a limited VT1.5 cross-connection. Each 27G-U OLIU provides timing signals to and receives timing signals from the TGS circuit packs.

## **Multiplexer Applications**

The FUNCTION A slots are equipped with multiplexer units that convert the virtual tributary groups (VT-Gs) (containing the DS1s) into an STS-1 signal.

### **VT to STS-1 Multiplexer (MXRVO)**

The VT to STS-1 BBG2 multiplexer circuit pack (MXRVO) multiplexes seven VT-G signals from the VTU packs (in the DS1/VT feeder interface) or from the DS1 packs (in the DS1 distribution section) into an STS-1 signal.

### **DS1 Low-Speed Interface (Eight Slots)**

The DS1 low-speed interface section (Figure 5-12) provides DS1 distribution from the "C" SONET multiplexer group (FUNCTION C) for up to 28 DS1 *pipes* (customer DS1 inputs). Each slot in this section accepts up to four DS1 signals (at standard DSX-1 levels) for clear channel transport.

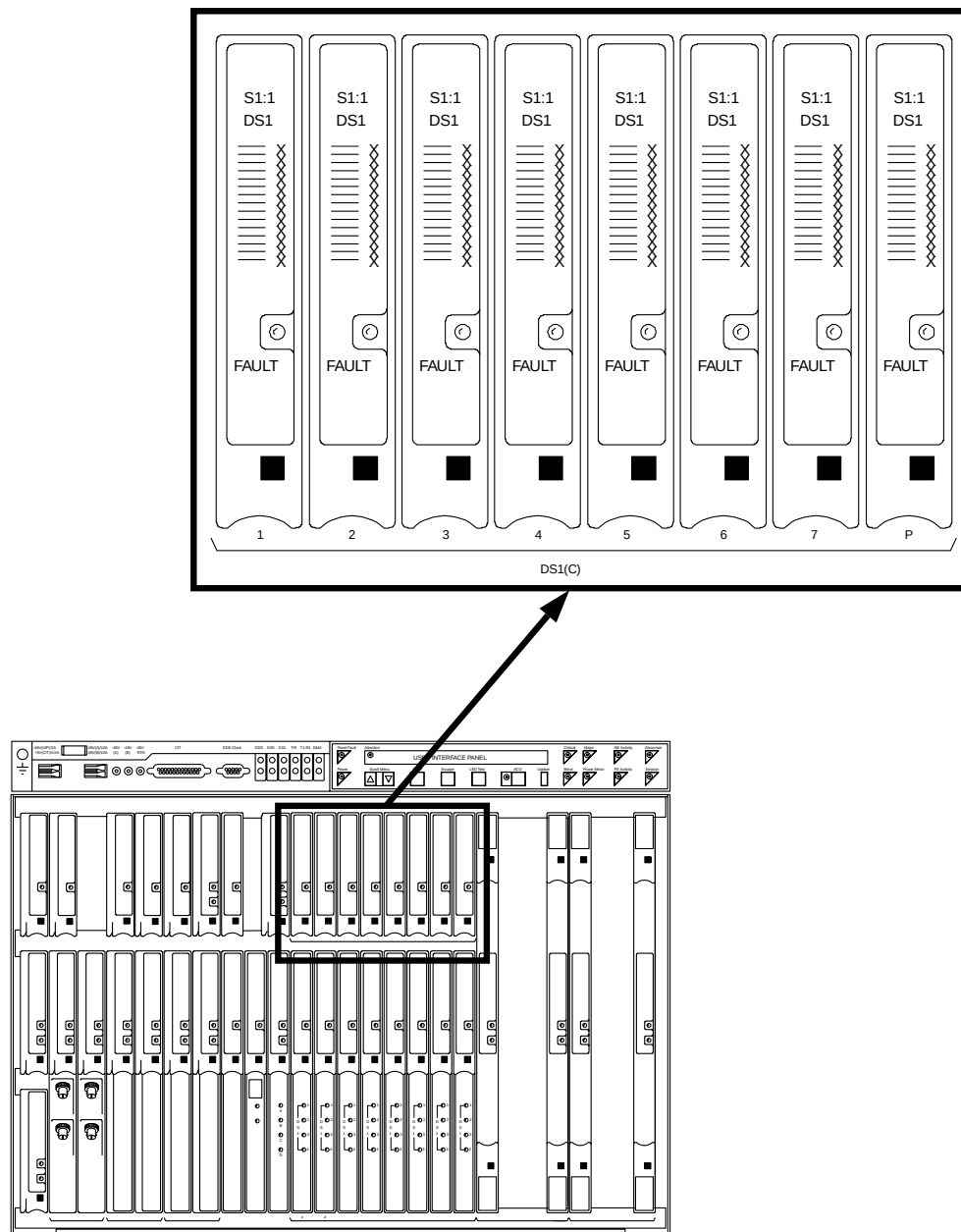
The slots are protected using a  $1 \times N$  configuration, where  $N = 1$  to 7 depending on the number of equipped slots. The 177A retainer card is used in the empty slots in this section so that protection switching will operate properly. If the retainer card is not used, transmission may be corrupted. The maximum number of circuit packs in this section is eight (1 through 7 service plus P for protection).

The DS1 circuit pack (BBF1B or BBF3) interfaces the DSX-1 on the *low-speed* side and the "C" SONET multiplexer group on the *high-speed* side. The DS1 circuit pack multiplexes four external DS1 interfaces into a SONET virtual tributary (VT) group (VT-G) signal. The VT-G is an intermediate step in multiplexing between DS1 and STS-1 signals and contains four DS1 signals.

In the transmit direction, four DS1 signals are mapped into floating mode asynchronous VT1.5s with VT path overhead then multiplexed into the VT-G signal. The VT-G signal is sent to the STS-1 multiplexer circuit pack (MXRVO for the "C" SONET multiplexer group).

In the receive direction, a VT-G received from the STS-1 multiplexer circuit pack is demultiplexed into four VT1.5 signals and passed through circuitry to interpret VT pointers and access path overhead. Finally, the DS1 payload is extracted from each VT1.5 and transmitted to the DSX-1.

The DS1 circuit packs can also interface DSX-1s from the Servers in the MDS assemblies to the SONET subsystem and multiplex them directly to an OC-1 ring. In a FITL configuration where the HDT is hosting a NBS through an OC-1 ring, this eliminates the need for a collocated WBS at the HDT. See Chapters 2 and 3 for details of these configurations.



ds1pipe.eps

**Figure 5-12. DS1 Low-Speed Interface Section**

## Feeder Section (DS1 / VT Feeder Interface) (Eight Slots)

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The DS1/VT feeder interface section (Figure 5-13) interfaces between DLC CORE (bandwidth section) and the SONET feeder or DS1 feeder (DSX-1) interface.

- **For SONET configurations:** This section contains the virtual tributary units (VTUs) that convert the SONET VT-Gs to the internal transmission format for the bandwidth management complex.
- **For DSX-1 feeder configurations:** This section contains metallic DSX-1 feeder cards, also called line interface units (LIUs).

**Slot protection:** The slots are protected using a  $1 \times N$  configuration, where  $N = 1$  to 7 depending on the number of equipped slots. The maximum number of circuit packs in this section is eight (1 through 7 service plus P for protection).

The VTU/LIU circuit terminates feeder DS1 signals. The VTU/LIU detects and reports failures associated with the DS1 signals such as alarm indication signals (AISs) and loss of frame (LOF). The DS1 indicators on the VTU/LIU faceplate (Figure 5-13) show failure of the DS1 inputs to the VTU/LIU and indicate received TR-08 digroup alarms and TR-303/integrated network access (INA) received yellow alarms.

At least one working CORE\* must be present in the bandwidth management complex for the VTU/LIU to operate properly. The SYSCTL and PDC also are required to power up a VTU/LIU. The system automatically installs the software on the VTU/LIU from the system memory unit (SMU) when the VTU/LIU is inserted into the shelf and the SMU is enabled.

To change the system configuration to SONET or DSX-1 feeder, use the **SET-FEEDER** command on the UIP.

## Virtual Tributary Unit (VTU)

The BBG266 VTU provides transmission for four DS1/VT1.5 signals. It converts signals from the VT group format (between the MXRVO and VTUs) to DS1 signals in the internal format (between TSI and VTUs).

## DS1 Line Interface Unit (LIU)

The BBG267 LIU circuit pack maps four sets of 24 DS0 channels (from the TSI/BMP) into DS1 signals for a DSX-1 cross-connection. The LIU replaces the VTU in Figure 5-13 for DS1 feeder applications. With metallic feeder, the SYSCTL (with software) and OHCTL circuit packs are required; however, the SLC-2000

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\* TSI circuit pack for R3.2, TSI/BMP pair for R4.0 and later.



Access System cannot be optically connected with other network elements in a SONET network.

The BBG268 retainer card is required in the empty slots in this section so that circuit pack protection switching will operate properly. If the retainer card is not used, transmission may be corrupted.

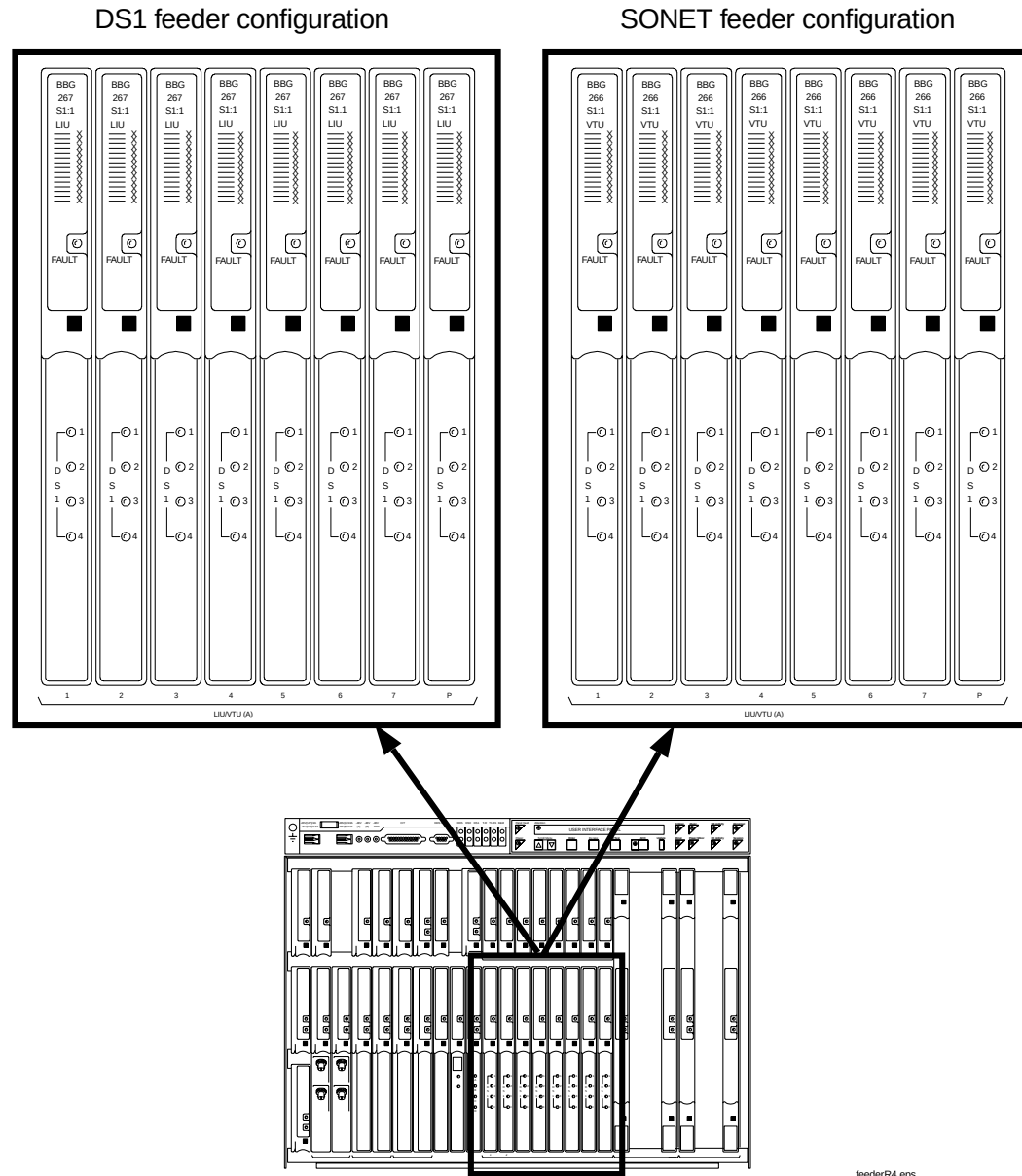


Figure 5-13. DS1/VT Feeder Interface Section

## **Provisioning and Display Controller (PDC) Complex**

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Figure 5-14 shows the location of the PDC complex in the ARM shelf.



**NOTE:**

While the SMU or PDC is failed or when it has been removed from the shelf, do not remove other circuit packs from the DLC subsystem or perform any provisioning functions.

### **PDC Slot**

The BBF240 PDC or the BBF241 PDC is a microprocessor-controlled circuit pack that provides high-level control of user interactions with the system. Software on this circuit pack is installed from the system memory unit (SMU). Failure of a PDC does not affect service. However, while the PDC is failed, the UIP and CIT interfaces are unavailable for any operation, administration, maintenance, and provisioning (OAM&P) operations, and no alarms will be reported.

The BBF240 is used with Releases 3.1, 3.2, and 3.3. The BBF241 is used with Release 4.0 and later.

The PDC collects alarm information and reports it through indicators and the UIP alphanumeric display. It also controls the dialog between the UIP or CIT and the system. The PDC shares control with the system controller (SYSCTL).

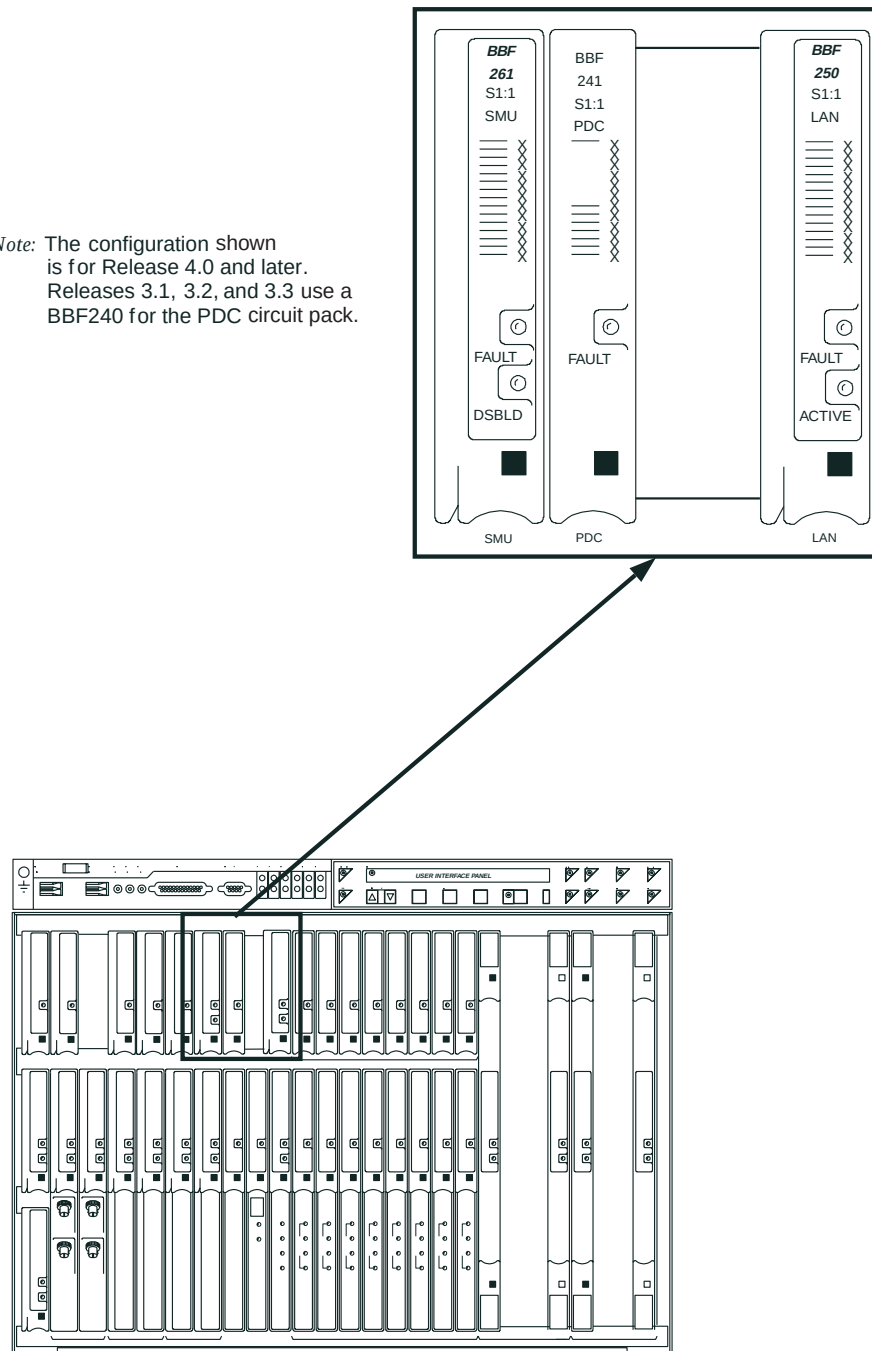
### **System Memory Unit (SMU) Slot**

The BBF261 SMU contains the DLC subsystem software for the *SLC-2000* Access System. For more detail, see the section on software architecture in this chapter. Failure of an SMU does not affect service as long as the system is not installing software when the failure occurs.

The SMU and a working PDC must be present in the ARM shelf to ensure that the common circuit packs in the DLC subsystem will have the correct software. If a controller pack in the DLC subsystem (PDC, TSI/BMP, VTU, MDC) is inserted with no software or with incompatible software, the system automatically installs the DLC software from the SMU into the circuit pack when the SMU is enabled.

Software is downloaded to the SMU from floppy disks using a personal computer as a CIT. Installation of the software into the DLC subsystem is enabled using UIP or CIT commands. You can also download software over the SONET DCC link.

*Note:* The configuration shown is for Release 4.0 and later. Releases 3.1, 3.2, and 3.3 use a BBF240 for the PDC circuit pack.



pdcR4.eps

**Figure 5-14. PDC Complex**

## Link to Alarms and Networks (LAN) Slot

The BBF250 LAN card is required at the COT. It is needed at the RT only if an external remote test unit (RTU) is to be used for special services testing or if CIT rear access is needed. It provides the interface to the following three ARM control ports:

- **Rear CIT Port (J182)** (Release 3.2 and later). This port provides an EIA-232 interface for the CIT. It is configured as a data terminal equipment (DTE) interface. You may connect a modem to this interface for remote CIT operations.
- **1A ATU Control Port (J183)** (Release 3.2 and later). This port provides the interface between the ARM shelf and the alarm test unit (ATU) panel.
- **RTU Control Port (J44)**. This port provides an interface between the ARM shelf and an external RTU for special services testing.

## Bandwidth Management Section

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The bandwidth management section is the transmission hub of the SLC-2000 Access System and provides the interface between the SONET or DSX-1 feeder and the subscriber distribution. The bandwidth management section provides synchronization and time slot interchange functions. For TR-303 operation, the bandwidth management section also supports the time slot management channel (TMC) and embedded operations channel (EOC) interfaces to the local digital switch.

To ensure that call processing functions are protected from failures, the bandwidth management section contains two sides:

- CORE (1)
- CORE (2).

In Release 3.1 and Release 3.2, the CORE (1) and CORE (2) slots are equipped with the TSIs shown in Figure 5-15. For Release 4.0 and later, CORE (1) and CORE (2) slots are additionally equipped with BMPs. The remaining slots are reserved for future use.

The system designates one of the COREs as *active*. The circuit packs in the active CORE will have a lighted green ACTIVE indicator. The system designates the other CORE as *standby* to provide protection for the slots in the active CORE. If the system detects a fault on a circuit pack in the active CORE, it switches all activity from the active CORE to the standby CORE. (All slots in the core are switched as a unit.)

After the system has been turned up, it executes an *automatic side switch* of the CORE at 3:00 a.m. each day for internal diagnostic purposes. For a TR-303 VRT, active jobs may be terminated with a processing failure response when the daily side switch occurs.

## Time Slot Interchange (TSI) Slot

The *BDK*<sup>®</sup> 250 TSI allows a nonblocking, full access, time slot interchange of maximum number of distribution time slots (768 or 1152) onto 672 feeder time slots. In TR-08 Mode 1 digroups, TR-303 VRTs, and INA DS1s, the TSI allows any distribution channel to be mapped to any feeder channel. It also supports the following bandwidth management applications:

- Grooming of nonswitched special services to INA DS1s.
- Shedding of the unused bandwidth in FITL and fractional DS1 applications such as:
  - With FITL, where the services assigned will likely be 12- and 24-line ONUs with widely varying applications.

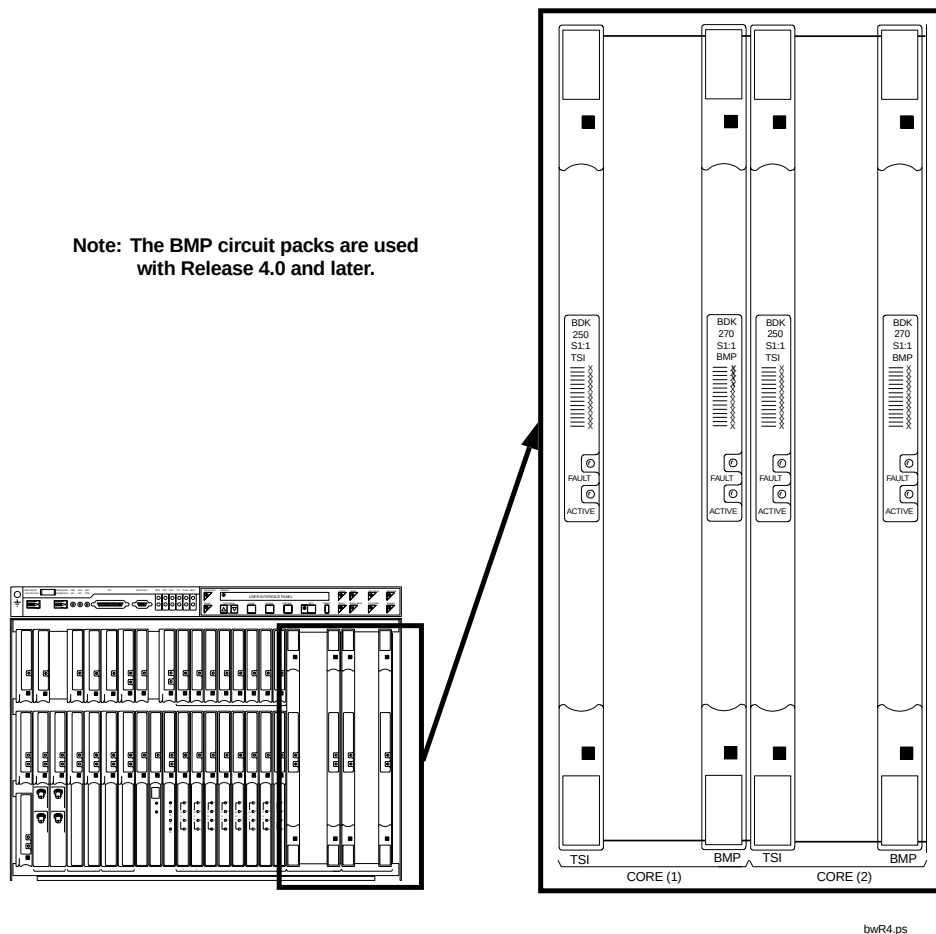


Figure 5-15. Bandwidth Management Section

- With special service circuit packs that support only single or dual circuits, the unused feeder circuits are not wasted (each MDS channel unit slot will support four circuits).
- With the re-use of *SLC*<sup>®</sup> Series 5 single or dual circuit packs, feeder capacity is not lost.
- Simplifying procedures for growth, load balancing, and RT/HDT line moves with VRTs.
- Packing of TR-303 Integrated Services Digital Network (ISDN) D-channel quarter time slots using 4:1 time-division-multiplexing (Release 4.0 and later).

For details, see Chapter 3.

### **Bandwidth Management Processor (BMP) Slot**

The *BDK270* BMP consists of two processors that support the TR-303 interface. Both processors support the data link path switching required by TR-303 as follows:

- ***Time Slot Management Channel (TMC) processor.*** This processor supports the TMC protocol with the local digital switch for call processing. It interfaces with the channel units to detect on-hook/off-hook signaling and reports these actions to the local digital switch. It also interfaces the TSI for transmission communication and control as requested by the LDS.
- ***Embedded Operations Channel (EOC) processor.*** This processor supports EOC functions of TR-303. These functions include provisioning of line terminations, semipermanent time slot assignment (nailup at the RT), reporting of alarm events, circuit testing, setting of performance monitoring parameters, and reporting of performance monitoring data.

### **Integral Test Head (ITH)**

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The ITH provides local test access (see Chapter 7). The ARM shelf contains the ITH (optional) (Figure 5-16), which consists of the following components:

- Test head controller (THC)
- Analog measurement unit (AMU)
- Power amplifier unit (PAU)
- Craft access unit (CAU)
- Transmission/signaling unit (TSU)
- Power converter unit (PCU).

### Test Head Controller (THC) Slot

The BBG220 THC is a microprocessor-based circuit pack that handles all processing and control functions for the integral test head (ITH). The THC configures the ITH measurement modules (the PAU, AMU, and TSU) for testing.

### Analog Measurement Unit (AMU) Slot

The BBF221 AMU contains precision analog measurement circuits for plain old telephone service (POTS) testing. The AMU and power amplifier unit (PAU) together form the multimeter function for the ITH.

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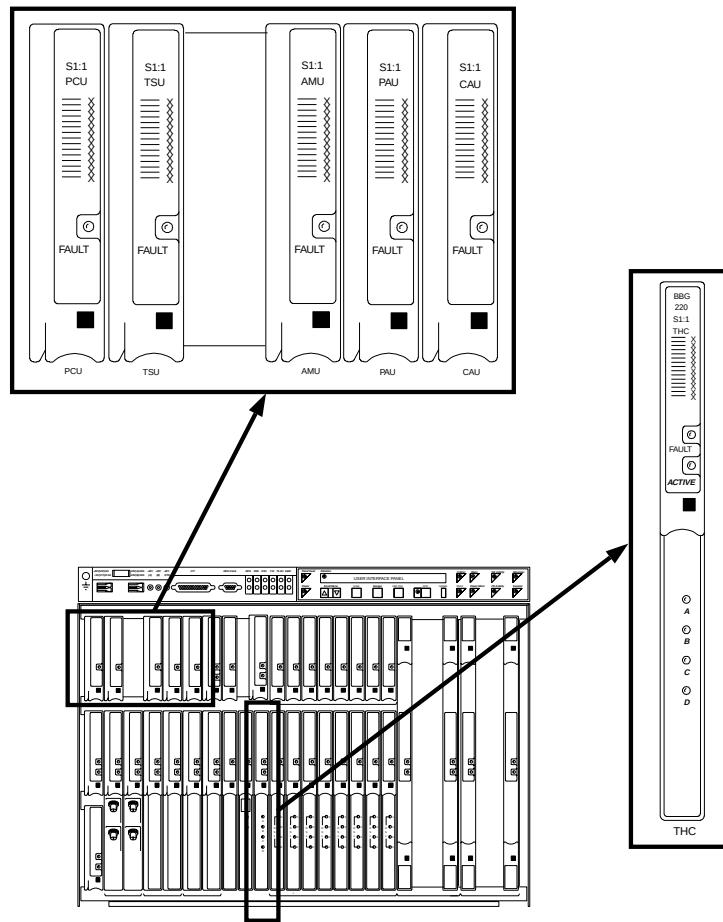


**Figure 5-16. Integral Test Head Location**

### **Power Amplifier Unit (PAU) Slot**

The BBF222 PAU contains a programmable voltage source and works with the AMU.

### **Craft Access Unit (CAU) Slot**

The BBF225 CAU provides maintenance personnel with local test access, metallic access, and DDS access through jacks located on the UIP (in response to CIT commands). The CAU is required only for local test access.

### **Transmission Signaling Unit (TSU) Slot**

The BBF223 TSU provides a 2- or 4-wire transmission interface and the required signaling features such as ringing, source battery, and loop closure.

### **Power Converter Unit (PCU) Slot**

The BBF220 PCU provides power to the ITH circuit packs.

## **User Interface Panel (UIP)**

---

The user interface panel (UIP) is shown in Figure 5-17. The UIP provides a central focus for system alarms, status displays, various controls, and control interfaces. The UIP contains a single-line 24-character alphanumeric display that provides system maintenance and alarm information. It also contains test jacks, an EIA-232-D port for CIT access, and a set of push buttons that control the display and affect certain maintenance activities.

For more complex operations, such as special services provisioning or DS0 time slot cross-connections, the CIT used with DDM-2000 is compatible with the *SLC-2000 Access System*. The CIT may be located remotely at a centralized work center or locally with the *SLC-2000 Access System* as follows:

- **For local operation**, the CIT plugs into a jack on the UIP to access the system for commands and reports. Detailed parameters (command specifications) can be entered from the CIT keyboard to provision specific units and system options and retrieve complete reports. (The UIP provides retrieval of basic reports.)
- **For remote operation**, the remote login feature is available in SONET feeder configurations. Also, the CIT may be plugged into a modem connected to the LAN circuit pack (the rear CIT port). For procedural details, see 363-208-003, *SLC-2000 Access System Commands and Messages*.



The UIP (Figure 5-17) supports installation and maintenance functions including the following:

- Alarm display
- Alarm and fault reports
- Basic provisioning
- Maintenance jacks
- Craft interface terminal (CIT) connection.

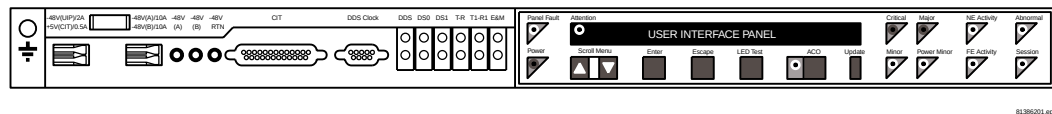


**Figure 5-17. User Interface Panel (UIP)**

The UIP is divided into maintenance and display sections.

- **Maintenance section** — The maintenance section contains the CIT jack, fuses, power test jacks, a DDS clock connector, and local test access jacks.
  - **Electrostatic discharge (ESD) ground connector** — A static ground jack is used to provide a convenient grounding point for an ESD-protection wrist strap.
  - **Craft interface terminal (CIT) connector** — A 25-pin EIA-232-D subminiature connector (jack) is provided to connect a standard ASCII terminal personal computer (PC).
  - **Fuses** — Fuses are provided for the two –48 V feeders coming into the ARM shelf assembly. There is also a UIP display fuse and CIT fuse.
  - **Power test points** — A set of power test points are provided for monitoring the –48 V feeders.
  - **DDS clock connector** — A nine-pin subminiature “D” connector, compatible with the standard DS data test set, provides digital data service testing.
  - **Local test access jacks** — Dual bantam jacks are provided for local test access of special services. These six dual jacks provide the following connections:
    - a. Transmit and receive side access to DDS signals for use with the KS dataport test sets.
    - b. Transmit and receive side connection to the voice frequency (VF) equivalent of a single DS0 time slot signal for channel unit testing.

- c. Transmit and receive side access to a selected DSX-1 feeder.
  - d. Channel and drop side access to Tip and Ring.
  - e. Channel and drop side access to Tip 1 and Ring 1 for testing 4-wire circuits.
  - f. Channel side access to E&M signaling leads.
- **Display section** — The display section of the UIP provides alarm indicators, a 24-character alphanumeric display, command entry push buttons, light-emitting diode (LED) test push button, and miscellaneous push buttons.
- The following 12 LED alarm indicators are located on the front of the UIP:
    - a. **Power (Green LED)** — When lighted, this LED indicates the presence of –48 V at the UIP.
    - b. **ATTN (Yellow LED)** — When lighted, this LED indicates that the alphanumeric display contains information to be reviewed in the fault and/or alarm list.
    - c. **Panel Fault (Red LED)** — When lighted, this LED indicates the presence of a fault in the UIP circuitry.
    - d. **ACO (Green LED)** — When lighted, this LED indicates that the alarm cutoff (ACO) push button has been pressed (during an active alarm condition) silencing the audible alarm.
    - e. **Critical (Red LED)** — When lighted, this LED indicates the presence of a critical alarm.
    - f. **Major (Red LED)** — When lighted, this LED indicates the presence of a major alarm.
    - g. **Minor (Yellow LED)** — When lighted, this LED indicates the presence of a minor alarm.
    - h. **Power Minor (Yellow LED)** — When lighted, this LED indicates the presence of a power minor alarm.
    - i. **NE Activity (Yellow LED)** — When lighted, this LED indicates that a displayed alarm is at the near end of the system.
    - j. **FE Activity (Yellow LED)** — When lighted, this LED indicates that a displayed alarm is at the far end of the system.
    - k. **Abnormal (Yellow LED)** — When lighted, this LED indicates the presence of an abnormal technician-induced state such as a loopback or force to protection or SMU disabled.

- I. **Session (Yellow LED)** — When lighted, this LED indicates that a remote CIT session on the DLC subsystem is in progress at this remote terminal (alerts the local technician at the remote terminal to CIT maintenance from the other end).
- The alphanumeric display is located on the UIP and contains a 24-character, 5-inch by 0.5-inch dot-matrix red LED display. The display is used with the following set of six command entry push buttons that allow the technician to perform many operations that would normally require a CIT:
  - a.  **and**  **Scroll Menu** — The button labeled with a down arrow is used to scroll forward through various menu selections. The button labeled with an up arrow is used to scroll backwards through various menu selections.
  - b. **Enter** — This button is used to select or execute the item or command currently displayed.
  - c. **Escape** — This button is used to return the user to the main UIP menu.
  - d. **LED Test** — This button is used to initiate an LED test.
  - e. **ACO** — This button is used in conjunction with the ACO LED and is used for alarm cutoff, indicated by the ACO LED.
  - f. **Update** — This button is used to update the system configuration in memory to the current configuration.

## **Alarm Test Unit (ATU) (Central Office Terminal Only)**

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The ATU reports alarms and trouble indications using telemetry and audible and visual closures. It provides the following capabilities:

- Office alarm closures for audible and visual alarms
- Parallel telemetry outputs for the central office terminal (COT)
- The interface to the PGTC for channel testing
- DC bypass pair connections.

Figure 5-18 shows the ATU and the following indicators:

- ***Fault (red)***: The ATU has failed.
- ***Critical (red)***: The COT is reporting a near-end or far-end critical alarm.
- ***Busy (green)***: A channel test is in progress.
- ***Major (red)***: The COT is reporting a near-end or far-end major alarm.
- ***PWR Minor (yellow)***: The COT is reporting a far-end power minor alarm.
- ***Minor (yellow)***: The COT is reporting a near-end or far-end minor alarm.

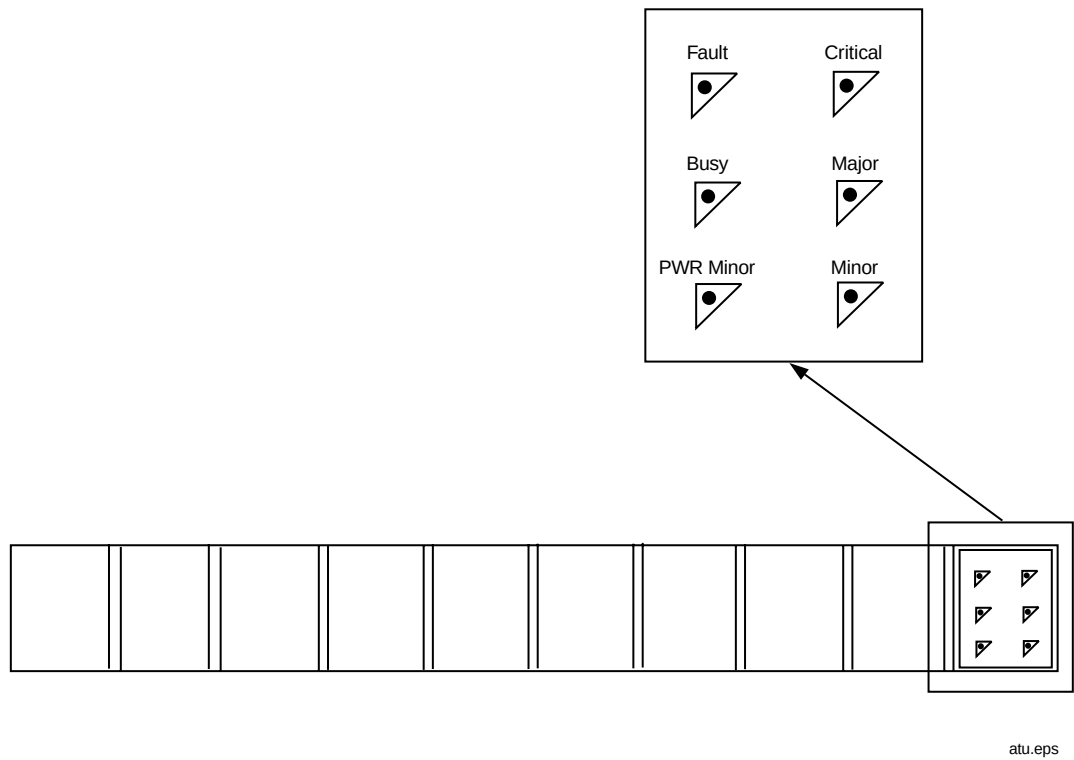


**Figure 5-18. Alarm Test Unit (ATU)**



Figure 5-20 and Figure 5-21 show MDS assemblies with each shelf provisioned for FITL distribution. The number of lines served by each shelf of the MDS assembly depends on the software release contained in the *SLC-2000* system:

- **Release 4.4 or Earlier.** Figure 5-20 shows a full MDS assembly when the *SLC-2000* system contains Software Release 4.4 or earlier. Each shelf can host ONUs containing up to 96 DS0s. Chapter 8 shows the minimum and maximum configurations for MDS assembly shelves configured for FITL distribution. Figure 5-20 shows the slot restrictions of the MSDT or DT Servers. In the figure, shaded servers must be provisioned as 12-line servers and can only be used if the server to the left is provisioned as a 12-line server. This allows you to provision 24-line servers in slots 1, 5, 13, and 17 in each shelf of the assembly; totalling 96 lines. If needed, you can provision 12-line servers — following the above restriction — in slots 1, 3, 5, 7, 13, 15, 17, or 19; again totalling 96 lines.
- **Release 4.5 or Later.** Figure 5-21 shows a full MDS assembly when the *SLC-2000* system contains Software Release 4.5 or later. Each shelf can host up to 144 DS0s through a variable number of ONUs when you provision the shelf for FITL distribution. Chapter 8 shows the minimum and maximum configurations for MDS assembly shelves configured for FITL distribution. Figure 5-21 shows the slot restrictions of the DT Servers. In the figure, shaded servers must be provisioned as 12-line servers and can only be used if the server to the left is provisioned as a 12-line server. As shown in the figure, slots 9 and 21 can contain a 12- or 24-line server. Slots 11 and 23 can only contain servers under the following conditions:
  - **Release R4.5.** Slots 11 and 23 can *not* contain servers. This allows you to provision 24-line servers in slots 1, 5, 9, 13, 17, and 21 in each shelf of the assembly; totalling 144 lines. If needed, you can provision 12-line servers — following the above restriction — in slots 1, 3, 5, 7, 9, 13, 15, 17, 19, or 21. However, when all servers are provisioned for 12 lines, the shelf will only serve 120 lines.
  - **Release R4.6 or Later.** When using the *SPQ811* server, slots 11 or 23 *can* contain servers provisioned for 12 lines if the server in the slot to the left is provisioned for 12 lines. This allows you to provision 24-line servers in slots 1, 5, 9, 13, 17, and 21 in each shelf of the assembly; totaling 144 lines. If needed, you can provision 12-line servers — following the above restriction — in slots 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, or 23; again totaling 144 lines.

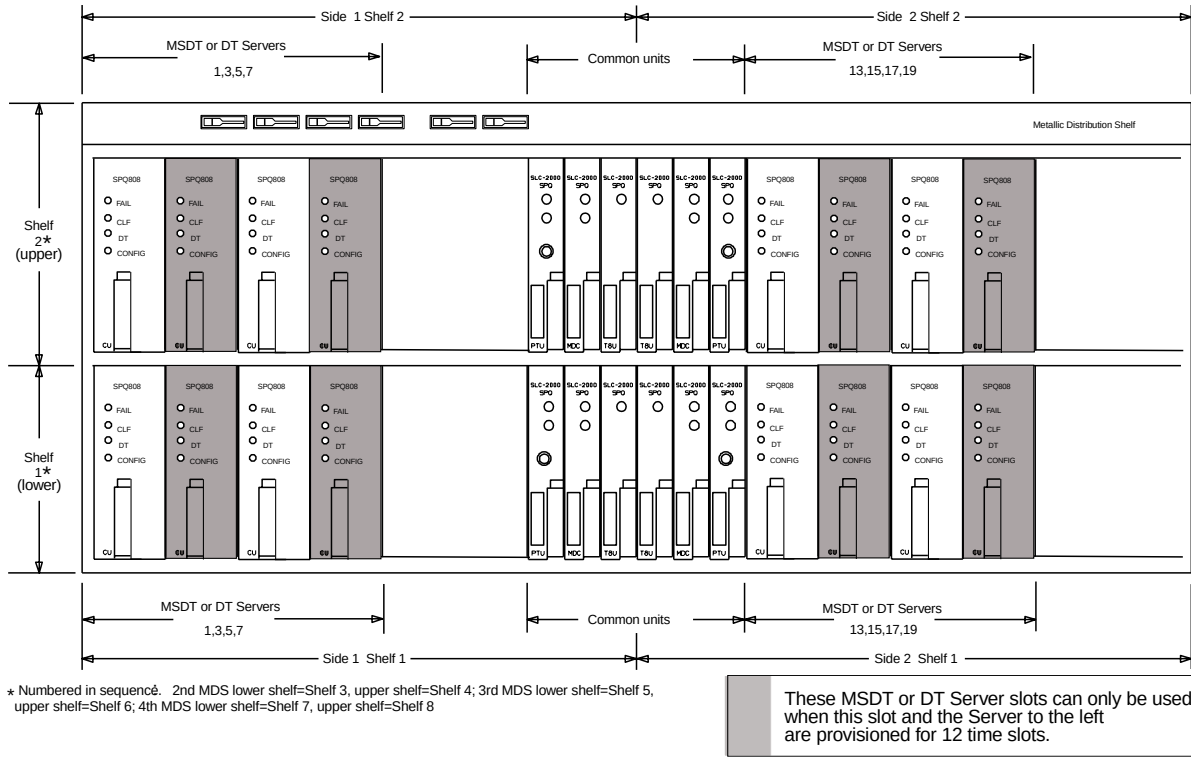


**Figure 5-20. MDS Assembly — 12- and 24-Line FITL Configuration (Release 4.4 or Earlier)**



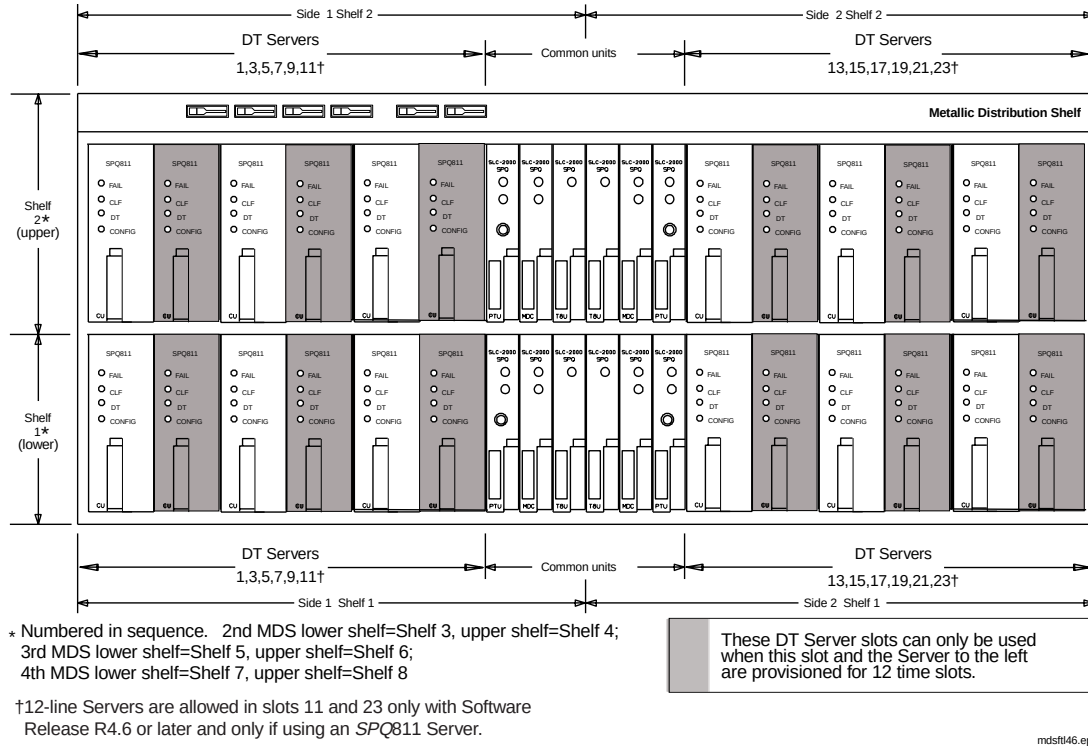


**Figure 5-21. MDS Assembly — 12- and 24-Line FITL Configuration (Release 4.5 or Later)**

The MDS assembly has 48 channel unit slots arranged in four groups of 12 slots (*side 1 or 2, upper or lower shelf*— Figure 5-19). Each side/shelf has three common unit slots to serve up to 48 customers using metallic distribution or up to 72 customers with Software Release R4.5 in FITL distribution. The MDS common units are not protected. However, alarms for failed common units are displayed and sent to the ARM shelf.

The top panel has a LED Test push button mounted on it that lights all indicators in the system (on the MDS assembly, ARM shelf, and UIP). This push button is provided for cabinet arrangements that have only metallic distribution shelves on Side 2 of the cabinet. It allows the indicators to be tested from the MDS assembly when no ARM shelf/UIP is mounted on that side of the cabinet. Operating this push button also verifies that the MDS assembly is connected to and communicating with the ARM shelf.

### **Common Units**

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The common units used in the MDS assembly are the metallic distribution controller (MDC), TR-08 unit (T8U), and power and test unit (PTU). These units provide powering, provisioning, and collection of alarm and inventory information from the MDS assembly for the ARM shelf, processing for the TR-08 interface, and a signaling and testing interface for the channel units.



**NOTE:**

Both sides of the metallic distribution assembly shelf must be equipped for alarm free operation if DS0s are cross-connected [in other words, two MDCs, two T8Us (TR-08 only), and two PTUs must be installed]. The MDS assembly shelf will report an alarm unless the common units are fully equipped.

### **Metallic Distribution Controller (MDC)**

With the system providing metallic distribution, the *BDJ*<sup>®</sup>240 MDC provides the interface between the bandwidth management section (the CORE in the ARM shelf) and up to 12 channel units (48 channels with quad channel units). With the system providing FITL distribution, the *BDJ*<sup>®</sup>240 MDC provides the interface between the bandwidth management section and up to four 24-line Servers (6 Servers with Software Release R4.5). At least one working CORE in the ARM shelf must be present for the MDC to operate properly. The MDC has control interfaces to the PTU, T8U (TR-08 systems only), and channel units that support channel maintenance, provisioning, alarming, and enhanced inventory. Software on the MDC is installed from the SMU.

### **TR-08 Unit (T8U)**

The *BDJ*205 T8U is the companion to the MDC unit for TR-08 configurations. The T8U detects on-hook/off-hook states for call processing, terminates the TR-08

data link, controls the CORE connections to the channel unit slots, and sends maintenance and alarm information (from the data link) to the MDC.

The T8U is an optional common unit for MDS shelves supporting a TR-303 VRT that has no TR-08 lines checkerboarded into the MDS assembly.

The MDC is required to provision the T8U for TR-08 Mode 1 or Mode 2 operation. The T8U also is synchronized entirely from the MDC. One T8U serves 12 channel unit slots or up to 48 lines.

### **Power and Test Unit (PTU)**

The *BDJ200* PTU supplies power to 12 channel unit slots and the other common unit slots in the quadrant. The PTU also controls the connections between the channel test bus and the appropriate test access path (TAP). Ringing is routed through the PTU. For channel testing, the PTU provides test terminations for 2-wire channel units.

### **Channel Units**

---

The MDS assembly provides up to 192 channels using the quad channel units for the *SLC-2000* Access System that provide four channels per circuit pack. The MDS assembly can also use *SLC* Series 5 channel units. Chapter 4, "Services," lists the channel units for the MDS assembly.

## **Multi-Services Distant Terminal (MSDT) or Distant Terminal (DT) Server**

---

The MSDT or DT Server is a channel unit slot compatible circuit pack that plugs into the MDS assembly of the *SLC-2000* Access System. The Server provides the interface function between the ONU and the host digital terminal (HDT).

One Server can interface with any of the following ONUs:

- ***SLC-2000 MSDT (Release 2.0 and later):***
  - One 12-line MSDT (the MSDT uses three of its six channel slots. It can use quad or dual-line channel units in these three slots. You can use slots 4 through 6 for future system growth, up to 24 lines).
  - One 24-line MSDT (MSDT contains six channel slots and uses quad or dual channel units).
- ***DDM-2000 FiberReach Narrowband Shelf :***
  - ***Quad mode (Release 4.3 and later)*** — One 12- or 24-line V-MSDT (V-MSDT contains six channel slots and uses quad or dual channel units. In a 12-line V-MSDT, the MSDT uses three of its six channel slots. It can use quad or dual-line channel units in these three slots. You can use slots 4 through 6 for future system growth, up to 24 lines).
  - ***Octet mode (Release 4.4 and later)*** — One 24-line V-DT (V-DT contains three channel unit slots and provides 24 DS0s. This allows the use of *SPQ494* quad ISDN channel units in the first two slots and an *AUA94* dual ISDN channel unit in the third slot. This combination will allow the V-DT to support ten ISDN lines with each line providing 2B+D service. The V-DT can also contain quad and dual channel units for other services and provide up to 12 lines of service).



### **NOTE:**

A *virtual MSDT* (V-MSDT) or *virtual DT* is a 12- or 24-line DT as seen from the HDT. It can be any of the above configurations. This means that the HDT “thinks” it is hosting a 12- or 24-line *SLC-2000* MSDT even if it is actually hosting the six channel slots in the top shelf of the *DDM-2000* FiberReach NBS. For a detailed definition of V-MSDT or V-DT, see Chapter 2.

All communications between the HDT and V-MSDT/V-DT pass through the Servers. Unlike a channel unit, an MSDT or DT Server does not terminate the digital path but effectively extends the digital backplane signals from the HDT to the V-MSDT/V-DT. This provides a virtual channel bank that reflects the equipment of the V-MSDT/V-DT. The Server maps DS0s on the HDT backplane to DS0s on the HDT-to-ONU link and uses the extended superframe/new data link (ESF/ndl) framing to communicate with the V-MSDT or V-DT. The Server also passes to the HDT any V-MSDT or V-DT alarm or event indications. In the

HDT-to-ONU direction, the Server transports provisioning and control information to ONU controller.

The Server terminates the DSX-1 transmission link coming from the V-MSDT or V-DT. It also sheds excess DS0s when an MSDT is provisioned for less than 24 lines. The *SLC-2000* HDT can serve the following MSDTs/V-MSDTs/V-DTs depending on the software release:

- **Release R4.4 or Earlier.** Up to thirty-two 24-line MSDTs/V-MSDTs/V-DTs, sixty-four 12-line MSDTs/V-MSDTs/V-DTs, or combinations of 12- and 24-line V-MSDTs/V-DTs
- **Release R4.5 or Later.** Up to forty-eight 24-line MSDTs/V-DTs, eighty 12-line MSDTs/V-DTs, or combinations of 12- and 24-line MSDTs/V-DTs
- **Release R4.6 or Later.** Same as R4.5 if using a *SPQ810* Server. If using a *SPQ811* Server, up to forty-eight 24-line MSDTs/V-DTs, ninety-six 12-line MSDTs/V-DTs, or combinations of 12- and 24-line MSDTs/V-DTs.

Depending on the expected growth in the area served by the ONU, any unused channels on the Server can be dropped off in the MDS assembly backplane. This allows service turn-ups without dispatch to the HDT site and without HDT reconfiguration.

On the loop side, a Server interfaces the ONU with either an optical or metallic link as follows:

- **SLC-2000 MSDT :**
  - **Release 2.0 and later.** The downstream electrical interface of the Server is normally comprised of 1.544-Mb/s Electronic Industries Association (EIA) standard RS-422 signals appearing on the T-R and T1-R1 pairs of the backplane connector. Bay cabling connects these signals to the RT high density optics shelf (HDOS) optical unit (OU) serving the MSDT. When using this configuration with the server interfacing the OU through the bay cabling, place the **DSX/OU** switch on the server in the **OU** position. The OU provides the interface between the electrical signals of the Server and the optical signals of the outside plant fiber. When using a metallic interface between the HDT and MSDT, the signal uses a T1 facility. When using this configuration, place the **DSX/OU** switch on the server in the **DSX** position.
  - **Release 4.5 or later.** The electrical RS-422 signals interface the HDOS through a DSX cross-connect instead of bay cabling. The OU in the HDOS then converts the signals as described above. When using this configuration, place the **DSX/OU** switch on the server in the **OU** position. When using a metallic interface between the HDT and MSDT, the signal uses a T1 facility. When using this configuration, place the **DSX/OU** switch on the server in the **DSX** position.
- **DDM-2000 FiberReach NBS (Release 4.3 and later).** The Server sends a DSX-1 signal to Function Group C or a WBS where it is multiplexed into an optical signal. At the ONU, a DDM-2000 FiberReach Wideband shelf

demultiplexes the optical signal back into a DSX-1 electrical signal. This signal is then conditioned by a DSXBIU for the channel unit slots of the NBS. The Server can also host an ONU over a T1 metallic facility. In both configurations, place the **DSX/OU** switch on the server in the **DSX** position.

A detailed description of the MSDT or DT Servers is provided in Chapter 4.

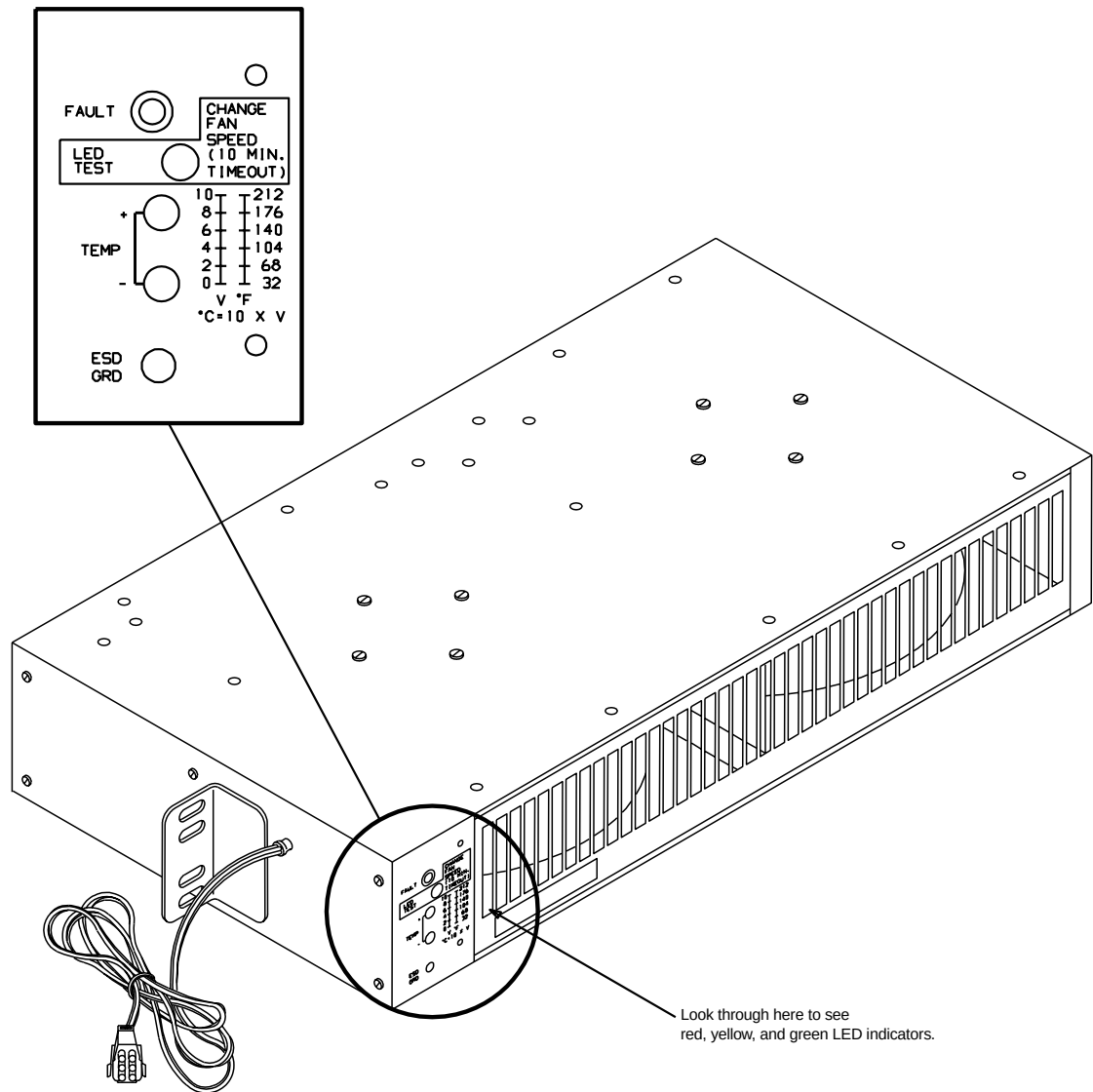
## Fan Unit

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The 4-type fan unit (Figure 5-22) is required with the *SLC-2000* Access System RT/HDT. It provides ventilation for the systems and equipment in the frame or cabinet. The fan unit features microprocessor-controlled fans, a solid-state thermal sensor (failure is alarmed), and faceplate jacks that allow measurement of the relative temperature at the thermal sensor.

The fan unit includes the following switches, jacks, and indicators:

- **Red FAULT Indicator.** The red FAULT indicator lights when one or both fan units operate at less than 1,900 rpm. Also, the FAULT indicator lights when the alarm circuitry, power supply, or thermal sensor fails.
- **Green Indicator.** The green indicator flashes once per second to show that the controller is properly working.
- **Yellow Indicator.** The yellow indicator lights when the thermal sensor fails. If the thermal sensor fails, the fans operate continuously at full speed.
- **LED TEST Push Button.** The LED TEST push button lights the indicators located on the fan unit and provides limited manual control of the fans (to reduce or eliminate acoustic noise during turn-up and maintenance operations).
- **TEMP Jacks.** The TEMP jacks provide access to the voltage output of the thermal sensor. This voltage is directly proportional to temperature at the thermal sensor. A scale on the faceplate provides quick reference for converting thermal sensor voltage to temperature.
- **ESD GRD Jack.** The ESD GRD jack provides a connecting and grounding point for the electrostatic discharge wrist strap.



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**Figure 5-22. Fan Unit**

## High Density Optics Shelf (HDOS)

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The high-density optics shelf (HDOS) (see Figure 5-23) allows the SLC-2000 Access System to serve as a host digital terminal (HDT) in a fiber-in-the-loop (FITL) distribution system when hosting a SLC-2000 MSDT as the ONU. The HDOS houses the optical units (OUs) (AYB1C, AYB3, and/or AYB5) and the AYB2 power converter unit (PCU) for the HDT end of the optical link serving the MSDT.

The HDOS interfaces the MDS assemblies depending on the SLC-2000 software releases:

- **Release 4.4 or Earlier.** The HDOS interfaces with up to two MDS assemblies fully configured to provide services to thirty-two 12-line MSDTs. Each OU slot is connected through bay cabling to one CU slot in the MDS assembly, to the T-R and T1-R1 pairs of the MDS CU connector. For ease of reference, OU slots in the HDOS are numbered using the corresponding MDS CU slot numbers.
- **Release 4.5 or Later.** The HDOS interfaces the Servers in the MDS assembly through a DSX cross-connect panel. Providing there is an HDOS OU slot available, any Server slot in the MDS assembly can connect to any HDOS OU through the DSX cross-connect. The system uses the following cables to for this connection:
  - **ED-7C723-35, G17:** One end of this 4-foot cable connects to the cable dangles on the MDS assembly shelf. The other end connects to the transmit and receive pairs of the ED-7C723-35, G19 cable.
  - **ED-7C723-35, G19:** This group actually consists of two cables — one for transmit pairs and one for receive pairs. One end of the cables connect to the ED-7C723-35, G17 cable and the other end connects to the DSX cross-connect. This cable group comes in 30-foot lengths.
  - **ED-7C723-35, G18:** One end of the cable connects to the cable dangles from the HDOS and the other end connects to the DSX cross connect.



### CAUTION:

*The combined length of all cables between the Server connection on the MDS assembly backplane and the connection on the HDOS backplane can **NOT** exceed 35 feet. This includes the cable dangles on both the MDS assembly and the HDOS; the ED-7C723-35, G17; the ED-7C723-35, G19; and the ED-7C723-35, G18 cables. If needed, cut the ED-7C723-35, G19 cable to meet the 35-foot restriction.*

The OU has an optical termination for one singlemode fiber on the backplane. The same fiber is used for both the transmit and receive optical signals through a standard connector (S7<sup>®</sup> type) on the backplane.



In a typical installation, the OU optical termination is connected to a fiber termination shelf such as the Lucent Technologies lightguide shelf, through single-mode fiber jumpers or cable assemblies such as Lucent Technologies lightguide interconnection cable (LIC) cables. The outside plant (OSP) fibers are also terminated on the fiber termination shelf or panel, which provides cross-connection between the OU and OSP fibers. The fiber connectors on the lightguide shelf can be *ST* type or *SC* type depending on the type that the customer selects (the *ST* type is standard).

Each PCU provides alarm contact closure. The alarm contacts of the eight PCU slots are paralleled and are available to the customer as a miscellaneous alarm. The HDOS alarm contact can provide an additional level of fault sectionalization, as an option.



**NOTE:**

If the DSX interface option is selected on the MSDT or DT Server, the HDOS is not required.

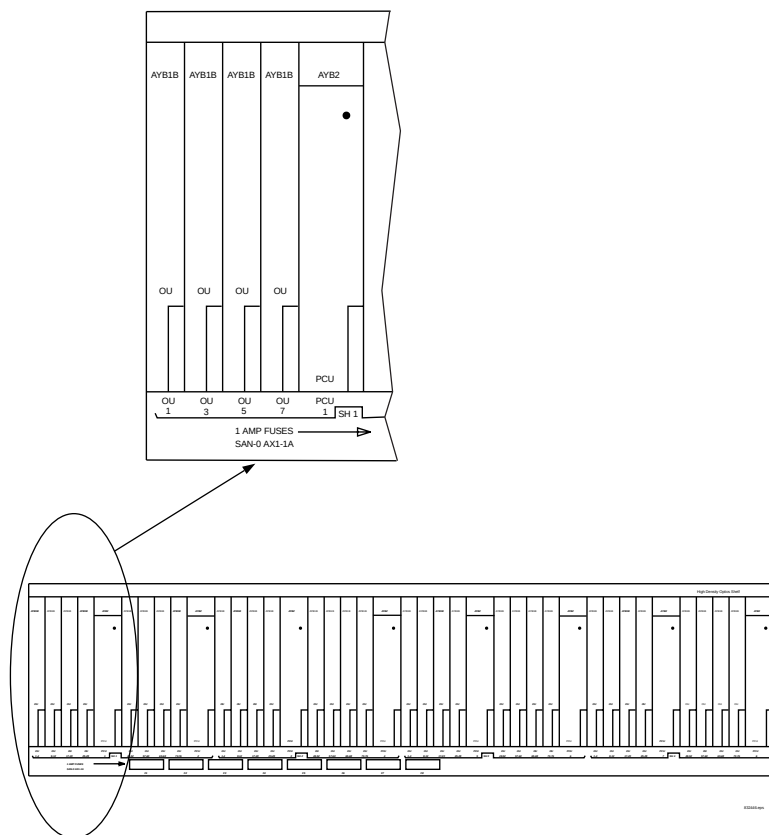


**Figure 5-23. High Density Optics Shelf (HDOS)**

## **Common Units**

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The HDOS common units provide electrical-to-optical and optical-to-electrical signal conversion processing to link the *SLC-2000* Access System with the FITL. Common units for the HDOS are the optical unit (OU) and the power conversion unit (PCU).

### **Optical Unit (OU)**

The OU (AYB1C OU Data Sheet 363-005-262) provides electrical-to-optical and optical-to-electrical signal conversions at the end of the fiber optic loop. The OU receives signals from either the HDT FITL Server or the MSDT. The OU converts the electrical 1.544-Mb/s signal to an optical 1.544 Mb/s signal using a laser diode and transmits it over one singlemode fiber at 1310 nm to the opposite end of the loop. The compatible optical unit at the MSDT is the BYB1C OU.

The receiving OU converts the optical 1.544-Mb/s signal to an electrical 1.544-Mb/s signal using a positive-intrinsic-negative (PIN) diode detector. The signal is fed to the associated MSDT or DT Server. Transmission in each direction is done the same way with both directions of transmission being carried over the same fiber.

The AYB3 OU replaces the AYB1C and the AYB1B OU; the functions are the same.

### **AYB5 OU**

The AYB5 is an extended-range optical unit used in the HDOS at the HDT end of a FITL system. The AYB5 OU operates with the BYB5 OU in the MSDT. The outside plant loss budget for this optical link is 13.3 dB compared to 9.8 dB for the standard AYB1C/BYB1C optical unit pair. The AYB5 OU functions the same way as the AYB1C OU.

### **AYB2 Power Conversion Unit (PCU)**

The AYB2 PCU (Data Sheet 363-005-286) converts the -48 V DC (-40 to -60 V DC) supply to +5 and -5 V DC for a group of four OU slots (supplying up to 1A). Output short circuit protection is designed into the DC-DC converters, as well as an output over-voltage clamp. Voltage detection circuitry monitors the 5 V buses and will cause an alarm when either output fails. This closure may be wired to the RT/HDT MISC alarm at the option of the customer.

## **Power Interface Unit (PIU)**

---

The power interface unit (PIU) — ED7C734-30 — distributes  $\pm 20$  Hz ringing and -48 V power from its frame sources to the test and fuse module and the MDS assembly shelves. It is attached to the right side plate of the ARM shelf.

## Software Architecture

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The SLC-2000 Access System has the following three software subsystems:

- DLC
- SONET
- ITH.

Each subsystem contains its own software package that is identified by a unique name and release number.

The DLC software is downloaded to the SMU, which distributes the software to the PDC, CORE circuit packs, MDCs, and the VTUs or LIUs. In FITL configurations, the MDC also downloads the software (via the MSDT or DT Server) to the BIU or DSXBIU in the ONUs if the correct versions of the circuit packs are present at both the RT and ONU. (See DLC software installation in Chapter 7.) The SMU keeps a backup copy of the DLC software. The provisioning parameters (nonvolatile storage) are duplicated in the TSI circuit packs; the TSIs and PDC contain a check sum to ensure that the current copy is loaded when a TSI is replaced (see provisioning in Chapter 7).

The SONET subsystem software runs on the SYSCTL and OHCTL circuit packs and must be ordered separately. This is the same software used in a DDM-2000 OC-3 multiplexer. The SONET software controls all SONET subsystem functions and is required for SONET and metallic DSX-1 feeder configurations.

The TST software package for the ITH subsystem runs on the THC circuit pack. The THC is shipped from the factory with the software loaded on it.

The UIP command **RETRIEVE-PROG-VRSN** will retrieve and display the software release information of the software package on the SMU and in the system. On the DLC subsystem, the **RTRV-EQPT** CIT command will retrieve and display the DLC software version and the software on the SMU.

Chapter 8, "System Planning and Engineering," contains software compatibility information for the COT and RT in addition to the compatible DDM-2000 releases.

Document 363-208-003, *SLC-2000 Access System, Commands and Messages*, contains important information about the CIT and UIP as follows:

- Compatible CIT equipment
- How to use the UIP and CIT
- UIP and CIT commands (the manual pages)
- Command syntax and addressing
- Fault and alarm message decoder.

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### Overview

The SLC<sup>®</sup>-2000 Access System remote terminal/host digital terminal (RT/HDT) and associated equipment can be mounted in a variety of cabinets selected according to the desired service configurations. The 80A-, 80D-, 80G-type, and 90A-type cabinets are listed and described in this chapter.

The 80-type cabinets are for *outdoor* applications. These cabinets look similar but are of different sizes to contain the following equipment to meet individual customer needs:

- **80A-type cabinet** — one complete SLC-2000 system
- **80D-type cabinet** — two complete SLC-2000 systems
- **80G-type cabinet** — three complete SLC-2000 systems.

The 90A cabinet is for *indoor* applications. It contains the following equipment to meet individual customer needs depending on the type of power supply:

- **90A-type cabinet with 240 V AC—20A (Maximum Configuration)** — one complete SLC-2000 system [one access resource manager (ARM) shelf and up to four metallic distribution shelf (MSD) assemblies]
- **90A-type cabinet using 120 V AC—20A (Minimum Configuration)** — one partial SLC-2000 system (one ARM shelf and up to two MDS assemblies).

The *SLC-2000* Access System can also be mounted in a 7-foot bay arrangement. A 7-foot bay arrangement also is used for the *SLC-2000* Access System synchronous optical network (SONET) central office terminal (COT).



**NOTE:**

For details on cabinets containing the *SLC-2000* Multi-Services Distant Terminal (MSDT) and the *DDM-2000* FiberReach Multiplexer, see the following documents:

- ***SLC-2000 MSDT*** — 363-205-004, *SLC-2000 Access System MSDT, User/Service and Ordering Manual*
- ***DDM-2000 FiberReach Terminal*** — 363-206-300, *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*.

## Cabinet Attributes

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### Cabinet Physical Dimensions and Cabinet and Bay Line Size Comparison

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Table 6-1 lists the following attributes for each cabinet type:

- Dimensions
- Line size (depending on terminal type and configuration).

**Table 6-1. Cabinet Dimensions and Line Size Comparison**

| <b>Cabinet Type</b>                                                                   | <b>Dimensions<br/>(Inches)</b> | <b>SLC<sup>®</sup>-2000 Access<br/>System Lines<br/>(Notes 1 and 2)</b>     |
|---------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------|
| 80A-HX: one system, bulk<br>powered, equipped with<br>heat exchanger (HX)             | 66 × 52 × 36                   | 768 (w/FITL) <sup>*</sup><br>1152 (w/FITL) <sup>†</sup><br>768 (w/o FITL)   |
| 80D-HX: two systems,<br>bulk powered, equipped<br>with heat exchanger                 | 69 × 90 × 38                   | 1536 (w/FITL) <sup>*</sup><br>2304 (w/FITL) <sup>†</sup><br>1536 (w/o FITL) |
| 80G-HX: three systems,<br>bulk powered, equipped<br>with heat exchanger               | 70.5 × 112 × 38                | 2304 (w/o FITL)                                                             |
| 90A (240 V AC-20A<br>supply): one system, (one<br>ARM, four MDS<br>assemblies)        | 77 × 28.5 × 29.5               | 768                                                                         |
| 90A (120 V AC-20A<br>supply): one partial system,<br>(one ARM, two MDS<br>assemblies) | 77 × 28.5 × 29.5               | 384                                                                         |

**Notes:**

1. Equipped with integral SONET interface.
2. In addition to 768/1152 lines, the SLC-2000 Access System can support up to 28 DS1 pipes.

<sup>\*</sup> SLC-2000 Software Release 4.4 or earlier.

<sup>†</sup> SLC-2000 Software Release 4.5 or later.



## **80A-Type Cabinet**

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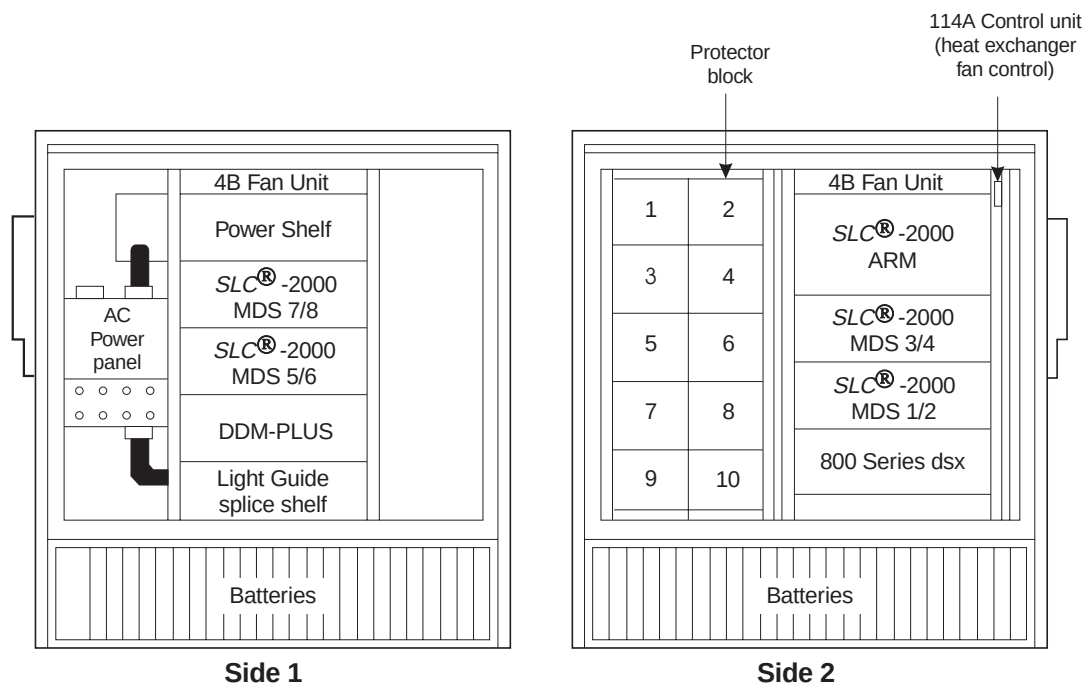
The 80A-type cabinet dimensions are 66 inches high, 52 inches wide, and 36 inches deep. This type cabinet has bulk power (BP) without or with a heat exchange (HX), side splicing access, a separate battery compartment, a cooling system, and shelf space for the access system equipment. It has the capacity for two Lucent Technologies battery strings [118 amp-hours (Ah) each] in a skirt below the electronics section of the cabinet. The 80A-type cabinet provides a large splicing chamber 40 inches high, 20 inches wide, and 11 inches deep with side access. Lightguide cables are terminated in the cabinet using a fiber splice shelf.

## **Deployment**

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### **80A-HX — Full SLC-2000 Access System Configuration**

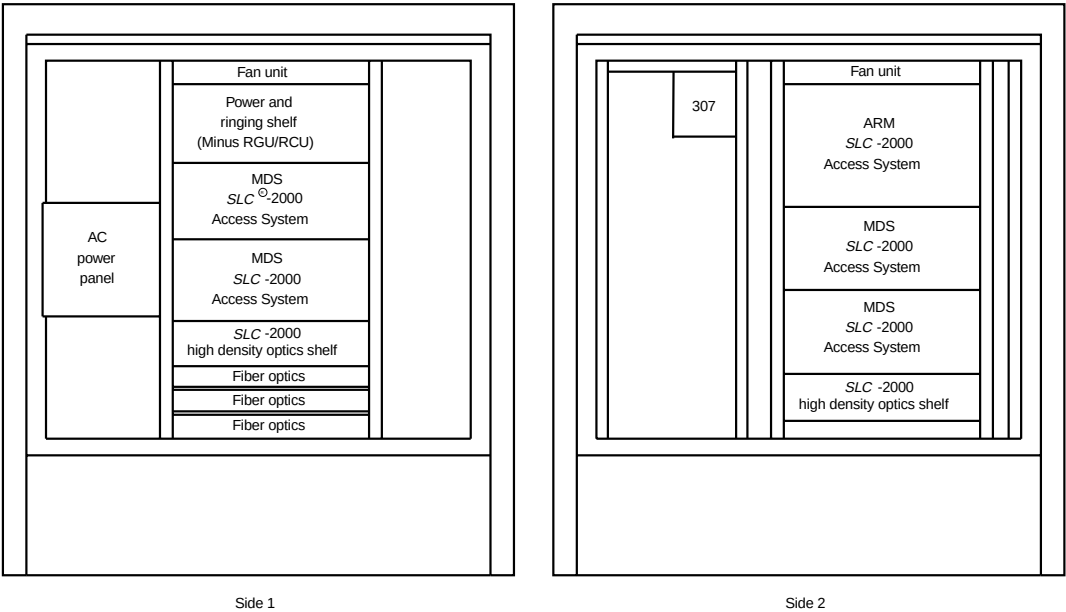
The 80A-HX cabinet can be fully equipped with *SLC-2000* Access System equipment (Figure 6-1) for metallic applications or fiber-in-the-loop (FITL) applications (Figure 6-2). The metallic application includes one ARM shelf assembly, up to four metallic distribution shelf (MDS) assemblies, and an optional DDM-Plus. This configuration serves up to 768 lines and up to 28 optional DS1 pipes.



80ahx.eps

**Figure 6-1. 80A-HX Cabinet Configuration for SLC-2000 Access System Equipment**

The FITL application of the 80A cabinet for a SLC-2000 Access System is shown in Figure 6-2. This configuration is nonstandard but is available with a special development request. Side 1 can contain two MDS assemblies, a high density optics shelf (HDOS), three lightguide shelves, a power and ringing shelf, and an AC power panel. Side 2 can contain one access resource manager (ARM) shelf, two MDS assemblies, and one HDOS assembly.



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**Figure 6-2. 80A-HX Cabinet Configuration for SLC-2000 Access System Equipped with FITL**

## **80A-Type Cabinet Features**

---

### **Separate Side Splicing**

All 80A-type cabinets provide a large splicing chamber with side access, allowing technicians to perform splicing operations without exposing the electronic equipment to the outdoor environment. The splice area also has a removable plate that allows the cabinet to slide over the cables during installation, eliminating the need to feed the cables up through the cabinet while it is suspended in air.

### **Lightguide Termination**

The 80A-type cabinet supports a high density fiber termination shelf. The fiber shelf is mounted at the bottom of the equipment bay, which allows technicians to sit down while accessing fibers and performing fiber splices.

### **Power**

#### **Input**

The 80A-type cabinet uses 30-amp, 120/240 single-phase AC power service.

#### **Output**

The 80A-type cabinet bulk power plant provides –48 V DC power and ringing equipment with a single power shelf. This power plant supports an internal power load of approximately 20.5 amps for the *SLC-2000* Access System.

#### **Reserve**

The 80A-type cabinet uses bulk power and houses the reserve power supply batteries in a skirt below the main electronics section. The 52-inch width of the cabinet houses up to two strings of Lucent Technologies *Lineage*® VR series batteries in the skirt. Depending on the way the cabinet is equipped, the batteries provide from 8 to 15 hours of reserve time using 118-Ah strings. There are two advantages of housing the batteries in the skirt below the electronics section of the cabinet:

- a. A separate area is created from the electronic section that provides more available space for the electronics.
- b. The batteries are in a cooler environment, which extends battery life. For colder periods of the year, battery heaters are located beneath the batteries to maintain a minimum battery temperature of 35° F.

## **Thermal Considerations**

The 80A-type cabinet has been designed to reduce internal cabinet temperatures and extend battery life. New fan units, door ducts, and other thermal enhancements provide improved air circulation within the cabinet. The 80A-HX cabinet has a center-mounted heat exchanger.

## **Bellcore Specifications**

The 80A-type cabinet has been designed to meet or exceed Bellcore specification TR-487\*.

## **80A-HX Cabinet Ordering Information**

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For ordering information on this cabinet, see Document 631-600-282.

## **80D-Type Cabinet**

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The 80D-type cabinet looks very similar to the 80A-type cabinet, but it is approximately two times larger. This type cabinet has bulk power (BP) without or with a heat exchanger (HX), side splicing access, a separate battery compartment, a cooling system, and shelf space for the access system equipment. The 80D-type cabinet dimensions are 69 inches high, 90 inches wide, and 38 inches deep.

## **Deployment**

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### **80D-HX — Full SLC-2000 Access System Configuration**

One option for deployment is an 80D-HX cabinet fully equipped with SLC-2000 Access System equipment for metallic distribution (Figure 6-3). Another option for deployment is an 80D-HX cabinet equipped for FITL applications (Figure 6-4). This configuration is nonstandard but is available with a special development request. The 80D-HX cabinet configured for metallic distribution may include up to two ARM shelf assemblies, up to eight MDS assemblies, and two optional DDM-Plus shelves and serve up to 1,536 lines and up to 56 optional DS1 pipes. The cabinet with FITL configuration may include up to two ARM shelf assemblies, up to eight MDS assemblies, and up to four HDOSs.

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\* Bellcore Technical Reference TR-TSY-000487, Issue 1, 1989, *Generic Requirements for Electronic Equipment Cabinets*.

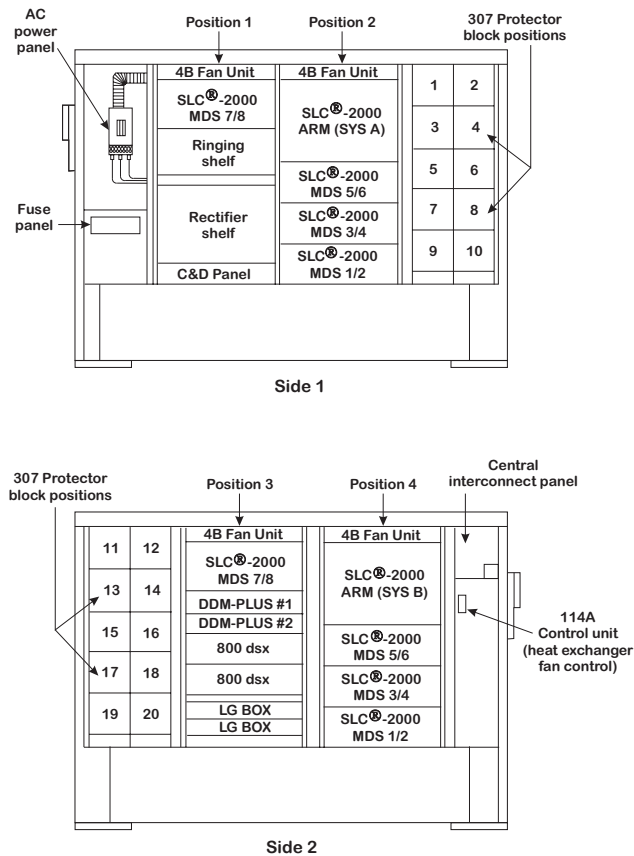


Figure 6-3. 80D-HX Cabinet Configuration for SLC-2000 Access System Equipment

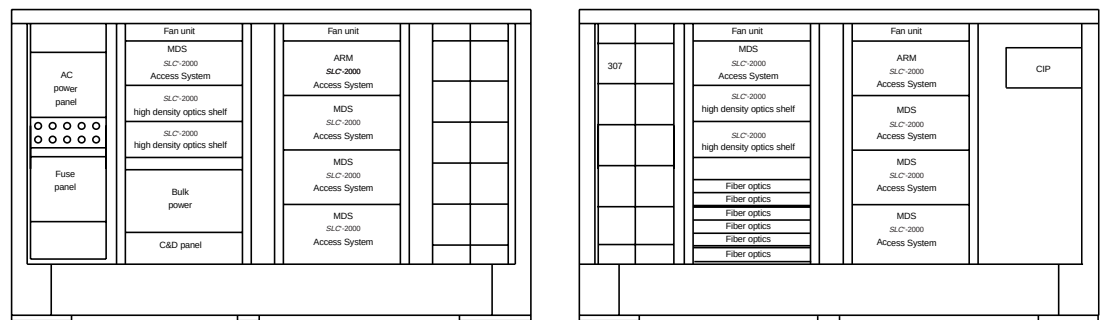


Figure 6-4. 80D-HX Cabinet Configuration for SLC-2000 Access System Equipped for FITL

## **80D-Type Cabinet Features**

---

### **Separate Side Splicing**

The 80D-type cabinets provide a large splicing chamber with side access, allowing technicians to perform splicing operations without exposing the electronic equipment to the outdoor environment. The splice area also has a removable plate that allows the cabinet to slide over the cables during installation, eliminating the need to feed the cables up through the cabinet while it is suspended in air.

### **Lightguide Termination**

The 80D-type cabinet supports a high density fiber termination shelf. The fiber shelf is mounted at the bottom of an equipment bay to allow technicians to sit down, easily access fibers, and perform splices.

### **Power**

#### **Input**

The 80D-type cabinet uses 120/240 single phase AC power service.

#### **Output**

The 80D-type cabinet power plant provides bulk power for the *SLC-2000* Access System.

### **Reserve**

The 80D-type cabinet uses bulk power and houses the battery reserve in a skirt below the main electronics section. This battery compartment holds up to three strings of Lucent Technologies *Lineage*® VR series batteries. This provides a minimum of 8 hours of battery reserve for fully equipped cabinets. The advantages of housing the batteries in the skirt below the electronics section of the cabinet include the following:

- a. The batteries are separated from the electronics section, which provides more available space for the electronics.
- b. The batteries exist in a cooler environment, which extends battery life. For colder periods of the year, battery heaters in a pad under the batteries maintain the minimum battery temperature of 35° F.

### **Thermal Considerations**

The 80D-type cabinet is designed to reduce internal cabinet temperatures and extend battery life. New fan units, door ducts, and other thermal enhancements improve the air circulation in the cabinet. The 80D-HX cabinet is equipped with a heat exchanger system.

### **Bellcore Specifications**

The 80D-type cabinet has been designed to meet or exceed Bellcore specification TR-487.

### **80D-HX Cabinet Ordering Information**

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For ordering information on this cabinet, see Document 631-600-267.



## **80G-Type Cabinet**

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The 80G-type cabinet houses *SLC-2000* Access System equipment and DDM-Plus extension shelves. It includes the following features:

- Side access splicing
- Separate battery compartment
- Patented enhanced cooling system with center-mounted heat exchanger (HX version)
- Bulk power system.

The cabinet is divided into three compartments:

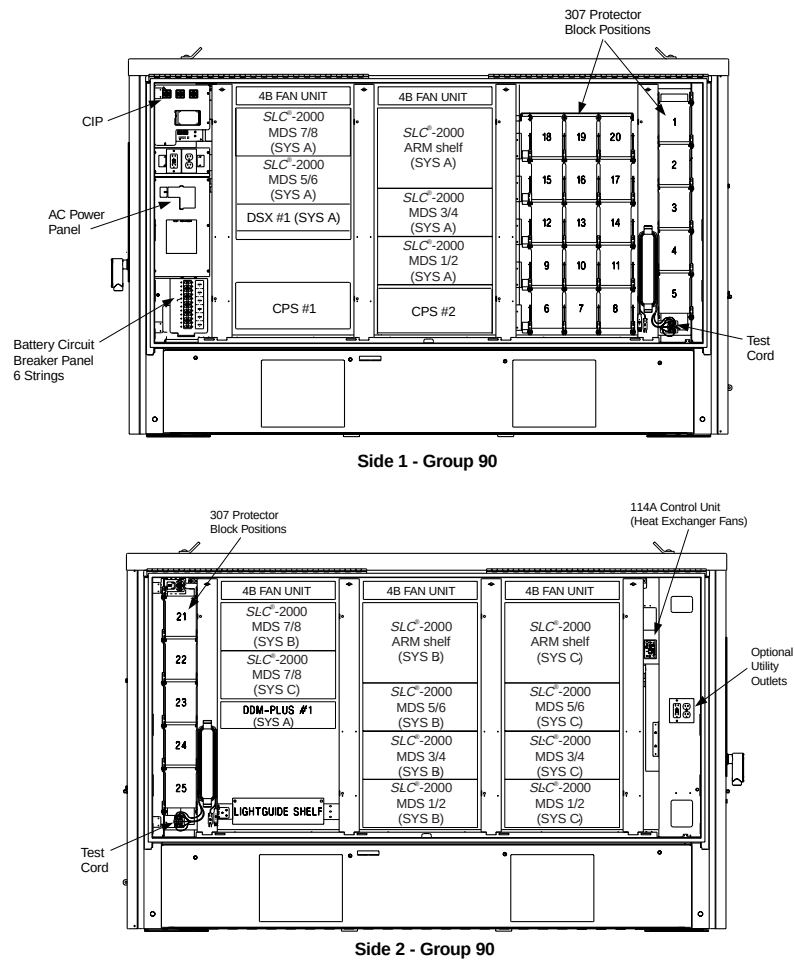
- An upper electronics and protector compartment
- A lower battery compartment
- A side (end) access splicing compartment.

## **Deployment**

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### **80G-HX — Full *SLC-2000* Access System Configuration**

As shown in Figure 6-5, the 80G-type cabinet can house up to three fully equipped *SLC-2000* systems. It can also contain a DDM-Plus shelf for DS1 extensions. The cabinet also includes all the necessary powering equipment, protector blocks, splicing accesses, and environmental controls.



80ghx.eps

**Figure 6-5. 80G-HX Cabinet Configuration for SLC-2000 Access System Equipment**

## **80G-Type Cabinet Features**

---

### **Separate Side Splicing**

The 80G-type cabinets provide a large splicing chamber with side access, allowing technicians to perform splicing operations without exposing the electronic equipment to the outdoor environment. The splice area also has a removable plate that allows the cabinet to slide over the cables during installation, eliminating the need to feed the cables up through the cabinet while it is suspended in air.

### **Lightguide Termination**

The 80G-type cabinet supports a high density fiber termination shelf. The fiber shelf is mounted at the bottom of an equipment bay to allow technicians to sit down, easily access fibers, and perform splices.

### **Power**

#### **Input**

The 80G-type cabinet uses 120/240 single phase AC power service.

#### **Output**

The 80G-type cabinet power plant provides bulk power for the *SLC-2000* Access System.

### **Reserve**

The 80G-type cabinet uses bulk power and houses the battery reserve in a skirt below the main electronics section. This battery compartment holds up to six strings of batteries depending on the type of battery in use. For the number of strings required for the type of battery and a minimum battery reserve for fully equipped cabinets, see 631-600-266, *80G-HX (Heat Exchanger) Cabinet Description and Ordering Information*.

The advantages of housing the batteries in the skirt below the electronics section of the cabinet include the following:

- a. The batteries are separated from the electronics section, which provides more available space for the electronics.
- b. The batteries exist in a cooler environment, which extends battery life. For colder periods of the year, battery heaters in a pad under the batteries maintain the minimum battery temperature of 35° F.

### **Thermal Considerations**

The 80G-type cabinet is designed to reduce internal cabinet temperatures and extend battery life. New fan units, door ducts, and other thermal enhancements improve the air circulation in the cabinet. The 80G-HX cabinet is equipped with a patented enhanced cooling system using a center-mounted heat exchanger.

### **Bellcore Specifications**

The 80G-type cabinet has been designed to meet or exceed Bellcore specification TR-487.

### **80G-HX Cabinet Ordering Information**

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For ordering information on this cabinet, see Document 631-600-266.

## 90A-Type Cabinet

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Figure 6-6 shows a fully equipped 90A cabinet. Table 6-1 on page 6-3 shows the dimensions of the 90A cabinet. This cabinet contains the following equipment:

- Cabinet Power System (CPS) or bulk power that supports:
  - 240 V AC - 20A power supply
  - 120 V AC - 20A power supply
- Shelf space for *SLC-2000* Access System equipment
- DDM-Plus shelf
- Central interconnect panel (CIP)
- Two flexible power system (FPS) battery shelves
- Two cooling fans
- A DS1 cross-connect shelf (DIXI-1)
- Tautron *ngRTH*<sup>\*</sup> test head or remote measurement unit (RMU) (optional).

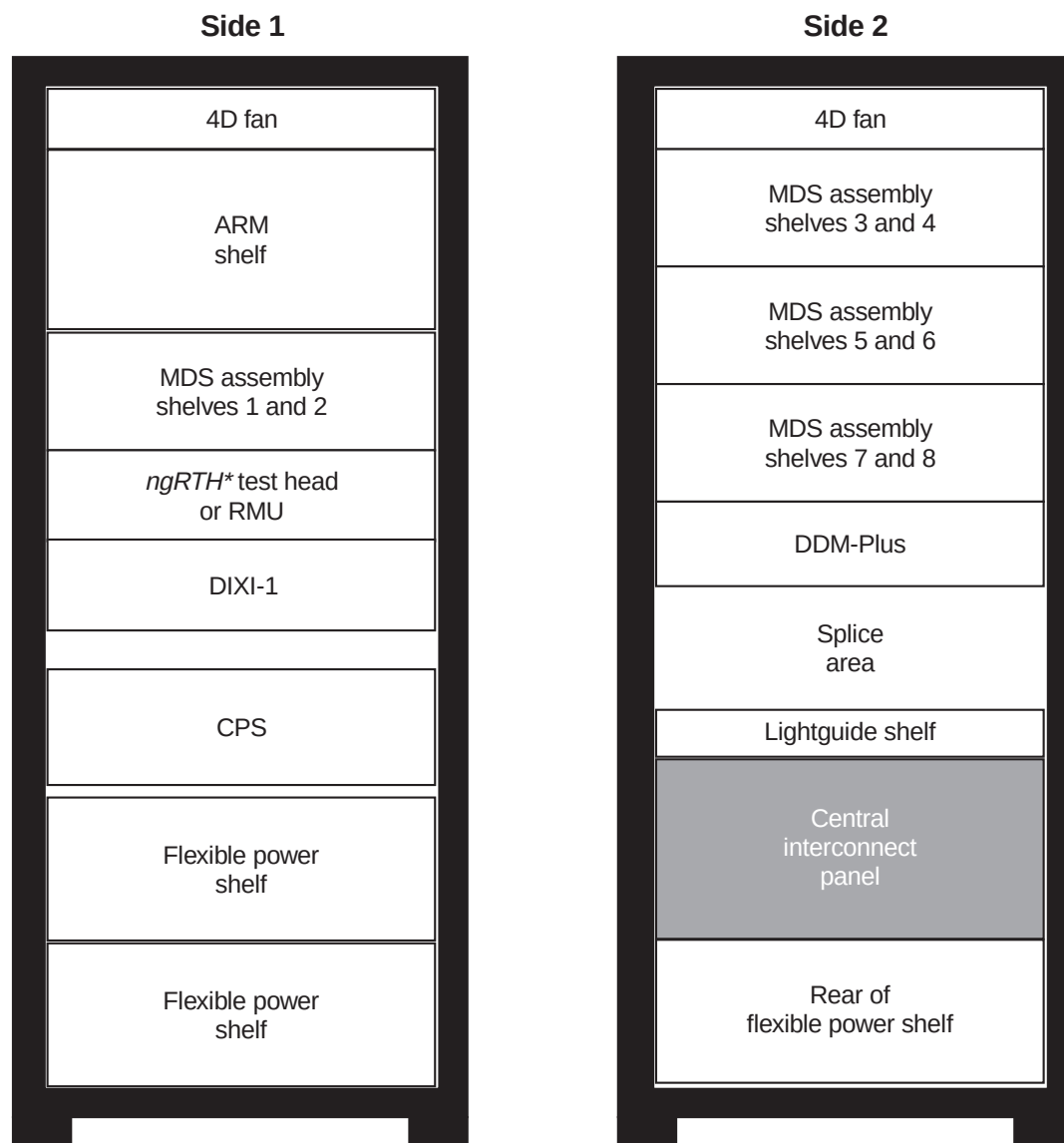
The two FPS shelves have capacity for four Lucent Technologies battery strings — 26 amp-hours (Ah) per string.

The cabinet also provides for the following:

- Splicing area within the cabinet
- Lightguide cable terminations on the Lightguide shelf.

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\* Trademark of Tautron Inc.



\*Trademark of Tautron Inc.

90a.eps

**Figure 6-6. 90A Cabinet Configuration for SLC-2000 Access System Equipment**

## Deployment

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### 90A Cabinet (240 V AC 20A) — Full Configuration

Figure 6-6 on page 6-17 shows a fully equipped 90A cabinet with a 240 V AC 20A power supply containing a *SLC-2000* system configured for metallic distribution. The metallic application includes the following equipment:

- One ARM shelf
- Up to four MDS assemblies
- DDM-Plus shelf
- Two fan assemblies.

For test access, you can use either a Tautron *ngRTH* test head or a RMU. This configuration serves up to 768 lines.

### 90A Cabinet (120 V AC 20A) — Partial Configuration

You can use the 90A cabinet with a 120 V AC 20A power supply in a partial configuration that serves up to 384 lines. This partial configuration can include the following equipment:

- One ARM shelf
- One of the following configurations:
  - Up to two MDS assemblies
  - One MDS assembly and one DDM-Plus shelf
- Two fan assemblies.

For test access, you can use either a Tautron *ngRTH* test head or a RMU.

## 90A Cabinet Features

---

### Splicing Area

The 90A cabinet provides a splicing area within the cabinet

### Lightguide Termination

The 90A cabinet supports one 2.5-inch high fiber termination shelf. The fiber shelf mounts in the lower half of the cabinet. This allows technicians to sit down while accessing fibers and performing fiber splices.

## **Power**

### **Input**

The 90A cabinet uses one of two service types based on the number of MDS assemblies included in the *SLC-2000* system:

- **120-Volt 20-amp single-phase AC:** Up to two MDS assemblies
- **240-Volt 20-amp single-phase AC:** Up to four MDS assemblies.

### **Output**

The 90A cabinet CPS/bulk power plant provides -48 V DC power and ringing equipment with a single power shelf. This power plant supports an internal power load of approximately 20 amps for the *SLC-2000* Access System.

### **Reserve**

The 90A cabinet uses a CPS/bulk power plant and houses the reserve power supply batteries in two FPS battery shelves below the main electronics. The 28.5-inch width of the cabinet houses up to two strings of Lucent Technologies *Lineage*® IR series batteries in each battery shelf. Depending on the way the cabinet is equipped, the batteries provide from 4 to 6 hours of reserve time using 26-Ah strings.

## **90A Cabinet Ordering Information**

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For ordering information on this cabinet, see Document 626-500-115.



## 7-Foot RT Bays

Figure 6-7 shows two 7-foot bay arrangements (one with metallic distribution and the other with FITL distribution). Both arrangements can be equipped with a single ARM shelf, up to four MDS assemblies, and one or two fan shelf assemblies. The FITL distribution arrangement can have up to two HDOSs to interface with Multi-Services Distant Terminals (MSDTs). The total number of lines supported is 768. In the metallic arrangement, an optional DDM-Plus can be included, which allows up to 28 DS1 extensions. For DS1 service, the ARM shelf assembly may be installed without MDS assemblies, which may be added later. Refer to Chapter 8 for powering and ringing configurations for the RT frame.

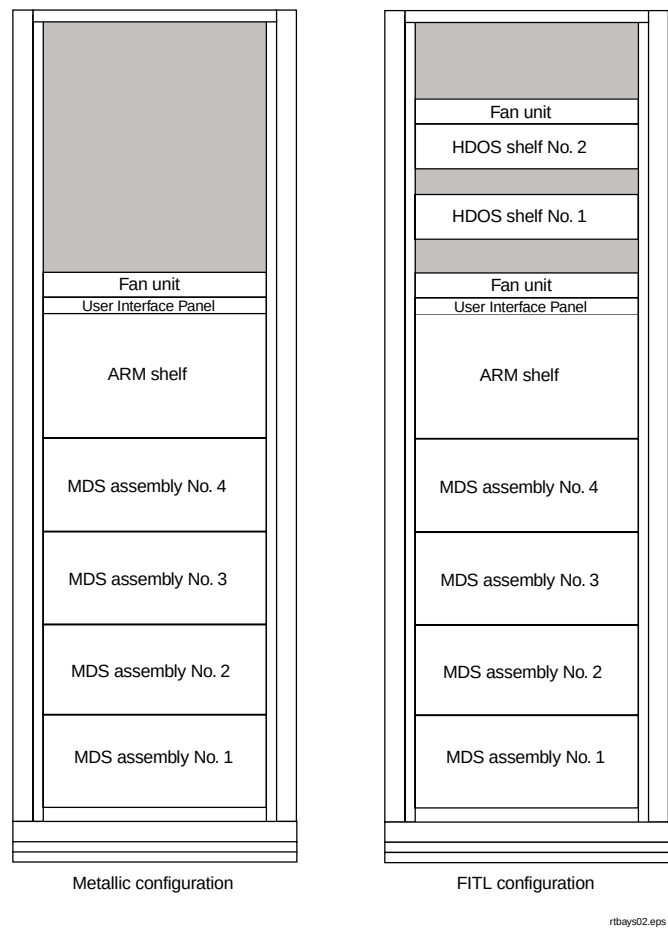


**Figure 6-7. 7-Foot Remote Terminal Bays**

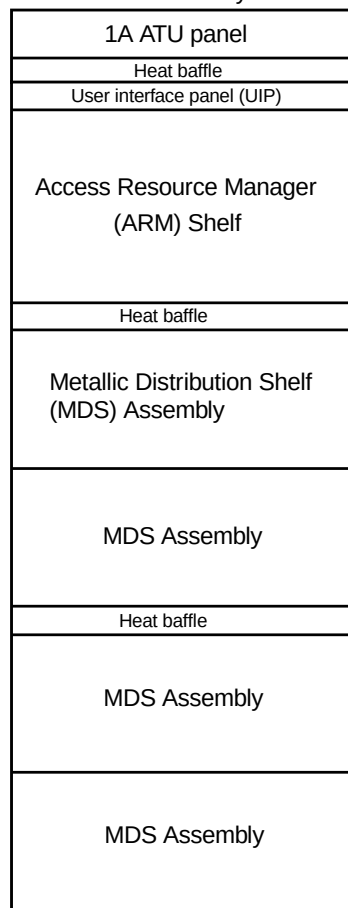
## 7-Foot COT Bays

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Figure 6-8 shows the *SLC-2000* Access System COT bay arrangement. The COT bay is equipped with a single ARM shelf, up to four MDS assemblies, a user interface panel (UIP), a 1A alarm and test unit (ATU), and three heat baffles. The total number of lines supported is 672. For DS1 service, the ARM shelf assembly may be installed without MDS assemblies, which may be added later. The COT bay can be ordered pre-cabled and equipped for standard arrangements (see Chapter 11).

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*SLC*<sup>®</sup>-2000 Access System COT



832445.eps

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**Figure 6-8. 7-Foot Central Office Terminal Bay**

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# Operations, Administration, Maintenance, and Provisioning (OAM&P) Considerations

# 7

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# **Operations, Administration, Maintenance, and Provisioning (OAM&P) Considerations**

# 7

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## **Introduction to *SLC*<sup>®</sup>-2000 Operations**

The *SLC*-2000 Access System provides a full range of OAM&P features that are accessible by local, remote, and centralized users. In addition, Lucent Technologies has a proven track record of interoperability with many operations systems (OSs). The *SLC*-2000 system supports remote and mechanized flow-through operations with existing OSs; its system architecture does not require a separate "system-specific" element manager or a supervisory system, but rather integrates most operations functions within the *SLC*-2000 system itself. Finally, Lucent Technologies has worked with Bellcore, and other OS vendors to ensure mechanized flow-through operations (no human involvement) and interoperability with embedded OSs.

The objectives of the *SLC*-2000 Access System OAM&P strategy are the following:

- To reduce operations cost with mechanized, flow-through operations and maintenance
- To maintain consistency with the embedded base of digital loop carrier (DLC) operations
- To provide an evolution path for enhanced operations based on standard interfaces

- To maintain consistency with the Lucent Technologies 2000 Product Family synchronous optical network (SONET) operations architecture
- To provide an evolution path for enhanced operations based on standard interfaces that supports SONET, integrated multiplexers and digital loop carrier, TR-303, integrated services digital network (ISDN), and fiber-in-the-loop (FITL) distribution.

The user interface panel (UIP) provides basic OAM&P functions without a craft interface terminal. A craft interface terminal (CIT) can be used for more detailed local and remote operations. The interface for centralized access is compatible with Bellcore's TR-303 interface and SONET TR-253<sup>\*</sup> and provides TL1 messages to Bellcore operations support systems (OSSs). This interface to operations systems / network elements (OS/NEs) is supported by the *SLC-2000* Access System using the SONET data communications channel (DCC). The *SLC-2000* central office terminal (COT) or the DDM-2000 multiplexer serves as the gateway network element and supports a TL1 message set compatible with Bellcore's *NMA*<sup>†</sup> OS and OPS/INE OS.

Consistency in operations has been maintained as much as possible between the DSX-1 metallic feeder configuration and SONET feeder linear configurations. However, remote CIT and OS connections are different; details are given in 824-102-149, *SLC-2000 Access System, Operations Systems Engineering Guide*.

The deployment of *SLC-2000* Multi-Services Distant Terminals (MSDTs) or DDM-2000 FiberReach Narrowband Shelves (NBSS) from a host digital terminal (HDT) does not result in significant change in the operations of the *SLC-2000* system; the *SLC-2000* FITL feature minimizes differences between metallic and fiber distribution from the OAM&P perspective.

In addition to the remote features supported, the *SLC-2000* Access System allows OAM&P from the HDT for FITL configurations. For example, maintenance personnel can test MSDT/V-MSDT/V-DT channel units as if they were in an metallic distribution shelf (MDS) assembly. They can also use the craft interface terminal (CIT) to set provisionable MSDT/V-MSDT/V-DT channel unit parameters as if these channel units were at the remote terminal (RT).

**NOTE:**

See Chapter 2 for a definition of *virtual-MSDT* (V-MSDT) and *virtual-DT* (V-DT).

---

\* Bellcore Technical Reference TR-NWT-000253, Issue 2, December 1991 (A module of TSGR, FR-NWT-000440), *Synchronous Optical Network (SONET) Transport Systems: Common Criteria*.

† Trademark of Bellcore.



## **Multilevel User Access**

---

The *SLC-2000* Access System allows local, remote, and centralized user access for OAM&P functions, as follows:

- Local user access allows maintenance personnel to access the system at the remote terminal/host digital terminal (RT/HDT) site for OAM&P activities. For example, a technician can use the *SLC-2000* user interface panel (UIP) at the RT for basic maintenance functions. The CIT is used to perform more advanced local operations and is required to turn up a system.
- Remote user access provides the technician with the ability to log in to one network element (NE) from a different NE in the same SONET subnetwork. This allows you to perform most OAM&P functions on multiple NEs from a single location using the CIT. For example, the technician can retrieve an alarm composite summary for all NEs in the SONET subnetwork by accessing any one of the NEs in the SONET subnetwork.
- Remote access in a metallic feeder configuration is provided with a rear access port for connecting a modem, which allows the CIT to dial up remote systems.
- Centralized user access allows OAM&P functions to be performed remotely from a centralized location such as a work center. For example, a technician who has access to various OSs [such as the Switched Access Remote Test System (SARTS), the Mechanized Loop Testing (MLT) system, and OPS/INE] can provision, test, and realign special services channel unit parameters from the same maintenance center.

Using the *SLC-2000* UIP, the CIT, the integral test head (ITH), and the DDM-2000 and the local digital switch (LDS) gateway network elements (GNEs) in the central office (CO) for the OS/NE interfaces, the *SLC-2000* system provides many element management layer (EML) functions that other vendors choose to implement in a "supervisory system" (SS) or "subnetwork controller" (SNC). A separate "system-specific" element manager (or supervisory system) is not required for basic operational support of the *SLC-2000* Access System.

## **Local User Access**

The *SLC-2000* UIP, a 24-character alphanumeric display located in the access resource manager (ARM) shelf, provides a central point of focus for system status displays, alarm information, various push button controls and control interfaces. The UIP also contains test jacks and an EIA-232-D port for CIT access.

With the UIP, the technician can perform basic installation and maintenance operations, for example:

- Select metallic or fiber distribution configuration for each MDS assembly shelf.
- Review fault and alarm conditions using the UIP 24-character display and UIP equipment indicators.
- Connect an ASCII terminal or a personal computer (PC) to the CIT port to support more advanced local operations such as SONET and DLC cross-connect provisioning, channel unit provisioning, and alarm retrieval.

The CIT can access the *SLC-2000* system with a cable that plugs into the port on the UIP or the rear access port. Using a CIT locally at the RT/HDT site, the technician can perform basic and complex OAM&P functions, including the following:

- Perform a full set of provisioning functions, including turning up any *SLC-2000* system configuration.
- Access the system for local testing.
- Download SONET and DLC software (*MS-DOS*\* PC required).
- Retrieve system information.

### **Remote User Access (from Another Network Element)**

The *SLC-2000* HDT/RT can be accessed remotely from another NE site with the CIT, which uses an interface with common messages and a similar "look and feel" to the *DDM-2000* multiplexer. This makes the *SLC-2000* system and other NEs in the same SONET subnetwork look interchangeable from the operations perspective.

The SONET DCC in SONET feeder configurations provides "single-ended operations." Remote login from the CIT allows a technician to perform OAM&P functions on a *SLC-2000* system from a different NE; for example, retrieving *SLC-2000* system provisioning information from a *DDM-2000* multiplexer in the same SONET subnetwork.

**Rear Access CIT Port.** The rear access port is used with a modem to allow the CIT to dial up remote sites. It may be used with SONET or metallic feeder, but it is especially useful with metallic feeder (which does not support the remote login feature).

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\* Registered trademark of Microsoft Corporation.

### **Centralized User Access (from Operations Systems/Work Centers)**

Centralized user access allows OAM&P functions to be performed remotely from a centralized location such as a work center. This can result in significant savings on “dispatch in/dispatch out” operations expenses. The *SLC-2000* system can improve efficiency of operations even further by allowing multiple OSs to access a *SLC-2000* system from the same centralized location. For example, a technician who has remote access to SARTS and OPS/INE may be able to provision and test (and realign and retest if necessary) special services channel unit parameters from his/her desk. This allows service to be delivered with a shorter interval and with only one technician.

The OAM&P capabilities of the *SLC-2000* system provide the most advanced operations capabilities with minimum effect on the present method of operations. Using the DDM-2000 multiplexer or *SLC-2000* COT as the GNE, the *SLC-2000* system communicates with embedded OSs for enhanced OAM&P features, via the SONET DCC between the GNE and the system. Integrated transport management Subnetwork Controller (ITM SNC) provides for inventory, provisioning, and alarm support. The *SLC-2000* system also supports interfaces to Bellcore's *NMA* and OPS/INE, for alarm reporting and DS0 provisioning.

### **Single-Ended Operation and Maintenance**

---

The *SLC-2000* system and the DDM-2000 multiplexers allow operation and maintenance of all remote systems in an OC-3 or OC-3/OC-12 SONET subnetwork from the central office system. ***A SONET subnetwork consists of SLC-2000 and DDM-2000 systems interconnected by optical lines with the SONET data communications channel (DCC) enabled.*** Similarly, a technician working at a remote site can access the central office system associated with the system he/she is working on, as well as with other remote sites in the same SONET subnetwork. The *SLC-2000* system and DDM-2000 use the SONET DCC to provide the following:

- Craft interface terminal remote access
- User panel remote access
- Operations system remote access.

The international standards organization (ISO) compliant open systems interconnection (OSI) protocol is used for communicating between systems over the DCC.

The single-ended operations (SEO) capability that provides remote access to all *SLC-2000* systems in a SONET subnetwork from a single location is shown in Figure 7-1 (SONET subnetworks must be logged into individually for maintenance). The ability to do many maintenance, provisioning, and administration tasks on a remote or centralized basis minimizes technician travel.

Table 7-1 and Table 7-2 list the maximum number of *SLC-2000* and or *DDM-2000* NEs that the SONET subsystem supports in one maintenance subnetwork. In a mixed OC-3/OC-12 network, each NE counts as one. Larger networks may be supported for specific applications or with new software releases if subnetwork growth is needed. Also, there is no limitation on the size of the networks formed by dividing a large network into several smaller maintenance subnetworks by disabling the DCC on the appropriate OC-N interfaces. Software upgrades and DCC partitioning can be done in-service without affecting traffic. If larger maintenance subnetworks are needed, contact your Lucent Technologies account manager.

**Table 7-1. SLC-2000 and DDM-2000 OC-3 — Maximum Number of SONET NEs in a SONET Subnetwork**

| SONET Release      | Linear | Ring |        |        |        |      |       |         |
|--------------------|--------|------|--------|--------|--------|------|-------|---------|
|                    | R6.2   | R7.0 | R7.1.n | R7.2.n | R9.0.n | R9.1 | R11.X | R13     |
| Number of Elements | 10     | 10   | 16     | 24     | 32     | 50   | 50    | 50/256* |

\* 50 per Level 1 area and 256 per subnetwork, including FT-2000 OC-48 R8.X, also. See Document 824-102-144, *Lucent Technologies 2000 Product Family, Multi-Vendor Operations Interworking Guide*.

**Table 7-2. External DDM-2000 OC-12 Multiplexer— Maximum Number of SONET NEs in a Maintenance Subnetwork**

| SONET Release      | Linear | Ring   |
|--------------------|--------|--------|
|                    | R2.2   | R3.1.n |
| Number of Elements | 10     | 16     |

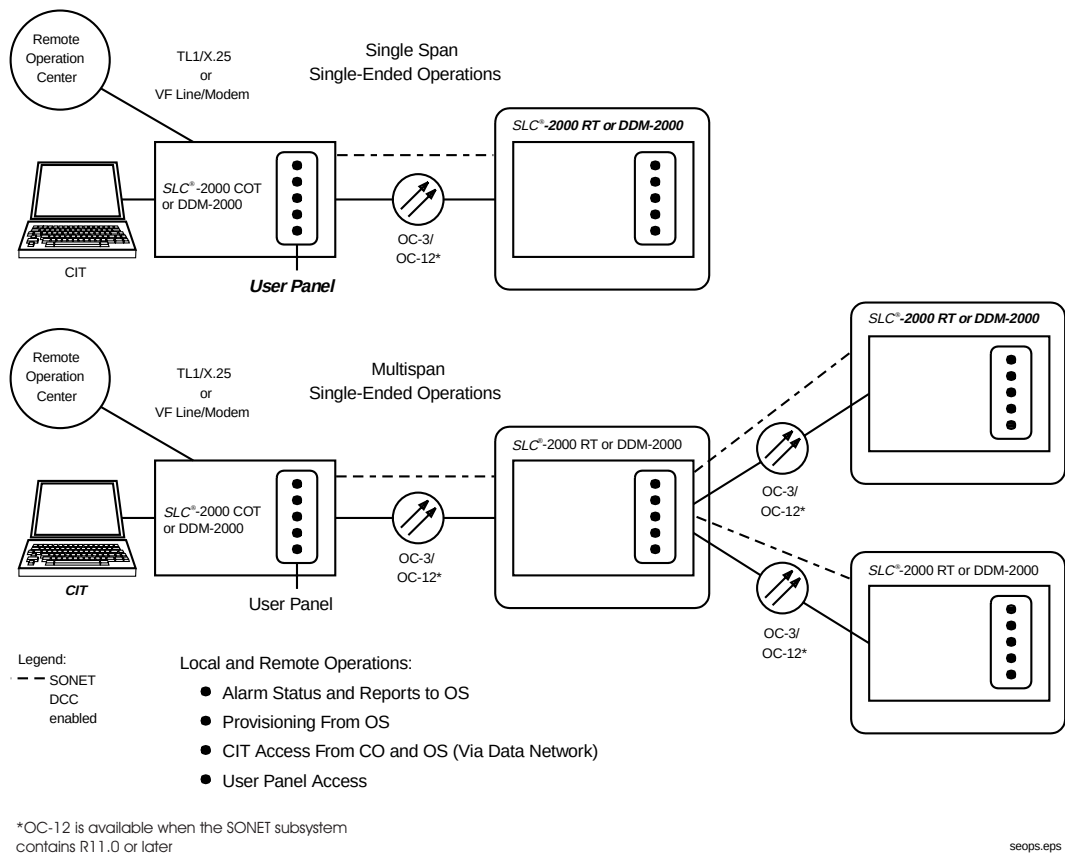


**Figure 7-1. Single-Ended Operations**

The number of systems at a single site that can be managed off an operations link is 8. If the maintenance subnetwork contains more than eight NEs, refer to 363-208-001, *SLC-2000 Access System, User/Service Manual*, for information on assigning site IDs and NE IDs. Also, the far-end alarm display feature on the UIP (controlled using the push button on the SYSCTL) combines the alarms of all NEs that have a site ID number greater than eight into a single alarm summary.

### Mechanized Operations (with No Human Involvement)

Mechanized operations means automatic flow-through operations with little or no human involvement in the daily operations process. This is the ideal operations environment because many operations steps are mechanized or transparent to the operations personnel. Mechanized operations also provide the most effective service with minimum personnel resources and human operation error.

The *SLC-2000* system supports mechanized operations for the following:

- Time slot cross-connect provisioning of STS-1/DS3, VT-1.5/DS1, and DS0 time slot interchange (TSI) [for *SLC-2000* TR-08 Mode 1 and Mode 2 virtual remote terminals (VRTs — see Chapter 3), integrated network access (INA) DS1s, as well as the *SLC-2000* TR-303 VRT]] plug-ins. This is done using *SLC-2000* access identifiers (AIDs) and the flow from Facilities Assignment and Control System (FACS) and/or the *TIRKS*\* OS to the network services data base (NSDB), to OPS/INE, and to the *SLC-2000* system via a GNE.
- DLC special service channel unit provisioning for both metallic and fiber distributions of the *SLC-2000* system using FACS, the *TIRKS* OS, NSDB, OPS/INE, and the GNE.
- Fault and performance monitoring threshold detection, and alarm suppression and generation. Mechanized alarm gathering from different sources, patterning, root cause analysis, alarm suppression, trouble ticket generation, and automatic dispatching are provided by the *NMA* OS, using the *SLC-2000* AIDs and *SLC-2000* equipment hierarchy generators (EHGs), and *TIRKS* OS and *NMA* OS data base information for the *SLC-2000* system.

### **TR-303 Operations**

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TR-303 defines the embedded operations channel (EOC) for transporting operations messages. Using operations messages, the operations systems (OSs) or the local digital switch (LDS) can instruct the virtual remote terminal (VRT) to perform provisioning, maintenance, and administration functions. TR-303 also defines the time slot management channel (TMC) for call control. By exchanging call control information between the LDS and the VRT, time slots can be assigned for setting up calls or unassigned for disconnecting calls.

In the TR-303 configuration, the *SLC-2000* system integrates into the *5ESS*® switch Release 5E9.1 BWM95-0001 or later, which offers a TR-303 interface. In addition to communicating with the embedded OSs via the GNE X.25/TL1 interface for service-order driven activities, the *SLC-2000* system supports the embedded operations channel (EOC) for certain OAM&P functions to be performed by the host local digital switch (LDS), using remote operations service element (ROSE), common management information service element (CMISE), and ASN.1 technology.

Functions supported via the EOC include the following:

- Provisioning of analog and Integrated Services Digital Network (ISDN) lines, including port states.

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\* Registered trademark of Bellcore.

- Providing on-demand removal and restoration of subscriber lines (analog and ISDN).
- Semipermanent time slot assignment of ISDN D-channels using 4:1 time division multiplexing.
- Semipermanent time slot assignment of special service time slots to dedicated DS0s driven by the service order process.
- On-demand circuit testing for switched services.
- On-demand path switching of EOC data links. (TMC path switching is performed via the TMC data link.)
- Allow the LDS to set and retrieve TR-303 LAPD parameters.
- Allow the LDS to set and retrieve TMC layer 3 parameters.
- Autonomous reporting of equipment, environmental, memory, data link, and feeder alarms.
- Autonomous reporting of service state changes of analog and ISDN lines as a result of problems detected within the *SLC-2000* system.
- On-demand retrieval of DS1 and ISDN performance monitoring counts.
- Provisioning of DS1 and ISDN performance monitoring alert thresholds.
- Autonomous reporting of DS1 and ISDN alert threshold crossings.
- On-demand loopback testing for ISDN lines and DSX-1 feeder facilities.



**NOTE:**

The EOC complements TL1; the TL1 OS interfaces are still required. EOC operations fit in with the overall operations plan as described in this chapter. There may be additional OAM&P available for the RT/HDT (also called the remote digital terminal — RDT) through the user (craft) and OS interfaces of the LDS. Consult the LDS maintenance documentation for further information.

### **Integrated Transport Management Subnetwork Controller (ITM SNC)**

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The ITM SNC provides a set of standard and value-added functions to administer a SONET network element such as the *SLC-2000* system. Software Release R3.2 or later supports the features provided by the controller.

The ITM SNC features are grouped by the following functions:

- **Fault Management:** The controller collects all facility and equipment alarm, event, and clear messages (including environmental alarms) that are autonomously generated by the *SLC-2000* system. It stores their current status in an alarm data base. SNC fault management supports a range of rates and services from optical facilities to DS0 metallic lines. Using the alarm and current configuration data, the controller creates

dynamic alarm displays that alert the user to the location of the problem. It also reduces the volume of alarm information by alarm processing such as thresholding and correlation. The controller keeps its alarm data base current to reflect the real-time alarm state of the network. At any time, the user can retrieve on demand any facility and equipment alarms from the network.

- **Configuration Management:** ITM SNC creates and maintains — in real time — an accurate model of the network with minimal user input. Using the Dynamic Network Operations (DNO) process, the controller creates and maintains an accurate model of the network. It also creates two views of the *SLC-2000* system:
  - Physical or equipment view
  - Logical or cross-connect view.

This information is the basis of the configuration management features. Users make configuration changes using a graphical user interface (GUI) that translates commands into corresponding TL1 messages, downloads them to the system, and updates its SNC data base after receiving confirmation of the change.

- **Performance Management:** ITM SNC support performance management by providing the following features:
  - Remote administration of parameters and thresholds
  - Exception reporting
  - Performance monitoring data collection and reporting
- **Graphical User Interface (GUI):** INT SNC provides a graphical interface to the most often used TL1 commands, while maintaining the ability to initiate a cut-through session and enter TL1 commands. The GUI includes the following multilevel displays of the network:
  - Automatically created map of the overall SONET domain
  - Shelf display of the individual circuit packs
  - Graphical representation of the logical cross-connects.
- **Security Management:** ITM SNC supports the following security management features:
  - User, target, and command group partitioning
  - Automatic log-off.



- **Communications Interface:** The ITM SNC communications interface has the following two parts

- *Southbound:* connects with network elements
- *Northbound:* connects with external OSs.

In the latest ITM SNC software release, the southbound communication interface supports OSI based Intra-Office Local Area Network (IAO-LAN). The northbound communication interface ensures proper external OS to NE communications in the IAO-LAN environment.

- **Remote Access Capability:** The craft interface terminal (CIT) that is physically attached to a CIT port on the *SLC-2000* system provides local craft access. This allows the user to input comand line entries. ITM SNC provides a cut-through capability for issuing commands directly to the *SLC-2000* system's TL1/X.25 interface (OS port). This provides a remote access capability through the OS port to provide direct TL1 character-oriented command exchange with the *SLC-2000* system's command set. This cut-through capability is a secure interface since it allows users of the system access only to the network elements and TL1 commands for which they have permission. The cut-through window has an editable command line for input and ITM SNC performs a level of syntax validation before sending the commands to the network element. This feature is especially useful for retrieving on-demand performance data or for entering infrequently used or new commands that are not yet supported by the ITM SNC GUI.
- **SNC Operations, Administration, and Maintenance:** ITM SNC provides the following operations, administration, and maintenance features, including SONET subsystem software download and installation (SONET subsystem software release R13 or later):
  - Generic software installation
  - Subnetwork initialization
  - ITM SNC self-monitoring
  - Network element memory backup and restoration
  - Date/time synchronization
  - Enhanced scheduler
  - Startup/shutdown
  - Data storage.

## **Bellcore Operations System (OS) Interoperability Support for the SLC-2000 Access System**

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### **LEIS\*/Loop Electronics Inventory Module (LEIM) and LEIM/TMM**

Bellcore's *LEIS* system is a decision-support system that allows outside plant engineers access to mechanized assignment data as well as planning and design capabilities in an environment of new services and technologies.

The loop electronics inventory module (LEIM) is a module of *LEIS* system. LEIM provides a mechanized physical inventory for the loop electronics equipment and connections. It also supports resource provisioning of the loop electronic network elements. LEIM is used mainly by the outside plant engineering (OSPE) organization to maintain, inventory, and provide the provisioning of loop electronics.

### **Facilities Assignment and Control System (FACS)**

Modules of FACS include service order analysis and control (SOAC), loop facility assignment and control (LFACS), and the computer system for main frame operations system (COSMOS).

Bellcore's FACS is an on-line data processing system that can maintain *SLC-2000* inventory information and provide assignment of outside plant and central office facilities. In R18.8 or later releases, FACS can also provide the *SLC-2000* system DS0 TSI static cross-connect assignments for integrated and universal TR-08 VRTs (Modes 1 and 2) and integrated TR-303 VRTs as well as integrated network access (INA) facilities.

The required FACS data base records, models, tables, line terminal status (LTS) codes, and assignment algorithms and rules to support the *SLC-2000* system are analyzed and developed through operations systems modifications for intelligent network elements (OSMINE) work. Bellcore has issued many documents outlining the interoperability between FACS and the *SLC-2000* system, covering OSIA, TR-303 and FITL configurations, the AUA94 ISDN channel unit, and access identifiers (AIDs).

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Trademark of Bellcore.

## **TIRKS OS**

The *TIRKS OS* is an integrated computerized system supporting the total network provisioning process in terms of (1) planning, (2) circuit and equipment order control, (3) circuit design, (4) inventory and circuit record maintenance, and (5) the preparation and distribution of work orders to field forces for message trunks, special services circuits, and carrier systems.

The required *TIRKS OS* data base records (for example, E1 catalogs and function encoder guides) and models (for example, equipment hierarchies), function codes, and other turn-up methods and procedures are analyzed and developed through the OSMINE work between Lucent Technologies and Bellcore. A number of *TIRKS OS* catalog update releases (CURs) related to the *SLC-2000* system have been issued, along with several operations support impact assessments (OSIAs) for support of the *SLC-2000* system.

## **NMA OS**

The *NMA OS* is designed to collect, analyze, and alert the responsible center for loop, interoffice, and switch troubles. The *NMA OS* can collect alarm and performance information from multiple sources via the generic OS/NE interface No. 2 Switching Control Center System (#2 SCCS), Telecommunication Alarm Surveillance and Control System (TASC), and E-telemetry.

The *SLC-2000* alarm and performance monitoring information is generally received by the *NMA OS* via the following:

- The LDS in integrated configurations
- The COT in universal configurations
- Alarm relay closures
- The telemetry byte-oriented serial (TBOS) interface (for the high-speed part of the *SLC-2000* system)
- Telecommunication alarm surveillance and control (TASC) and E2A parallel telemetry
- The OS/NE X.25/TL1 interface from the DDM-2000 GNE or from the *SLC-2000* COT.

Through the OSMINE process, the *NMA OS* has built the necessary *SLC-2000* system models and provided inventory and data base methods; many *TIRKS* models for the *SLC-2000* system can flow to the *NMA* data base automatically. In addition, Bellcore has tested the *SLC-2000* R3.2 system with the *NMA OS* for OC-3 rings and OC-3 linear point-to-point and taper configurations. The OSMINE work ensures easier turn-up of the *NMA* data base to support *SLC-2000* alarm surveillance and performance monitoring. Several OSIAs and other documents have been issued covering inventory methods and outlining *NMA OS* interoperability with the *SLC-2000* system, *SLC-2000* configurations, and test plans.

## **OPS/INE System**

The Bellcore OPS/INE system can provide remote device administration, management of equipment, automated circuit provisioning, and memory restoration. Through the OSMINE process, the OPS/INE R1.8 and later releases (when used with FACS R18.8 and later) will support *SLC-2000* system flow-through provisioning of SONET and DLC cross-connections, DLC special service channel units, and FITL services. *SLC-2000* Software Release 4.5 or later allows ISDN provisioning with OPS/INE.

OPS/INE turn-up for support of the *SLC-2000* system requires that its data base "know" the *SLC-2000* target identifier (TID). Additional requirements may include using the *SLC-2000* AIDs and other methods and procedures.

Several documents have been issued outlining OPS/INE requirements for interoperability with *SLC-2000* test plans, test reports, and configurations. Part of the interoperability testing from FACS and the *TIRKS* OS to the *SLC-2000* RT via NSDB, OPS/INE, and DDM-2000 GNE has been done through OSMINE.

## **Bellcore OS Support for Other Lucent Technologies NEs**

Lucent Technologies switching and other transmission organizations also worked with Bellcore to ensure Bellcore OS support for the *5ESS* switch, DDM-2000, FT-2000, and many Lucent Technologies digital cross-connect systems. Most existing OS interfaces to the LDS need not be modified to support the *SLC-2000* system, and OSMINE projects will address Lucent Technologies product-specific issues.

## **Testing OSs**

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The *SLC-2000* Access System is compatible with different testing OSs and remote test units (RTUs) for testing plain old telephone service (POTS) and special services. See the section "Circuit Maintenance" (under fault detection for the DLC subsystem) in this chapter for compatibility and configurations for circuit testing.

## **Configuration Management**

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Configuration management is defined as the functions that exercise control over, identify, collect data from, and provide data to network elements.

## **Upgrading System Software**

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The SLC-2000 system provides an in-service software installation capability to update the generic program in local and remote systems. Upgrades to the SONET and DLC software will be distributed on *MS-DOS* formatted diskettes containing the new software and an installation program for installing the software. These software upgrades are the mechanism to upgrade from one system software release to the next. All software upgrades maintain the provisionable parameters of the previous software generic. For example, cross-connections are left unchanged by the software upgrade. Also, stable calls are always maintained.

## **Network Element Software Compatibility**



### **CAUTION:**

*All network elements within the subnetwork must be running the same SONET software release. This means that you must be running the same SONET software in all network elements of a ring or linear network, even if they are part of a larger network. For example, in a SONET Release 7.0 OC-3 ring, you cannot have some nodes running DDM-2000 R7.0 while others are running DDM-2000 R7.1. Also, each SLC-2000 DLC software release is compatible only with specific DDM-2000 releases. For example, to interface a SONET Release 7.1 OC-3 ring, the SLC-2000 DLC subsystem must be running Release 3.2 or a later release.*

The *SLC-2000* Access System uses the DDM-2000 OC-3 multiplexer software for the SONET subsystem along with a *SLC-2000* Access System DLC software package. When upgrading *SLC-2000* Access Systems in the subnetwork, make sure the DLC software is compatible with the DDM-2000 OC-3 multiplexer software. The DDM-2000 software (SONET subsystem) may need to be upgraded also.

Table 7-3 lists the software compatibility between the *SLC-2000* Access System and the DDM-2000 multiplexer. All configurations listed support SEO. The table lists all possible software combinations. Combinations not marked are not supported. For software compatibilities between *SLC-2000* and other hardware, see Table 8-7 on page 8-54.

**Table 7-3. SONET OC-3 Networking Software Compatibility (Note)**

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| Release                     | SONET OC-3 Software Release |     |     |     |     |     |     |    |      |    |
|-----------------------------|-----------------------------|-----|-----|-----|-----|-----|-----|----|------|----|
|                             | 6.2                         | 7.0 | 7.1 | 7.2 | 8.0 | 9.0 | 9.1 | 11 | 11.1 | 13 |
| SLC <sup>®</sup> -2000 R3.1 | X                           | X   |     |     |     |     |     |    |      |    |
| SLC-2000 R3.2               | X                           |     | X   |     |     |     |     | X  |      |    |
| SLC-2000 R3.3               | X                           |     | X   | X   |     | X   |     | X  |      |    |
| SLC-2000 R4.0               | X                           |     | X   |     |     |     |     |    |      |    |
| SLC-2000 R4.1               | X                           | X   | X   | X   |     |     |     |    |      |    |
| SLC-2000 R4.2               | X                           | X   | X   | X   |     | X   |     |    |      |    |
| SLC-2000 R4.3               | X                           | X   | X   | X   |     | X   |     |    |      |    |
| SLC-2000 R4.4               | X                           | X   | X   | X   |     | X   | X   | X  | X    | X  |
| SLC-2000 R4.5               | X                           |     | X   | X   | X   |     | X   | X  | X    | X  |
| SLC-2000 R4.6               | X                           |     | X   | X   | X   |     | X   | X  | X    | X  |

**Note:** Refer to 363-205-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*, for interworking with OC-12 releases.

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## **Synchronous Optical Network (SONET) and Digital Loop Carrier (DLC) Software Download**

SONET and DLC software can be downloaded locally or remotely from an *MS-DOS* PC using the CIT port on a *SLC-2000* Access System or *DDM-2000* multiplexer. The upgrade procedure is straightforward. The technician connects an *MS-DOS* personal computer (PC) serial port to the CIT port on the *SLC-2000* system, starts the installation program, and is prompted with a few safety questions before the software upgrade starts installing. When the technician responds "Yes" at the prompt to proceed, the "PC installation software takes over the process and completes the download from the PC.

The SONET software is installed directly onto the SYSCTL and OHCTL system controller circuit packs, which are shipped from the factory without the software loaded in their memories. The SONET software takes approximately 30 to 45 minutes to download to the system controller circuit packs at the recommended baud rate of 9600 b/s.

The DLC software is downloaded onto the SMU. For R3.2, the download of the DLC software to the SMU takes approximately 90 minutes at the recommended baud rate of 9600 b/s. For R4.0, the download takes approximately 110 minutes. When complete, the SMU must be enabled to initiate an in-service software installation from the SMU to the DLC subsystem.

Depending on the system configuration, only one or both of the software packages will need to be upgraded. Refer to the software release description for the desired release for detailed upgrade procedures.

### **SONET Software Installation (into the SONET Subsystem)**

As soon as the installation software on the PC finishes the process, the SONET subsystem automatically restarts with the new software (the SYSCTL resets).

### **DLC Software Installation (into the DLC Subsystem)**

Once the DLC software is downloaded to the SMU and the user enables the SMU, a software installation will occur to distribute the software to the DLC subsystem circuit packs. After the software is installed in each pack, the circuit pack automatically starts running the new software. The system first installs the software to the PDC and then to duplicated bandwidth management CORE. [The CORE consists of the TSI and BMP (R4.0 and later) circuit packs.]

After the CORE is successfully downloaded, the MDCs are loaded, starting with the first MDC in the first MDS shelf. When loading an MDC that supports TR-303 service (R4.0 and later), call processing will be interrupted (stable calls will be maintained) during the time the MDC is being loaded and reset (approximately 4



minutes). If the MDC supports only TR-08 service, established calls will be maintained, but call processing will be interrupted for about 30 seconds when the MDC is reset for the new load.

For FITL systems using the downloadable BIU (MC97793A1) or DSXBIU (FHB2), the BIU/DSXBIU software resides on the SLC-2000 system and starts installing as soon as the MDC reset is complete. After the BIU/DSXBIU software is installed, the BIU/DSXBIU resets and all V-MSDT or V-DT calls will be dropped. At all other times during the download, call processing and maintenance activities continue.

The VTUs or LIUs are downloaded last.

To assist with installation planning of R3.2, 3.3, 4.0, 4.1, and later software, Table 7-4 provides an estimate of the software installation times for each circuit pack. The total time required for installation of the system software will depend on the system configuration.

**Table 7-4. Estimated Software Installation Times for Circuit Packs**

| Circuit Pack | Release  |             | 4.0      | 4.1 and     | 4.3 and 4.4    | 4.5            |
|--------------|----------|-------------|----------|-------------|----------------|----------------|
|              | 3.2      | 3.3         |          | 4.2         |                |                |
| SMU          | 90 min.  | 120 min.    | 110 min. | 120 min.    | 120 min.       | 120 min.       |
| PDC          | 4 min.   | 5 min.      | 4 min.   | 5 min.      | 5 min.         | 5 to 9 min.    |
| TSI          | 3 min.   | 6 to 7 min. | 4 min.   | 6 to 7 min. | 6 to 7 min.    | 6 to 7 min.    |
| BMP          | —        | —           | 4 min.   | 6 to 7 min. | 6 to 7 min.    | 6 to 7 min.    |
| MDC          | 2 min.   | 4 min.      | 4 min.   | 4 min.      | 4 min.         | 4 min.         |
| VTU          | 2.5 min. | 4 min.      | 3.5 min. | 4 min.      | 4 min.         | 4 min.         |
| LIU          | 3 min.   | 4 min.      | 4 min.   | 4 min.      | 4 min.         | 4 min.         |
| BIU          | 45 min.  | 60 min.     | 60 min.  | 60 min.     | 60 min.        | 60 min.        |
| DSXBIU       | —        | —           | —        | —           | Approx. 4 hrs. | Approx. 4 hrs. |

## SONET Software Remote System Upgrade

SONET software may be downloaded to remote systems as follows:

- On command, the new software can be copied from the upgraded local system to remote systems over the SONET DCC, allowing software version changes without having to dispatch technicians to each remote site. SONET software may be copied from one system to another using the CIT command **cpy-prog**.
- In metallic DSX-1 feeder configurations, the CIT port can be remoted using the AUA232 channel unit. The software can then be downloaded from a PC to the remote CIT port.

## DLC Software Remote System Upgrade

DLC software may be downloaded to remote systems as follows:

- In SONET configurations, the software can be downloaded from a PC connected to an NE in the same SONET subnetwork.
- In metallic DSX-1 feeder or SONET configurations, the CIT port can be remoted using the AUA232 channel unit. The software can then be downloaded from a PC to the remote CIT port.

## Provisioning

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The SLC-2000 Access System allows the user or OS to customize many system characteristics through its provisioning features. SONET provisioning parameters are set as follows according to the SONET subsystem software release:

- **Release 7.x or Earlier.** Parameters are set by a combination of on-board switches and software control.
- **Release 9.0 or Later.** Most parameters are set by software control.

Most DLC provisioning parameters are set by software control.

Transmission parameters that usually change from one installation to the next (for example, DS1 and DS3 line buildouts) can be set with on-board switches. Other system configuration parameters (like the baud rate for the CIT port) can be set using the UIP. Parameters that require a wide range of options or in-service changes must be set under software control using a CIT or from an OS (for example, performance-monitoring thresholds, special service channel unit parameters, and FITL setup).

All provisioning data is stored in nonvolatile memory to prevent data loss during power failures. The SYSCTL, OHCTL, TSI, PDC, and THC circuit packs provide nonvolatile storage, as follows:

- The SYSCTL and OHCTL store provisioning parameters for the circuit packs in the SONET/DSX-1 feeder and DS1 distribution sections (SONET subsystem).
- The duplicated TSIs store provisioning parameters for the DLC subsystem and a copy of the check sum. The PDC stores only the check sum. If any one of the stored check sums disagrees with the other two copies, the circuit pack with the incorrect data is updated. (The check sum helps resolve conflicts in data between the TSI circuit packs.) When the TSI is replaced, the DLC subsystem data base from the other TSI will be automatically copied to the new TSI.
- The THC stores the ITH provisioning parameters.

### **Default Provisioning for System Turn-Up**

The *SLC-2000* Access System minimizes the required turn-up tasks with carefully chosen default values. Each turn-up parameter is assigned a default that is maintained in the *SLC-2000* DLC subsystem and SONET subsystem software. The SONET and DLC subsystems each support a single command (**init-sys**) entered (from CIT) to initialize the subsystem and reset turn-up parameters to their default values. Refer to 363-208-001, *SLC-2000 Access System, User/Service Manual*, for the default values.

### **Automatic Provisioning of Replaced Circuit Packs**

Replacing a failed circuit pack is simplified by automatic provisioning of the original circuit pack values. When a circuit pack is replaced, it is automatically provisioned with data from the circuit packs that contain the nonvolatile memory. If the SYSCTL is replaced, data from the transmission packs is loaded automatically into the nonvolatile memory on the new SYSCTL.

### **Pre-provisioning of Circuit Packs**

The DLC subsystem allows pre-provisioning of DS1 and DS0 cross-connections (via the CIT), and special service circuit parameters (via the CIT or an OS). This allows the cross-connections and optioning to be performed before the physical installation of a circuit pack. The result is greater flexibility in system installation and growth.

### **Initial Resource Provisioning**

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The initial resource provisioning process is a one-time, pre-service turn-up process, in preparation for turning up the first customer on a newly installed

*SLC-2000* system. Turn-up of a system involves provisioning of a number of configurable parameters, as follows:

- System-level identifiers and characteristics, such as site number, network element number, system name, terminal type (CO/RT), gateway network element, CIT page length and baud rate, and CIT and DCC security options
- Alarming options, such as alarm severity levels; power, environmental, and EC1/DS1 alarms; telemetry byte-oriented serial (TBOS) interface options; hold-off and clear delays; and environment alarm descriptions
- Feeder characteristics, such as OC-3/OC-12 and EC-1 degrade thresholds, DS1 parameters [line coding, framing format, alarm indication signal (AIS) insertion, etc.], and DS1/STS-1 line buildout
- Synchronization options, such as timing source, output mode, and mode switching
- Feeder performance monitoring alert threshold crossing for OC-3/OC-12, EC-1, DS3, STS-1, VT1.5, or DS1 (depending on system configuration)
- Configuration options, such as TR-08 VRT mode (Mode 1 or Mode 2), feeder type (LIU or VTU), and distribution shelf type (metallic or fiber).

Most of this provisioning is performed locally via option switches on the SYSCTL and OHCTL, or via commands at the CIT or UIP. Some options, such as defining alarm severities and performance monitoring alert threshold crossings, are also supported via the X.25/TL1 interface. The provisionable parameters are listed in Chapter 8, and details on the commands supported on the X.25/TL1 interface can be found in 824-102-149, *SLC-2000 Access System, Operations Systems Engineering Guide*.

### **Initial Time Slot Interchange (TSI) Provisioning**

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There are several levels of TSI within a *SLC-2000* network element (NE). The *SLC-2000* system supports a high-speed SONET interface and can provide low-speed STS-1E drops (for "drop-and-continue," "pass-through," and "optical extensions"), DS3, VT1.5, DS1, DS0 and quarter-DS0 drops by utilizing TSI at the STS-1/DS3 level, VT1.5 level, DS1 level, DS0 level, and at the quarter-DS0 level. Refer to the bandwidth management section in Chapter 3 for details of the internal structure of the *SLC-2000* system with different levels of TSI.

### **Synchronous Optical Network (SONET) Subsystem TSI Provisioning**

Like the Lucent Technologies DDM-2000 OC-3 multiplexer, the *SLC-2000* system supports SONET TSI at the STS-1 and VT1.5 levels. The *SLC-2000* system uses the DDM-2000 optical line interface units (OLIUs) in its **MAIN** and **FUNCTION (C)** slots. The 21 series OLIUs can provide only the STS-1 level TSI, and the 22 series OLIUs can provide both the STS-1 level and VT1.5 level TSI.

Provisioning of the SONET TSI can be done in a flow-through manner with OSs via the *SLC-2000* X.25/TL1 interface. A typical flow will take the following path:

- Facility design and assignment is created by *TIRKS*, which forwards the assignment information to OPS/INE (R1.8 or later). (The SONET low-speed ports are represented in *TIRKS* as unit numbers.)
- OPS/INE generates the appropriate TL1 commands (**ent - crs - xx**) by translating the *TIRKS* termination format to the *SLC-2000* AID addressing scheme, and forwards the command to the *SLC-2000* system.
- When the TL1 command is received from OPS/INE, the *SLC-2000* system will cross-connect the TSI and return confirmation information to OPS/INE via the X.25/TL1 interface.

*TIRKS* cross-connect information can also flow through to *NMA* automatically to eliminate the need for manual input to the *NMA* data base.

### **STS-1 TSI Provisioning**

Mechanized flow-through SONET STS-1 TSI provisioning is supported in *SLC-2000* SONET ring, point-to-point, and taper (linear-drop) configurations. Similar to the process of provisioning DDM-2000 SONET cross-connects, the *TIRKS* OS (R15.5 or later) can statically "drop" any of the STS-1 time slots from the high-speed SONET interface to any of the low-speed port in function group C.

### **VT1.5 TSI Provisioning**

Mechanized flow-through SONET VT1.5 TSI provisioning is also supported in *SLC-2000* SONET ring, point-to-point, and taper (linear-drop) configurations. Similar to the STS-1 provisioning process, the *TIRKS* OS can statically "drop" any of the VT1.5 time slots from the high-speed SONET interface to any of the 56 low-speed VT1.5 ports.

### **Digital Loop Carrier (DLC) Subsystem TSI Provisioning**

In addition to SONET-level TSI, the *SLC-2000* system has DLC bandwidth management capabilities, including the DLC DS1 mapping function and the DLC DS0 and quarter-DS0 TSI functions. (See the section on bandwidth management in Chapter 3.) DS1 TSI provisioning is part of the resource provisioning process; DS0 and quarter-DS0 TSI provisioning is part of the service provisioning process. Refer to Chapter 3 for details on bandwidth management and DS0/DS1 TSI capacity.

The *SLC-2000* DS1 mapping function provides efficient use of the bandwidth dropped from function group A. This DS1 mapping function is done after engineering; the CIT is used to set up the T1 cross-connections. Since this type of cross-connection is made only at the turn-up time or when the system is being re-engineered, the *SLC-2000* system currently does not have flow-through OS support for the **ENT - CRS - T1** TL1 command.

## Service Provisioning

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### DS0 TSI Provisioning

The *SLC-2000* system is designed with a DS0 TSI that can be grouped into a maximum of 28 DS1s consisting of the following:

- Up to eight TR-08 VRTs
- TR-303 VRTs depending on the software release:
  - **Release 4.0 or 4.1:** One TR-303 VRT
  - **Release 4.2 and later:** Up to two TR-303 VRTs
- Up to 28 INA facilities
- A combination of the above.

Mechanized flow-through provisioning of the DS0TSI is more complex than provisioning the feeder TSI because, to provide service, DS0 TSI requires coordination of LDS provisioning and provisioning of the *SLC-2000* system.

If your system is not connected to an OS such as FACS, it can be provisioned manually.

### Provisioning TR-08 Systems with DS0 TSI

The typical recent change process for switched services can be used for mechanized flow-through assignment for *SLC-2000* TR-08 VRTs (Mode 1, Mode 2, integrated and/or universal). Provisioning of the *SLC-2000* system (Figure 7-2) typically will flow as follows:

1. FACS inventories the *SLC-2000* system and statically assigns the DS0 TSI terminations and assigns outside plant facilities. It also generates and forwards the necessary cross-connect assignment information (in *SLC-2000* AID format) to OPS/INE.
2. OPS/INE, in turn, generates the DS0 TSI cross-connect TL1 commands (**ENT-CRS-T0**) using the FACS assignment information.
3. When it receives the TL1 command from OPS/INE, the *SLC-2000* system creates a DS0 cross-connection in the TSI and returns confirmation messages to OPS/INE over the X.25/TL1 interface.



For nonswitched special services, the flows similar to those previously described apply, except that the *TIRKS* OS determines the assignments and provisioning data and forwards this information to OPS/INE and COSMOS (Figure 7-3). In addition, provisioning may be needed through the LDS (recent change). This involves grooming of the DS0 at the LDS TSI [for example, using the *5ESS* switch integrated digital carrier unit (IDCU) hairpin feature described in Chapter 3].

**NOTE:**

Any special service customer can be cross-connected to a TR-08 Mode 1 system but cannot be cross-connected to a TR-08 Mode 2 system. A *TIRKS* OSIA provided *SLC-2000* models for providing special services in TR-08 Mode 1 systems; however, the *TIRKS* OS cannot model *SLC-2000* TR-08 Mode 2 systems.

**Provisioning a TR-303 System with DS0 TSI**

The *SLC-2000* TR-303 VRTs can be statically cross-connected with the same mechanized OS flow-through process described for the TR-08 systems.

Provisioning of the LDS is similar, except that TR-303 needs only part of the feeder bandwidth assignment procedures. The major change involves the LDS treatment of the OE and the LDS action in response to recent changes received from the *MARCH* OS or RMAS. This flow involves the following steps:

1. FACS forwards the feeder DS0 termination (cable and pair number for the AID-C termination) to COSMOS as part of the office equipment (OE). The line number in the OE is critical in this flow.
2. COSMOS again forwards the assignment information (recent change) to the LDS via a recent change OS such as the *MARCH* OS or RMAS.
3. The LDS treats the line number in the OE as a TR-303 call reference value (CRV) and provisions the appropriate common management information service element (CMISE)/abstract syntax notation (ASN.1<sup>\*</sup>) objects in the *SLC-2000* system via the EOC.
4. When this is completed, the TR-303 LDS provides the dial tone to the AID-C termination (specified by the CRV/OE) with the LDS dynamic concentration function via TMC and the cross-connect function via EOC.

A key part of this flow is that a cable and pair number is sent from FACS to COSMOS whether the AID-C termination is for an OE or for a CRV. This minimizes the OS effect on the provisioning flow.

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\* Specification of Abstract Syntax Notation (ASN.1), 1988, International Telephone and Telegraph Consultative Committee (CCITT) Recommendation X.208.



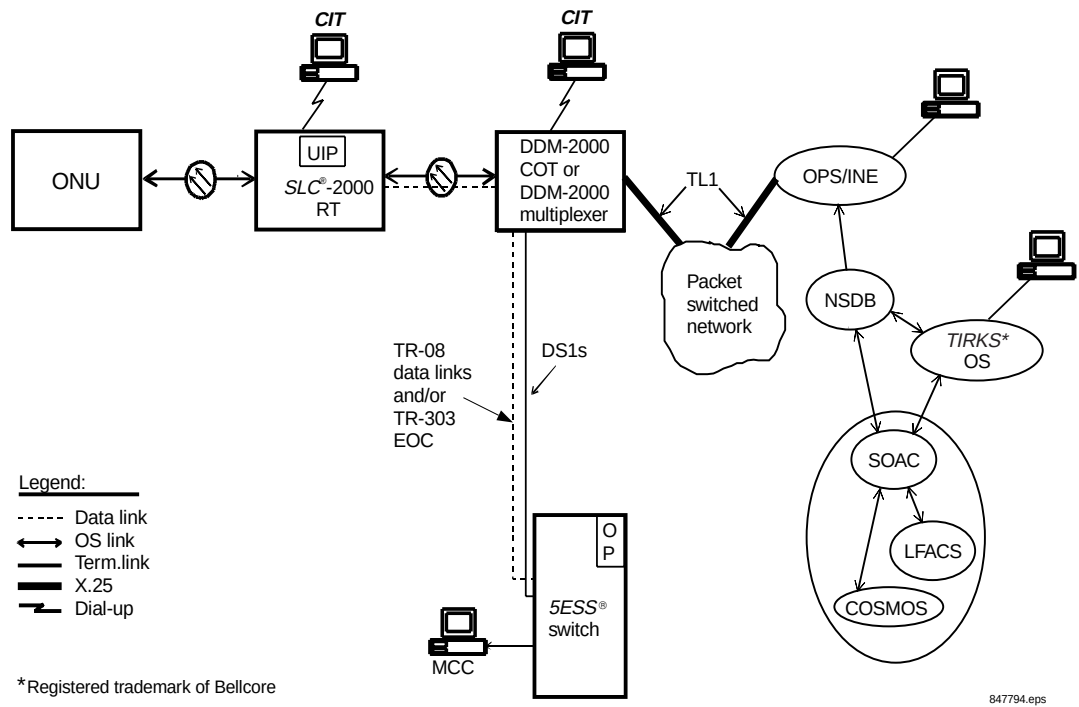


**Figure 7-3. Example of Designed Services Provisioning**

## Provisioning TR-303 ISDN Services

You can provision ISDN services as follows depending on the *SLC-2000* software release at the RT:

- **Release 4.0 through Release 4.4.** The OS uses a TL1 message to assign a T0 cross-connection (that is, the logical to physical line mapping) for each ISDN line. The LDS will then manage the B1, B2, and D-channel assignments.



**NOTE:**

If you are using the CIT for preliminary provisioning activities, the CIT can provision the T0 and T1 cross-connections. This allows the LDS to place the circuits into service without having to manually provision the cross-connections from the LDS. When using this method with the CIT, it is only necessary to provision the B1 DS0 channels of the U-DSL channel unit. The LDS automatically provisions the other DS0 channels.

The LDS uses an EOC command to make semipermanently time slot assignment of ISDN D-channels using 4:1 time division multiplexing (TDM) of the quarter-DS0 channels to provide cost-effective ISDN-supported services.

ISDN B1 and B2 channels can be semi-permanently assigned to a specific DS0 by the LDS via the EOC on a service-order basis for designed services as directed by an OS (*TIRKS* OS), or dynamically assigned on a per-call basis.

- **Release 4.5 or Later.** If your LDS has the capability to provision ISDN lines, then you can use the method shown for Release 4.4 or earlier. If your LDS does not have this capability or you do not want to provision from the LDS, then Release 4.5 allows you to provision ISDN lines from any *SLC-2000* user interface including the TL1/X.25 interface, CIT interface, or the rear CIT interface. For more information on ISDN provisioning using the TL1 interfaces, see the following commands in Document 363-208-003. *SLC-2000 Access System, Commands and Messages*:

- **ent-t0**
- **dlt-t0**
- **rtrv-t0**
- **ed-t0**
- **cpy-t0**



**NOTE:**

If the LDS has the capability to provision ISDN lines, any changes from the LDS — either manual or automatic — to ISDN lines provisioned from the TL1/X.25/CIT interface will override the provisioning from the TL1/X.25/CIT interface.

### **Provisioning the DS0 TSI with Integrated Network Access (INA)**

The *SLC-2000* system supports grooming of the designed special services customers at the DS0 TSI (circuit pack) to an INA logical DS1.

In this case, FACS will assign the path from the customer location to the INA side of the DS0 TSI (or AID-C). The *TIRKS* OS will model the whole system (in some cases, duplicated models) as T-carrier systems and assign special services customers to INA facilities that terminate on a DCS or a D-bank.



**NOTE:**

FACS provides special assignment rules for grooming/removing a TR-08 Mode 2 special services customer to/from an INA digroup. FACS also provides special TSI assignment rules for special service channel units such as T-interface basic rate interface transmission extension (T-BRITE) ISDN, U-BRITE ISDN, DDS, AUA232, and other special service channel units that use two DS0s. (See also the section on designed services parameter provisioning in this chapter.)

### **DS3 and DS1 Services Provisioning**

Like the Lucent Technologies DDM-2000 OC-3 multiplexer, the *SLC-2000* system supports DS3 and DS1 services. The *SLC-2000* system can use the DDM-2000 DS3 and DS1 circuit packs in its ARM shelf. Mechanized flow-through provisioning of *SLC-2000* DS3 and DS1 services is supported by the *TIRKS* OS, NSDB, and OPS/INE.

DS3 and DS1 parameters such as frame format line coding are provisioned by the *TIRKS* OS and OPS/INE. The CIT can also be used to provision T3- and T1-level parameters.

### **Designed Services Parameter Provisioning**

The architecture of the *SLC-2000* system is completely compatible with FACS, R18.8, and OPS/INE, R1.8 and later, systems (Figure 7-3). FACS line terminal status (LTS) codes, table changes, and methods and procedures are provided to support flow-through provisioning of optioning parameters for designed special services, including support of *SLC* Series 5 Carrier System special service channel units and the new digital data services (AUA200/232) and quad E *SPOTS*<sup>®</sup> (*SPQ*<sup>®</sup> 442/443) channel units.

The *SLC-2000* system provides mechanized flow-through provisioning of channel unit parameter optioning for special service circuits via the same X.25/TL1 interface used for DS0 cross-connect provisioning. This interface automates the work order record document (WORD)-driven functions and eliminates the need for the CIT user to interpret the WORD document and manually enter channel unit parameter optioning commands. The same channel unit parameter optioning/

special services are available regardless of the upstream OS interface to OPS/INE [NSDB/CDOC to OPS/INE or *TIRKS* OS/CDOC to OPS/INE].

In a TR-303 configuration, the LDS cannot completely provision the CMISE/ASN.1 objects for designed services other than ISDN via the EOC. Special service time slots and ISDN B1 and B2 channels can be semipermanently assigned as dedicated DS0s on a service-order basis. Provisioning of channel unit parameter options must be performed by an OS via the X.25/TL1 interface.

## **Fiber-In-The-Loop (FITL) Provisioning**

### **SLC-2000 MSDT (Release 2.0 and Later) and DDM-2000 FiberReach Terminal Narrowband Shelf (Release 4.3) ONUs**

Provisioning channel units in the ONU is done the same way as provisioning channel units at the RT/HDT. Once you provision the shelves in the HDT for fiber distribution (using the CIT or UIP) and you set the number of lines hosted by each MSDT Server (using the CIT), provisioning of individual channels in the ONU follows the service order flows described for the RT/HDT.



#### **NOTE:**

See 363-208-001, *SLC-2000 Access System User/Service Manual*, and 363-205-004, *SLC-2000 MSDT User/Service and Ordering Manual*, for details on provisioning the MSDT Server.

Through the OSMINE process, *SLC-2000* AIDs are supported in FACS and OPS/INE. In addition, *TIRKS* OS and *NMA* OS organizations provide OSIA and methods to inventory and assign *SLC-2000* FITL facilities and equipment.

### **DDM-2000 FiberReach Narrowband Shelf ONU (Release 4.4 and Later)**

Using the CIT, you can provision each DSX-1 signal feeding a *V-DT* in the NBS to any one of the following two modes:

- **Quad Mode:** In this state, the DSXBIU continuously attempts to find or frame-up on the DSX-1 input, establish the message link, alarm any DSX-1 faults, and provide service to a set of six channel unit slots in the NBS. This mode is similar to the service provided with Release 4.3 where a single server can feed a six-slot V-MSDT for 24-line service. You can also provision the quad mode for 12-line service.
- **Octet Mode:** In this state, the DSXBIU continuously attempts to find or frame-up on the DSX-1 input, establish the message link, alarm any DSX-1 faults and provide service to a set of three channel unit slots in the NBS. In the octet mode, each channel unit slot can support eight DS0s instead of the four DS0s supported in the quad mode. The octet mode allows the use of the maximum number of ten ISDN lines in the NBS when using the *SPQ494* quad ISDN channel units along with the *AUA94* dual ISDN channel units. You can provision the octet mode for 24-line service only.

**NOTE:**

See Chapter 2 for a definition of V-MSDT or V-DT and a description of the octet mode.

Figure 7-4 shows a basic configuration with the *SLC-2000* HDT hosting an NBS in the octet mode.

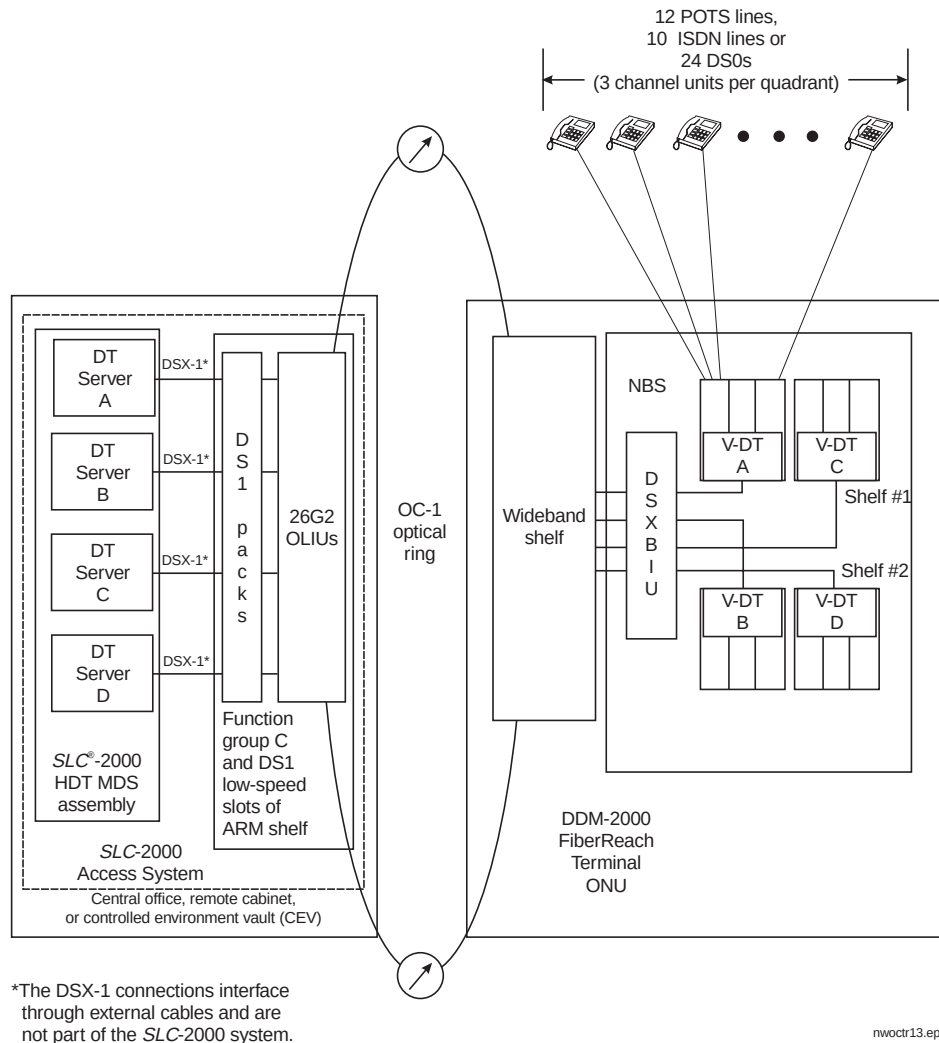


**Figure 7-4. Basic Octet Mode Configuration**

When in the octet mode, each of the four three-slot V-DTs can contain *SPQ494* quad ISDN channel units in the first two slots. The third slot can contain an *AUA94* dual ISDN channel. This will allow the V-DT to support a total of ten ISDN lines with each line offering 2B+D service. The third slot can also contain any of the other channel units available for the NBS. This allows the V-DT to offer a

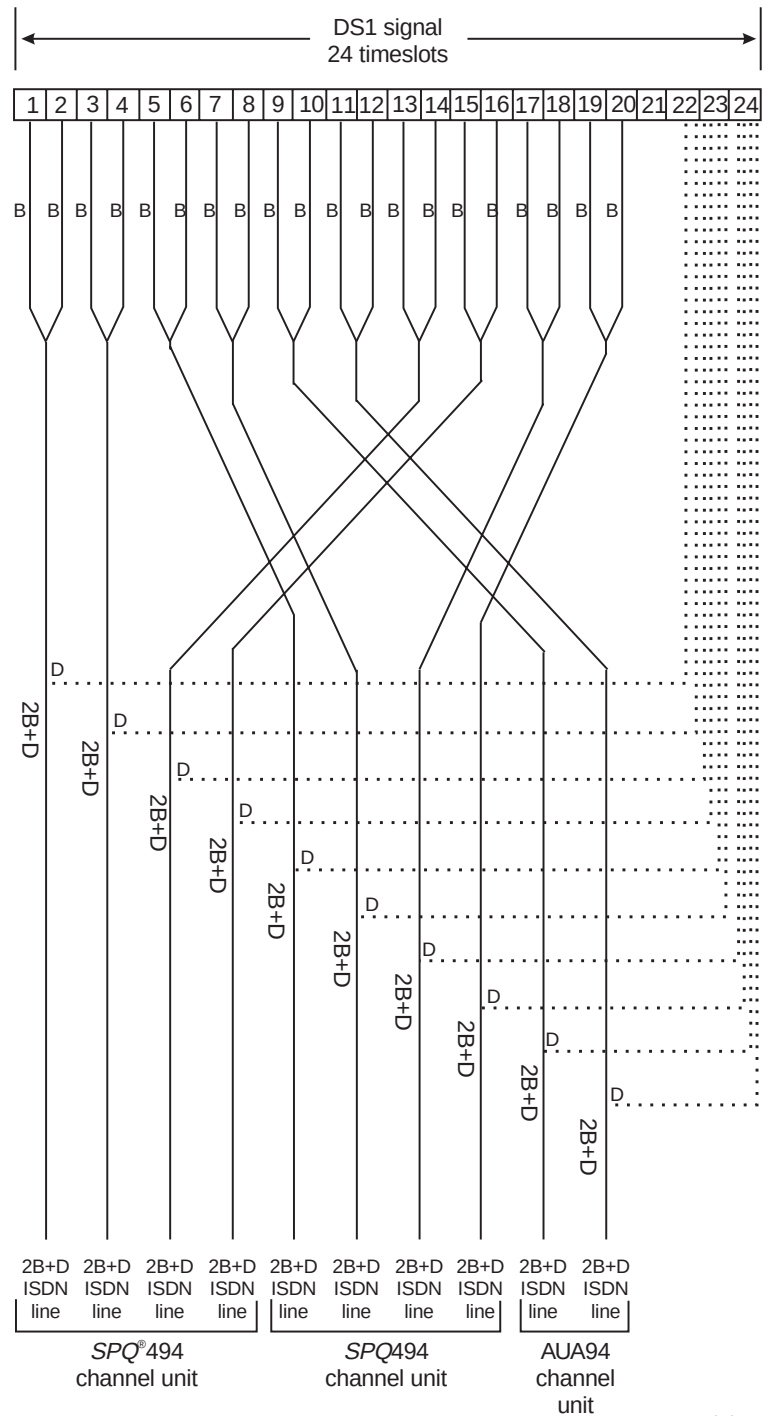
combination of services, depending on the channel units installed. Therefore, an NBS with all quadrants in octet can provide 40 ISDN lines.

To provide ISDN 2B+D service in the octet mode, you must manually provision the cross-connections using the CIT. Figure 7-5 shows the following process of how the V-DT uses the 24 time slots of its DSX-1 feeder signal to support two *SPQ494* quad ISDN channel units and an *AUA94* dual ISDN channel unit. This combination can produce ten ISDN lines providing 2B+D service:

**NOTE:**

The time slot representation shown in Figure 7-5 is used to explain the concept of how the system uses the 24 time slots of a DSX-1 signal to build the 2B+D ISDN lines. The actual time slots are assigned by the system and vary according to system requirements. However, the concept for building the 2B+D ISDN lines is the same as described below.

- The ISDN lines providing 2B+D service are *built* as follows:
  - A “B” data channel equates to a 64-kb/s DS0 signal that can be used for voice connections or equipment connections such as a computer. As shown in Figure 7-5, each “B” channel uses 1 time slot of the 24 time slots in the DSX-1 signal (therefore, “2B” uses 2 time slots). In Figure 7-5, the first ISDN line uses time slots 1 and 2 for its “B” channels.
  - A “D” signaling channel equates to a 16-kbs signal that is used to carry signaling and overhead data. As shown in Figure 7-5, each “D” channel uses one-fourth of a time slot. In Figure 7-5, the first ISDN line uses one-fourth of time slot 22 for its “D” channel.
  - Added together, each 2B+D ISDN line takes  $2\frac{1}{4}$  time slots of the 24 time slots in the DSX-1 feeder signal.
- As shown in Figure 7-5, each *SPQ494* quad ISDN channel unit provides four 2B+D ISDN lines. These four lines use a total of 9 time slots of the 24 time slots in the DSX-1 feeder signal (8 time slots for the 8 “B” channels and 1 time slot for the 4 “D” channels). This allows the V-DT to contain two *SPQ494* channel units using 18 time slots.
- As shown in Figure 7-5, the V-DT can also contain an *AUA94* dual ISDN channel unit. This unit provides two 2B+D ISDN lines using a total of  $4\frac{1}{2}$  time slots (four time slots for the four “B” channels and one-half time slot for the two “D” channels).
- Therefore, a V-DT provisioned for the octet mode can provide ten ISDN lines with each line offering 2B+D service. These ten lines use a total of  $22\frac{1}{2}$  of the 24 time slots provided by the DSX-1 feeder.

**Figure 7-5. Building an ISDN 2B+D Line from a DSX-1 Signal in the NBS (Octet Mode)**

For these time slots to be correctly associated with the actual channel unit slots in the MDS assembly, the system uses a *virtual channel unit slot* concept. You must use the CIT to cross-connect the real and virtual time slots to the appropriate VRTs. Figure 7-6 shows the actual NBS configuration with its four DSX-1 feeder signals.

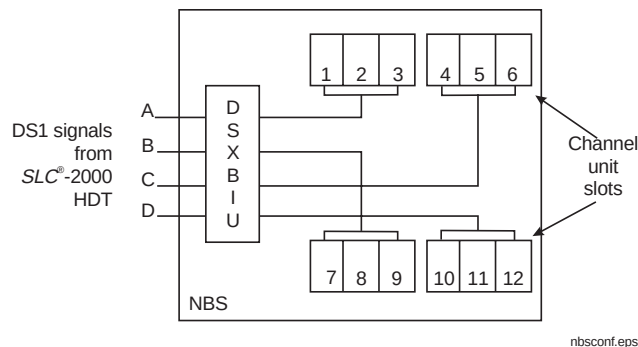


**Figure 7-6. Actual NBS V-DT Configuration (Octet Mode)**

Using the *virtual* concept as shown in Figure 7-7, the SLC-2000 HDT software, when provisioning ISDN circuits, “thinks it sees” a six-slot V-DT instead of a three-slot V-DT. As Figure 7-7 shows, slots 4, 5, and 6 of the V-DT are *not* physically present. However, they are present in the software and are called *virtual slots*, actually representing the third and fourth lines on the SPQ494 ISDN channel units.

When installing and cross-connecting ISDN circuits in an NBS with DSX-1 feeders provisioned for the octet mode, you must understand the relationships between the NBS, octet mode, and actual or virtual slots. Refer to Figure 7-7 to understand these concepts.

- **Addressing the NBS Quadrant.** You must address each quadrant of the octet NBS using its DT Servers address in the MDS assembly at the HDT (MDS shelf number, MDS shelf slot number).
- **Addressing the Slots in the NBS Quadrant.** Each quadrant's slots (both real and virtual) are numbered the same for provisioning (Figure 7-7). For example, the physical slots fed by DSX-1 signal D are numbered 10, 11, and 12 in the NBS. But when provisioning with the software from the CIT, they are numbered 1, 2, and 3 (plus 4, 5, and 6 virtual slots).



**NOTE:**

Virtual slot 6 is *never* addressed for ISDN line provisioning.



- ***SPQ494 Channel Unit Drop Identifications.*** The four ISDN 2B+D drops are identified in the software as follows:

- ***SPQ494 channel unit in slot 1 of the quadrant:***

- drop 1 = slot 1, line 1
    - drop 2 = slot 1, line 2
    - drop 3 = slot 4, line 1 (virtual slot 4)
    - drop 4 = slot 4, line 2 (virtual slot 4)

- ***SPQ494 channel unit in slot 2 of the quadrant:***

- drop 1 = slot 2, line 1
    - drop 2 = slot 2, line 2
    - drop 3 = slot 5, line 1 (virtual slot 5)
    - drop 4 = slot 5, line 2 (virtual slot 5)

- ***AUA94 Channel Unit Drop Identifications.*** The drops for the AUA94 in slot 3 do not need virtual slots. The two ISDN 2B+D drops in slot 3 are identified in the software as follows:

- drop 1 = slot 3, line 1
  - drop 2 = slot 3, line 2

- ***POTS and Special Service Channel Units.*** Other channel units do not use virtual slots. For example, the four drops from a POTS quad channel unit in physical slot 8 of the NBS are identified in the software as follows:

- drop 1 = slot 2, line 1
  - drop 2 = slot 2, line 2
  - drop 3 = slot 2, line 3
  - drop 4 = slot 2, line 4

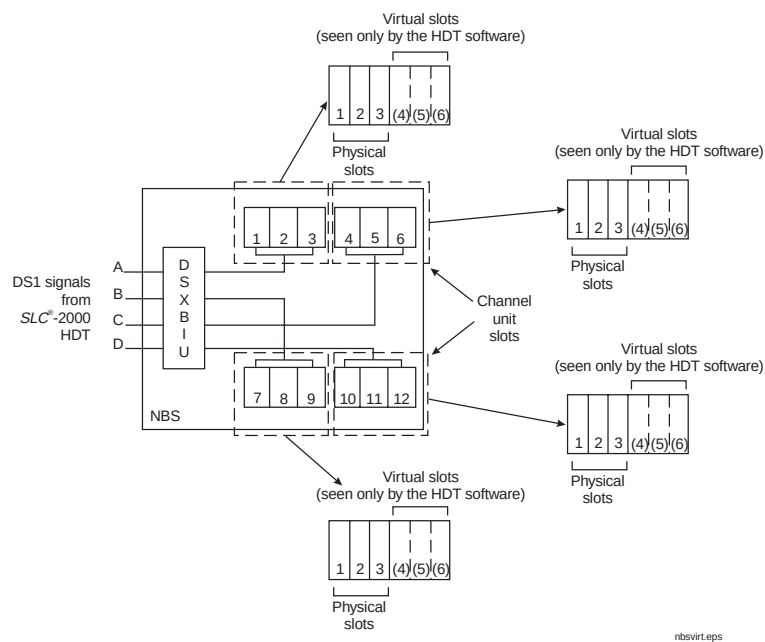


**Figure 7-7. Virtual Slot Concept (Octet Mode)**



**NOTE:**

For the specific procedure and software commands to perform this function, see the following documents:

- 363-208-001, *SLC-2000 Access System, User/Service Manual*
- 363-208-003, *SLC-2000 Access System, Commands and Messages* (see the **ENT-CRS-T0** command).

Table 7-5 shows the possible combinations of channel units for a three-slot octet V-DT.

**Table 7-5. Channel Unit Slot Restriction When Using an SPQ494 in a Three-Slot V-DT**

| Slot 1 can contain ...                                                                                                                                             | Slot 2 can contain ...                                                                                                                                             | Slot 3 can contain ...                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• <i>SPQ494</i></li><li>or</li><li>• <i>AUA94</i></li><li>or</li><li>• Any other channel unit supported by the NBS</li></ul> | <ul style="list-style-type: none"><li>• <i>SPQ494</i></li><li>or</li><li>• <i>AUA94</i></li><li>or</li><li>• Any other channel unit supported by the NBS</li></ul> | <ul style="list-style-type: none"><li>• <i>AUA94</i></li><li>or</li><li>• Any other channel unit supported by the NBS (except the <i>SPQ494</i> channel unit)</li></ul> |

Provisioning channel units other than the *SPQ494* channel unit in the ONU is done the same way as provisioning channel units at the RT/HDT. Once you provision the shelves in the HDT for fiber distribution (via the CIT or UIP) and you set the number of lines hosted by each DT Server (via the CIT), provisioning of individual channels in the ONU follows the service order flows described for the RT/HDT.

**NOTE:**

See 363-208-001, *SLC-2000 Access System User/Service Manual*, and 363-205-004, *SLC-2000 MSDT User/Service and Ordering Manual*, for details on provisioning the MSDT or DT Server.

Through the OSMINE process, *SLC-2000* AIDs are supported in FACS and OPS/INE. In addition, *TIRKS* OS and *NMA* OS organizations provide OSIA and methods to inventory and assign *SLC-2000* FITL facilities and equipment.

## Service States (TL1)

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### State Definitions and Transitions

The *state* of an entity represents the current condition of that entity. It determines what operations may be performed upon it. An entity has *primary* and *secondary* service states:

- **Primary Service State:** This state shows the service availability of a managed entity. It consists of these components:
  - Service condition
  - Service condition qualifier
  - Operational restriction.

Table 7-6 gives each primary state and its definition.

- **Secondary Service State:** This state provides supplementary information that further qualifies the primary state. It may also give more detailed information that clarifies a primary state. Table 7-7 gives the primary state along with its applicable secondary state and its definition.

State transitions may occur as a result of directed commands or happen automatically as a result of events within the system (such as equipment removal or failure).

**Table 7-6. Primary State Definitions**

| Primary State                                                       | Definition                                                                                                                                                                |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IS</b> (in-service)                                              | The entity is available to perform all or part of its designated service functions.                                                                                       |
| <b>OOS-MA-UAS</b> (out-of-service memory administration unassigned) | The entity is <b>OOS</b> because of provisioning driven memory administration activity. In particular, resource/service parameters have not been assigned for the entity. |
| <b>OOS-MA-AS</b> (out-of-service memory administration assigned)    | The entity is <b>OOS</b> because of provisioning driven memory administration activity. However, resource/service parameters have been assigned.                          |
| <b>OOS-MT</b> (out-of-service maintenance)                          | The entity is <b>OOS</b> for maintenance reasons (such as a fault, performance monitoring, or testing).                                                                   |

**Table 7-7. Secondary State Definitions**

| <b>Primary State</b>              | <b>Applicable Secondary State</b>                 | <b>Description</b>                                                                                        |
|-----------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| OOS-MT                            | <b>FLT</b> (fault)                                | The entity is <b>OOS</b> because it is faulty.                                                            |
| OOS-MT                            | <b>MAN</b> (manual)                               | The entity has been manually taken <b>OOS</b> for maintenance reasons.                                    |
| OOS-MA-AS<br>OOS-MT               | <b>MEA</b> (mismatch of equipment and attributes) | The entity is equipped with improper equipment.                                                           |
| OOS-MT                            | <b>TS</b> (test)                                  | The entity is <b>OOS</b> because of testing.                                                              |
| OOS-MA-UAS<br>OOS-MA-AS<br>OOS-MT | <b>UEQ</b> (unequipped)                           | The entity has not been equipped with the necessary equipment.                                            |
| OOS-MT                            | <b>AUTO</b> (automatic)                           | AUTO is equivalent to a pre-service state. No alarms are reported on the entity when it is in this state. |

## SONET Subsystem

### Port State Provisioning

Port state provisioning is a feature provided on the SONET subsystem that suppresses alarm reporting and performance monitoring by supporting multiple states (automatic, in-service, and not-monitored) for low-speed ports (DS1, DS3, and EC-1).

Ports without signals (undriven) are in the automatic state until they are changed to the in-service state when a signal is present. The **set-state-t1**, **set-state-t3**, and **set-state-ec1** commands allow a user to change the state of a port to the not-monitored state or from the not-monitored state to the automatic state. The **rtrv-state-eqpt**, **rtrv-t1**, **rtrv-t3**, and **rtrv-ec1** commands allow a user to retrieve current port states. The **upd** command allows a user to change the port state of all undriven ports from in-service to automatic.

### Channel State Provisioning

Channel state provisioning is a feature provided on the SONET subsystem (Release 6.2 for linear releases and 7.1 or later for ring releases) that suppresses reporting of alarms and events for VT1.5 and STS-1 channels during provisioning by supporting multiple states at the OC-3 and EC-1 ports (automatic, in-service,

and not-monitored) for these channels. The **rtrv-state-eqpt**, **rtrv-t1**, **rtrv-t3**, and **rtrv-ec1** commands allow a user to retrieve current channel states.

While an end-to-end circuit is being set up, particularly during VT1.5 or STS-1 cross-connect provisioning, transient maintenance signals may result. Without automatic channel state provisioning, these are reported as alarms or events. The technicians are expected to ignore these transient alarms and initiate corrective action only if the alarms persist after the provisioning is completed. To avoid the confusion created by this, the SONET subsystem provides automatic channel state provisioning.

A VT1.5 or STS-1 channel stays in the default automatic (**AUTO**) state until a valid signal (a framed signal that is not an alarm indication signal or loss of pointer signal) is received on that channel. While in the AUTO state, no alarms or events are reported on the channel by the SONET subsystem. On receiving a valid signal, which occurs when the end-to-end circuit is completely provisioned, the channel automatically changes to the in-service (IS) state and starts reporting normal alarms and events. An additional state, not monitored (NMON), is also supported, in which alarm and event reporting is suppressed regardless of the validity of the signal being received on the channel. Like the port state provisioning capability provided for DS1, DS3, and EC-1 ports, the user can use CIT or TL1 commands to manually change a channel from IS or AUTO to NMON, and from NMON to AUTO.

## DLC Subsystem

### Quad Low-Speed (QLS) (VTU or LIU) Port State Provisioning

Port state provisioning is a feature provided in the DLC subsystem. It is used to suppress alarm reporting for feeder DS1 interfaces (on the VTUs or LIUs). This feature is similar to the SONET subsystem's DS1 port provisioning, except that the *incoming* direction is from the feeder side as opposed to the drop side for the SONET subsystem low-speed ports.

The default state for feeder DS1 ports is out-of-service-maintenance-automatic (**OOS-MT-AUTO**). This corresponds to the SONET subsystem's automatic state (**AUTO**). A signal will remain in this state until a good signal is received; that is, the system must receive a signal with valid framing. If the DS1 signal is not cross-connected to a logical VRT feeder or logical INA DS1, the system expects a signal with extended superframe (ESF) framing. If the feeder DS1 is cross-connected, the system expects a signal with framing that is appropriate for the type of logical feeder (for example, TR-08, TR-303, INA/SF, INA/ESF).

When a good signal is received, the feeder DS1 transitions to in-service (**IS**). Full alarming is provided for signals in this state.

An **IS** feeder DS1 transitions to the **OOS-MT** state if a *bad* DS1 signal is received. This includes loss of frame, high bit error rate, and alarm indication signal (AIS). The signal transitions back to in-service when valid framing is obtained.

If a feeder DS1 signal is in the **OOS-MT** state, and the user executes the update function (UPD) on the UIP or CIT, the port transitions to the **OOS-MT-AUTO** state. The user may also use the **ED-T1** command on the DLC subsystem CIT to transition a port in the **OOS-MT** state to the **OOS-MT-AUTO** state.

The **RTRV-T1** command on the DLC subsystem CIT can be used to determine the feeder DS1 service states.

When all of the ports of a VTU/LIU are in the **OOS-MT-AUTO** state, the VTU/LIU can be removed and the UPDATE function can be used to take the VTU/LIU off protection and to clear the associated alarm.

### **TR-08 and TR-303 VRT and INA States**

TR-08 and TR-303 VRTs and INA DS1s are logical entities having service states that depend on the physical entities supporting them. These states are used for alarming purposes.

A VRT is in-service (**IS**) if any one of the feeder DS1 inputs that are cross-connected to it are **IS** or **OOS-MT**. If all of its feeder DS1 inputs are in the **OOS-MT-AUTO** state, or if there are no feeder DS1s cross-connected to the VRT, it is in the **OOS** state. Table 7-8 shows the VRT entity state transitions.

The transition tables in this section are read as follows:

- **Input/Event** — describes the input/event affecting the current state.
- **Current State** — this heading covers two or more possible current states for the entity. Listed in each current state column are the states of the entity after the input/event. If the entity is unchanged, no state is listed.

**Table 7-8. VRT Entity State Transitions**

| Input/Event                                                                                                  | Current State |     |
|--------------------------------------------------------------------------------------------------------------|---------------|-----|
|                                                                                                              | IS            | OOS |
| No logical feeder DS1s cross-connected to quad low-speed (QLS) DS1 ports                                     | OOS           |     |
| QLS port state = OOS-MT-AUTO for all QLS ports DS1-cross-connected to the VRT                                | OOS           |     |
| At least one logical feeder DS1 of the VRT cross-connected to QLS DS1 port and QLS port state = IS or OOS-MT |               | IS  |

A logical INA DS1 is in-service (**IS**) if the feeder DS1 inputs that are cross-connected to it are **IS** or **OOS-MT**. If its feeder DS1 input is in the **OOS-MT-AUTO** state, or if there are no feeder DS1s cross-connected to the INA DS1, it is in the **OOS** state. Table 7-9 shows the logical INA DS1 entity state transitions.

**Table 7-9. Logical INA DS1 Entity State Transitions**

| Input/Event                                                                                                | Current State |     |
|------------------------------------------------------------------------------------------------------------|---------------|-----|
|                                                                                                            | IS            | OOS |
| Logical INA DS1 not cross-connected to QLS DS1 port                                                        | OOS           |     |
| QLS port state = OOS-MT-AUTO                                                                               | OOS           |     |
| Logical INA DS1-cross-connected to correspondingly numbered QLS DS1 port and QLS port state = IS or OOS-MT |               | IS  |



Service states for VRTs and logical INA DS1s can be obtained using the **RTRV-VRT** and **RTRV-INA** commands on the CIT.

If a TR-08 VRT is **OOS**, the common equipment in the metallic distribution shelf that supports the VRT is not needed. Thus, if all of that common equipment is removed from the shelf, no alarms are raised. However, if the TR-08 VRT that corresponds to a shelf is **OOS** but there is a DS0 cross-connection through that shelf to another in-service VRT, removal of the common equipment will be alarmed.

The TR-303 VRT is defined by the common equipment associated with the T0s that are cross-connected to it. Removal of the common equipment associated with the TR-303 VRT will be alarmed.

### **TR-08 Digroups and Line Group States**

The TR-08 digroups and line groups are logical entities that are used mainly by provisioning OSs. You can use the **RTRV-STATE-VEQPT** CIT command to retrieve their state.

Table 7-10 shows the TR-08 digroup entity state transitions.

**Table 7-10. TR-08 Digroup Entity State Transitions**

| <b>Input/Event</b>                                                                    | <b>Current State</b> |            |
|---------------------------------------------------------------------------------------|----------------------|------------|
|                                                                                       | <b>IS</b>            | <b>OOS</b> |
| TR-08 Log. Fdr. DS1 not cross-connected to QLS DS1 port                               | OOS                  |            |
| QLS port state = OOS-MT-AUTO                                                          | OOS                  |            |
| TR-08 Log. Fdr. DS1 cross-connected to QLS DS1 port and QLS port state = IS or OOS-MT |                      | IS         |

Table 7-11 shows the line group entity state transitions.

**Table 7-11. Line Group Entity State Transitions**

| Input/Event                                                         | Current State |     |
|---------------------------------------------------------------------|---------------|-----|
|                                                                     | IS            | OOS |
| One or more MDCs and/or PTUs serving Line Group Missing or Removed* | OOS           |     |
| Both MDCs and both PTUs Serving Line Group Installed*               |               | IS  |
| * The T8U is also required for the TR-08 VRTs.                      |               |     |

### T0 States

**T0** entities correspond to channel circuits used to serve subscriber lines. You can use the **RTRV - T0** CIT command to retrieve their state. Table 7-12 shows the state transitions of the T0 entities in the *SLC-2000* system.

**Secondary States Allowable when Primary State is OOS-MT:** The secondary states that apply to **OOS-MT** are defined as follows:

- **UEQ:** The channel unit slot is empty.
- **MEA:** The equipped channel unit does not match the line termination data.
- **TS:** The metallic test relay of the line circuit is operated.

**Table 7-12. DS0 (T0) Entity State Transitions**

| Input/Event                         | Current State   |                    |                                                            |                     |                                |                                 |
|-------------------------------------|-----------------|--------------------|------------------------------------------------------------|---------------------|--------------------------------|---------------------------------|
|                                     | IS              | OOS-MA-<br>UAS-UEQ | OOS-MA-UAS-<br>CU equipped<br>(Note 1)                     | OOS-MA-<br>AS-UEQ   | OOS-MA-<br>AS-MEA-<br>(Note 2) | OOS-MT                          |
| ENT-T0                              | DENY            | OOS-MA-AS,<br>UEQ  | IS (if properly<br>equipped)<br>OOS-MA-AS,<br>MEA (if MEA) | DENY                | DENY                           | DENY                            |
| ED-T0                               | IS*             | DENY               | DENY                                                       | OOS-MA-<br>AS, UEQ  | OOS-MA-AS,<br>MEA†             | OOS-MT‡                         |
| DLT-T0                              | OOS-MA-<br>UAS, | OOS-MA-UAS,<br>UEQ | OOS-MA-UAS                                                 | OOS-MA-<br>UAS, UEQ | OOS-MA-UAS                     | OOS-MA-UAS                      |
| Install Proper<br>Channel Unit      | NA              | OOS-MA-UAS         | NA                                                         | IS                  | NA                             | IS (if no OOS-<br>MT condition) |
| Install Improper<br>Channel Unit    | NA              | OOS-MA-UAS         | NA                                                         | OOS-MA-<br>AS, MEA  | NA                             | OOS-MT<br>MEA,[FEF§]            |
| Remove Channel<br>Unit              | OOS-MT<br>UEQ   | NA                 | OOS-MA-UAS,<br>UEQ                                         | NA                  | OOS-MA-AS,<br>UEQ              | OOS-MT,<br>UEQ,[FEF§]           |
| Maintenance<br>Condition Occurs     | OOS-MT          | OOS-MA-UAS,<br>UEQ | OOS-MA-UAS                                                 | OOS-MA-<br>AS, UEQ  | OOS-MA-AS                      | OOS-MT‡                         |
| All Maintenance<br>Conditions Clear | NA              | OOS-MA-UAS,<br>UEQ | OOS-MA-UA                                                  | OOS-MA-<br>AU, UEQ  | OS-MA-AS                       | IS                              |

**Notes:**

1. Since EQ is not a secondary state supported in any TL1 message, "CU equipped" is used to represent the fact that the secondary state does *not* equal UEQ.

2. The secondary state MEA implies that the channel unit is equipped.  
DENY = command is denied. NA = not applicable.

\* Although (as shown here), IS is the desired resulting state, in the *SLC-2000* system R3.2, it is possible that an **ED-T0** command could create a mismatch by changing the *CLEI* or function code, thus yielding OOS-MA-AS, MEA as the resulting state.

† Although (as shown here), OOS-MA-AS, MEA is the desired resulting state, in the *SLC-2000* system R3.2, it is possible that an **ED-T0** command could clear a mismatch by changing the *CLEI* or function code, thus yielding IS as the resulting state.

‡ The following combinations of T0 secondary states and the FEF associated state are allowable when the primary state is OOS-MT: **[{UEQ|MEA|FLT, TS}], [FEF]**.

§ Release 4.0 and later.

## Fault Management

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Fault management consists of alarm surveillance, testing, and fault recovery (protection switching).

### Alarm Surveillance

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The *SLC-2000* Access System alarms alert the responsible maintenance center to any system troubles, including facility alarms (maintenance signaling such as AIS and yellow), miscellaneous alarms, and circuit failures (reported in status conditions). For local, remote, and centralized alarm surveillance, the *SLC-2000* Access System supports extensive fault isolation and reporting features as follows:

- The equipment indicators show failures and status conditions.
- The UIP has alarm summary indicators and a 24-character display that provides alarm detail locally.
- The CIT can be used locally to retrieve complete alarm and status condition reports.
- With the remote login feature or a modem, the CIT can request alarm information from remote locations. Alarms and status conditions are reported autonomously to operations systems (such as the *NMA OS*) via the X.25/TL1 link (Figure 7-8 and Figure 7-9).
- In addition to the X.25/TL1 link, alarms for TR-303 systems (*SLC-2000 R4.0*) are reported autonomously to the LDS via the EOC.
- For TR-08 systems, DLC alarms also are reported on the TR-08 data link (on each VRT).
- Separate history logs for DLC events and SONET events are available via the CIT.
- Environmental alarm inputs and outputs are supported.
- The *SLC-2000* Access System also supports parallel telemetry and office alarms at the central office.
- Maintenance signaling is supported on the SONET, TR-303, and INA interfaces.



In FITL configurations, *SLC-2000* Access System MSDT ONU or DDM-2000 FiberReach NBS ONU related alarms appear as DLC alarms. Alarms originating from the *ONU*, or from the failure of the optical link and link interfaces to the *ONU*, are mapped into DLC alarms by the *SLC-2000* system and transmitted as DLC alarms to the maintenance center (via the X.25/TL1 OS/NE interface) or switch (via the EOC interface). The UIP and CIT displays of alarm information identify *ONU* failures. The CIT may also be used remotely, connected to a modem, to provide alarm inquiry for the DLC alarms at the RT/HDT and *ONU*.

The *SLC-2000* system does its own internal fault analysis so it can report root cause information on internal failures. The OS must correlate the alarms from various sources, since a single failure may cause multiple alarms across the network. For example, when a single failure causes alarms from the *SLC-2000* Access System and from the switch, the OS needs to be able to coordinate the alarms (which may differ in severity, etc.).

## Alarm Classifications

The urgency of the trouble depends on its immediate or potential effect on customer service. The *SLC-2000* Access System classifies failures and conditions based on the following definitions:

- **Critical (CR)** — A single failure that affects 128 or more customers. In a TR-303 system, a critical alarm also will be reported if a failure affects 50 percent or more of the feeder capacity.
- **Major (MJ)** — A single failure that affects 24 or more customers. In a TR-303 system, a major alarm also will be reported if a failure affects 25 percent or more of the feeder capacity. A SONET controller failure also is reported as major.
- **Minor (MN)** — The trouble does not affect service immediately but could affect service if additional trouble occurs.
- **Power Minor (PMN)** — The system is operating on battery reserve. This condition does not affect service immediately but will affect service if not corrected before the battery reserve is used up.
- **Abnormal (ABN)** — The system is configured for testing or for some arrangement other than providing service (for example, during a loopback or manual protection switch).

## **Fault Detection, Isolation, and Reporting**

The *SLC-2000* Access System continuously monitors incoming signals and internal system conditions. Fault isolation is used to identify the failed entity. The system uses several methods to display and report detected failures as follows:

- Incoming signals are monitored for loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), AIS (DLC), incoming yellow alarm (INA, TR-303, and SONET interfaces), high bit error rate (BER), and signal degrade. The LOS and BER threshold crossings are detected for incoming SONET and DS1 signals and subscriber ISDN lines.
- When an internal fault is detected, automatic diagnostics isolate the faulty circuit pack. Fault indicators on each common unit provide a simple means for a local user to find failed circuit packs.
- The UIP alarm light-emitting diodes (LEDs) indicate the most severe alarm condition affecting the system or other site in the SONET subnetwork.
- The UIP alphanumeric display gives a local user more detail on the existing alarm and status conditions. System faults and abnormal conditions are itemized so that usually no CIT is required.
- If needed, the CIT can be used to get a more extensive report on alarms, or to retrieve an alarm and status report on a remote network element.
- TR-303 systems can also be queried by the LDS via the EOC for current alarms.
- Incoming TR-08 digroup alarms are reported on the "A" data link.

In addition to storing the active alarm and status conditions, the system maintains two history logs of the past 500 alarm and status conditions and CIT events: one for the SONET subsystem and one for the DLC subsystem. Each event is real time and date stamped. The history can be retrieved using a CIT.

The *SLC-2000* Access System also provides various other paths for reporting failure conditions (Figure 7-8). The *SLC-2000* system remotes alarm information through the SONET subnetwork, TR-08 data links, and TR-303 embedded operations channels. This information is reported using the office alarm closures, telemetry byte-oriented serial (TBOS) (serial telemetry), and parallel telemetry outputs at the gateway network element and the LDS. Alarms are remoted using telemetry at the GNE; also, DLC alarms are remoted at the LDS telemetry outputs. 824-102-149, *SLC-2000 Access System, Operations Systems Engineering Guide*, contains more detail on these interfaces.

The *SLC-2000* Access System also supports an X.25/TL1 OS/NE interface via the GNE for reporting circuit pack and feeder alarms. The TL1 messages provide more detailed information than the telemetry outputs. This information can be used by an OS such as Bellcore's *NMA* OS for alarm analysis and correlation, resulting in more accurate personnel dispatch. Technicians can use the alarm detail in the TL1 messages to determine the circuit pack(s) that need to be replaced before dispatching to the remote terminal.

For TR-303 systems, the same level of detailed DLC and miscellaneous alarm information also is provided to the LDS via the EOC. This allows central office personnel to determine the circuit pack(s) that need replacement, which may facilitate the restoration process.

Fault detection and reporting on FITL elements is integrated with those functions of the *SLC-2000* Access System. The BER of the DS1 link between the MSDT/V-MSDT/V-DT and the Server in the RT/HDT is monitored by the Server, and a carrier line failure (CLF) is declared when the link fails. Failures of ONU circuit packs are reported by the Server to the *SLC-2000* system. Failure of the Server is also reported to the system. Faults associated with an MSDT/V-MSDT/V-DT or ONU link are mapped into DLC subsystem alarms. Failures affecting 24 lines are major (MJ); others are minor (MN). Faults associated with 12-line MSDTs are always mapped as minor alarms.

The UIP, CIT, TL1, and EOC messages resulting from ONU and ONU link faults identify the failed ONU circuit pack whenever possible. Maintenance personnel located at the RT are informed by the DT LED on the Server and the associated UIP fault report. This information also is available at the RT/HDT via the CIT.

## **Maintenance Signaling**

Maintenance signals are transmitted by the *SLC-2000* Access System to notify other equipment in the transmission path of detected failures. The alarm indication signal (AIS) notifies downstream equipment that a failure has been detected and alarmed by some upstream equipment. This helps to reduce the number of alarms reported when a failure affects multiple network elements. Yellow alarm signals (INA and TR-303 VRTs only) are transmitted by the terminating equipment when an incoming signal failure (including AIS) is detected. The yellow signal notifies upstream equipment to begin trunk processing.

Whenever a DS1 signal failure is detected or yellow or AIS is received, the terminal takes the affected lines out of service to prevent subscriber line errors such as spurious ringing and false billing (after the failure continues for a specified "hit" timing period). This is called trunk processing.

DS1 yellow alarm signal is transmitted on an ESF DS1 signal towards the source of the received signal whenever a failure in the signal is detected. Therefore, both ends will perform trunk processing even if only one direction of transmission fails.

Alarm indication signals supported by the *SLC-2000* Access System include SONET line AIS, STS-1 path AIS, virtual tributary (VT) path AIS, and DS1 AIS. Yellow signals include STS-1 path yellow, VT path yellow, and DS1 yellow. Other maintenance signals include line far-end-receive failure (FERF), STS-1 path unequipped, and VT path unequipped. The TR-08 data link is used for maintenance signaling instead of sending yellow alarms on TR-08 DS1s.



Maintenance signaling complies with SONET (Bellcore TR-TSY-000253), asynchronous (Bellcore TR-TSY-000191), and digital loop carrier (Bellcore TR-TSY-000008) requirements.

The "A" DS1 signal of TR-08 VRTs carries the data link that is used to report failure information. DS1 yellow is not used; instead a "Major Alarm" message is transmitted, along with an indication of the shelf (or shelves) that has failed (in TR-08 VRTs, a shelf is equivalent to a DS1 signal) to alert the far end that a failure condition has been detected on the received signal. It is also used to report internally detected failures. The *SLC-2000* system will send DS1 AIS on a DS1 signal when an internal failure that affects the entire transmitted DS1 signal is detected.

Whenever a TR-08 VRT receives a shelf Major Alarm message on the "A" data link, the channels in the DS1 signals indicated in the message are trunk processed.

For the TR-303 VRT, in addition to maintenance signaling transmitted on the ESF DS1, TR-303 EOC messages are transmitted to notify the LDS of alarm setting and clearing conditions.

### Miscellaneous Alarms and Controls

The *SLC-2000* Access System provides an interface that can be used to monitor and control collocated equipment at the RT site. The connections provided include the following:

- **Power Minor (PMN):** Used to detect loss of commercial AC power at the RT. This condition may not affect service immediately when the remote site has battery reserve.
- **External Major:** Detects failure of the ringing supply to the system. This alarm is reported as CR on TL1 and EOC interfaces and causes MJ on all in-service TR-08 data links.
- **External Minor:** Detects a single rectifier failure in the power system, or a single (protected) ringing generator failure, or a cooling fan failure.
- **14 Miscellaneous Inputs:** Detects conditions from external inputs (such as collocated equipment, environmental monitors, DDM Plus, etc.).
- **Four Control Outputs:** Allow control of equipment such as pumps and generators at the remote site.

The severity of alarms reported on the TL1 and CIT interfaces can be provisioned. See 363-208-001, *SLC-2000 Access System, User/Service Manual*, for details.

Activating one of these inputs at the RT site results in forwarding of the information to one or more of the following, depending on system configuration:

- TL1 alarm messages are transmitted (to an alarm OS) via the X.25/TL1 interface.
- If configured for TR-303, alarm messages are also transmitted to the LDS via the EOC.
- In SONET configurations, the raw telemetry data is forwarded to the GNE (DDM-2000 multiplexer or SLC-2000 COT), which can be used to set contact closures for central office display or for polling by a maintenance OS using TBOS or parallel telemetry.
- In metallic DSX-1 feeder configurations, sense point inputs are translated to TR-08 data link alarms.

Environmental alarms (power fail, door open, etc.) are also reported from SLC-2000 MSDTs connected to the system in FITL configurations. Refer to 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service and Ordering Manual*, for details on MSDT inputs.

### **Miscellaneous Alarms in DSX-1 Feeder Configurations**

In SLC-2000 RTs with metallic feeder, the first eight miscellaneous discrete inputs are *mapped* to the data link of a TR-08 VRT. ***The VRT must be in service (in other words, terminated on an in-service COT or LDS) for the alarm to appear at an output closure at the CO.***

The inputs are mapped as follows:

- The power minor (PMN) alarm input is mapped to TR-08 VRT number 1.
- Inputs two through eight are mapped to the corresponding in-service TR-08 VRT (second input to VRT 2, etc.) or to the EOC in a TR-303 VRT.
- The external major and minor inputs (MN) are mapped as major and minor alarms (with no miscellaneous alarm indication). On the TR-08 data link, the MJ alarm and MN alarm are carried by each in-service VRT.

In SLC-2000 COTs with DSX-1 feeder, the COT supports up to seven VRTs, so only miscellaneous inputs/outputs numbers two through seven and the external minor are supported. If another COT or LDS that supports Mode 2 is connected to VRT 8, and VRTs 7 and 8 are set for Mode 2, then miscellaneous input number 8 can also be used at the RT.

All miscellaneous alarms are sent on the TL1 interface and EOC interfaces. Therefore, be careful that no duplicate information is sent to OSs when the X.25/TL1 interface is used with the existing alarm interfaces provided by the LDS (Figure 7-9) and SLC 96 COTs. This duplication is possible also in mixed TR-08/TR-303 applications. See also the section "Alarm Surveillance" in this chapter.

## **Fault Management — Testing**

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A primary objective of the *SLC-2000* system is to interface with telephone company test systems. To help ensure compatibility, the *SLC-2000* system testing interfaces and features comply with many Bellcore technical references (TRs) and technical advisories (TAs).

The *SLC-2000* system supports a variety of tests, including on-demand testing. Standard external test systems for universal or integrated TR-08 and TR-303 configurations are supported.

### **Turn-Up Tests**

The *SLC-2000* system provides automatic tests that may be invoked as part of the turn-up process. The tests provide the capability to verify the SONET and low-speed DS1 interfaces by looping a test signal through them and comparing the received signal to the transmitted signal. The turn-up tests can be run from the CIT, which provides detailed reports to isolate failures to the circuit packs or facilities. The UIP commands also can be used to verify proper metallic distribution shelf (MDS) assembly connectivity and TR-08 VRT alarm transmission.

### **Loopbacks**

The *SLC-2000* Access System supports various loopback controls as follows:

- An LDS or a *SLC 96* COT can request a far-end loopback (FELP) over the TR-08 data link.
- Using the CIT, the user can request a DS1 loopback toward the SONET feeder.
- A TR-303 LDS can use the EOC to request DS1 loopbacks for DS1s associated with the VRT served by the EOC (SONET and DS1 configurations).
- ISDN loopbacks can be requested for circuit testing. See the section on ISDN U-DSL testing in "Circuit Maintenance."

In SONET configurations, an abnormal (ABN) condition is raised when an electronic loopback is active. Also, an MJ alarm is reported when a loopback is active on a feeder DS1 [on the **FUNCTION (A)** multiplexer group].

### **Self-Tests**

The *SLC-2000* system supports extensive self-tests that are independent of any external connections. When installed, each common unit performs a self-test; if the self-test fails, the appropriate alarm is reported.

## Circuit Maintenance — Demand Testing

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The SLC-2000 Access System is compatible with loop testing and special services operations support systems (OSS). Demand loop testing requires a *loop test head* located in the CO and either a *DC bypass pair* or *digital bypass pair* connected from the CO to the RT. Demand loop testing can also be supported with either a *remote measurement unit (RMU)* collocated with the RT or with the *integral test head (ITH)*.

**NOTE:**

The ITH is an optional, built-in remote measurement unit located in the ARM shelf of the SLC-2000 system. Chapter 5 gives the location and basic function of each ITH circuit pack.

The system performs the following during a demand loop test depending on the configuration:

- **Universal configuration.** The pair gain test controller (PGTC) or extended test controller (XTC), while operating in the PGTC mode, performs the channel testing. After completing the loop test, the loop testing OS can request the channel test results from the PGTC or XTC.

**NOTE:**

For detailed information on the operation and ordering of the PGTC, see Document 363-205-000.

- **Integrated configuration.** The LDS performs the channel testing. The LDS emulates the tests performed by the PGTC/XTC. Again, after completing the loop test, the loop testing OS can request the channel test results from the LDS.

If the RT is equipped with a Teradyne 4TEL<sup>\*</sup> RMU, the system will also support Teradyne OSS routine loop testing.

With a remote test unit (RTU) collocated at the RT, the system will also be compatible with special services OSSs such as Lucent Technologies SARTS. The SLC-2000 system can also support TR-834 compliant RTUs such as the Lucent/Tautron ngRTH<sup>†</sup> test head. The ngRTH test head has been co-developed in partnership by Lucent Technologies and Tautron, Inc. Tautron Inc. manufactures the test head.

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\* Registered trademark of Teradyne, Inc.

† Trademark of Tautron Inc.

The following list contains many of the testing and test access capabilities supported by the *SLC-2000* system:

- Remote demand POTS loop and channel testing using an external loop testing OSS and the PGTC/XTC for universal configurations or an LDS (such as a *5ESS* switch and test bus control unit) for integrated systems
- Routine POTS loop testing using a Teradyne OS and *4TEL* RMU
- Routine POTS automatic line insulation tests (ALIT) using LDS and a DC bypass pair or a digital bypass pair, for an integrated configuration
- Local test access for special services testing and alignment using external test equipment through the ITH, CIT and UIP test jacks
- Remote demand special services testing using the Tautron *ngRTH* test head and SARTS test system
- Remote demand U-interface digital subscriber line (U-DSL) ISDN loop and circuit testing using the loop testing OSS and the LDS.
- POTS testing from MLT using the *ngRTH* test head
- Testing ISDN loops using the *ngRTH* test head's Quick ISDN test feature from the SARTS OSS.

## Universal Configurations Using a DC Bypass Pair or a Digital Bypass Pair

Figure 7-10 shows the loop testing arrangement for a *SLC-2000* system in the universal configuration. The arrangement is the same as that used for universal *SLC 96* systems and *SLC Series 5 Carrier Systems*. The loop is tested by a loop testing OSS. This OSS can use mechanized loop testing (MLT) with the PGTC or XTC operating in the PGTC mode performing the channel testing.

The PGTC/XTC testing hardware provides the interface between universal carrier systems and the testing OSS. It tests the universal carrier system channel and sets up the metallic access to the loop testing OSS to test the subscriber loop beyond the RT. The PGTC/XTC supports channel testing of locally switched lines interfacing with the following types of channel units:

- POTS channel units
- *SPOTS* channel units
- Coin channel units
- Multiparty channel units
- Frequency selective ringing (FSR) channel units.

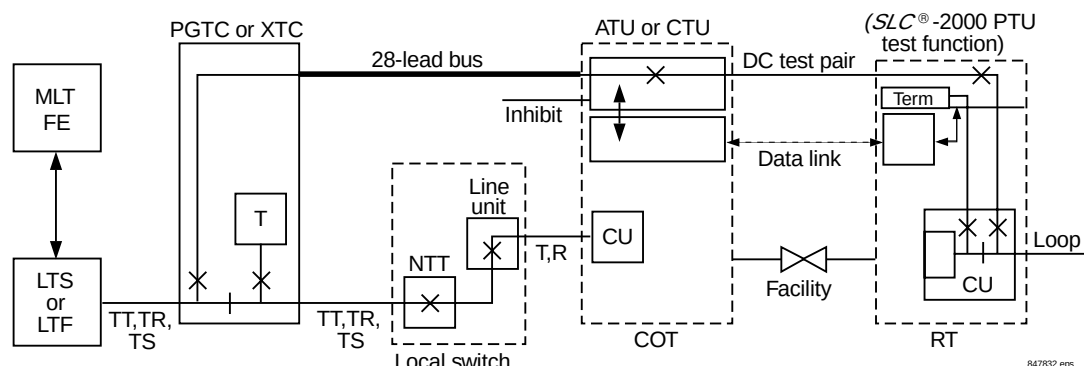


**Figure 7-10. Test Arrangement for Locally Switched Circuits Using a DC Test Pair**

The PGTC/XTC connects to the COT with a 28-lead bus. It is wired into the test trunk path between the CO based test head and the switch no-test-trunk (NTT) circuits at the local switch. [As shown in Figure 7-10, the CO based test head can include MLT, loop test system (LTS), or loop test frame (LTF).] In the idle condition, the PGTC/XTC provides a direct connection between the test head and the switch NTT. When the loop testing OSS sends a request to test a universal *SLC-2000* line, it activates the PGTC/XTC. The *SLC-2000* system and the PGTC/XTC set up the metallic network to allow testing of the channel and loop connected to the universal *SLC-2000* configuration.

The PGTC connects the loop testing OSS test trunk to either a metallic DC bypass pair or a digital bypass pair. This pair connects to the subscriber loop beyond the RT through relays in the PTUs at the COT and RT and relays in the RT channel unit. Once connected, the test head performs loop tests and the PGTC/XTC performs the channel test. After the system tests the loop, the OSS requests the result of the channel test from the PGTC/XTC. The PGTC/XTC presents the results to the test head as voltages.

The PGTC/XTC can provide access to and perform channel testing on four channels at a time as long as each channel is in a different RT and each system has a different bypass pair. Detailed descriptions of the PGTC and XTC are provided in 363-202-300 and 363-205-300.

## DC Bypass Pairs and Digital Bypass Pairs

A *DC bypass pair* is a metallic pair of wires connected from the CO to the RT. This pair provides a metallic path for metallic loop testing. *Digital bypass pair* channel units can emulate a metallic DC bypass pair. The T/R pair of the bypass pair channel units at each end of the carrier system provide the equivalent of a metallic pair. Tollgrade Communications manufactures the digital bypass pair channel units that provide the following capabilities:

- Synchronous dataport type channel units
- A loop testing MLT compatible digital bypass pair
- Elimination of a metallic bypass pair or RMU for subscriber loop testing
- The speed and accuracy of typical good quality metallic bypass pair with the following improvements:
  - Greater operating range
  - Elimination of inductive interference, ground potential problems, and other environmental conditions
- An ADPCM voice channel
- Use of two consecutive DS0 time slots for operation.

There are three digital bypass pair channel units used depending on the application and equipment configuration:

- ***SLC-2000 COT and RT.*** *MCU*<sup>\*</sup>5405 channel unit
- ***SLC 96 COTs and D4 Channel Banks.*** *MCU*4496 channel unit and *MCU*4496ER extended range channel unit.

The digital bypass channel units require two consecutive DS0 time slots on the feeder facility for operation and must be handled as nonswitched special service circuits. In integrated *SLC-2000* configurations, you must hairpin or nail up the two time slots from the RT channel unit through the switch and connect the time slots to a channel unit in a D4 channel bank. The two time slots can also be assigned to an INA facility and then be connected to a DC bypass pair channel unit in a D4 channel bank or in a *SLC-2000 COT* terminating an INA digroup.

The *MCU*5405 should not be installed in the *SLC-2000 MSDT* or the *DDM-2000 FiberReach NBS*.

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\* Trademark of Tollgrade Communications, Inc.



### Remote Measurement Unit (RMU)

Instead of using a DC test pair arrangement as shown in Figure 7-10 on page 7-56, you can equip the RT with an external RMU for loop testing. The RMU is connected to the DC test pair input at the RT and requires two POTS channels as follows for operation:

- One channel is used as a data communications path.
- A second channel is used as a talk monitor channel.

Figure 7-11 on page 7-60 shows the RMU configuration. In this configuration, the loop testing OS sets up the test using the PGTC the same way it does for the bypass pair configuration. In addition, it calls up the RMU over the dialup data communications path through an assigned POTS channel in the *SLC-2000* system. The RMU performs the loop tests while the PGTC/XTC performs the channel test (testing the channel unit's electronics). At the end of the loop tests, the OSS can request the result of the channel test from the PGTC/XTC. The PGTC/XTC presents the results as voltages to the CO test head. Examples of the CO test head are the LTS or LTF.

To configure an RMU for access to the *SLC-2000* Access System, channels within the distribution frame must be designated for use with the external RMU. The drop side of these channels must be wired to the RMU at the RT site, according to the RMU vendor-specific procedures. (Chapter 8 describes some of the *SLC-2000* Access System cabling requirements for an RMU.)

Once wired, it is necessary to associate a time slot with the channels wired to the RMU control and talk path. This may be done with the **ENT-CRS-T0** DLC CIT command or with a provisioning OS, such as OPS/INE. For example, the following commands assign lines 200 and 300 of the TR-303 VRT to first and second channels of the channel unit installed in shelf 2, slot 12 (that must be wired to the control and talk paths of the RMU):

**ENT-CRS-T0 : v3dp-1-200, drop-2-12-1**  
**ENT-CRS-T0 : v3dp-1-300, drop-2-12-2**

An external RMU may not be limited to TR-303 systems, so the virtual drop (line) could specify either a TR-303 or a TR-08 drop.

Further details on the specific TL1 command format and parameters, including the specific TR-834 commands supported by the LAN plug-in for circuit testing, can be found in 824-102-149, *SLC-2000 Access System Operations Systems Engineering Guide*.

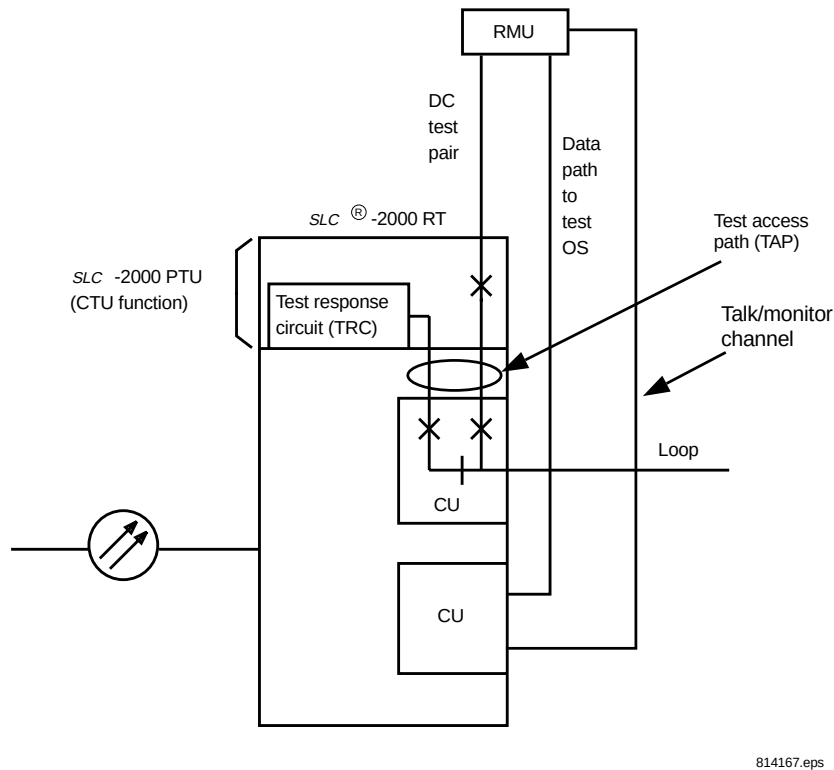


**Figure 7-11. Typical Testing Arrangement for the SLC-2000 Access System Using an RMU**

### Integral Test Head (ITH)

The ITH subsystem is an optional section in the *SLC-2000* system. Its circuit packs are located in the ARM shelf and it provides the following functions:

- MLT compatible RMU-like functions
- Local test access.

The ITH provides a built-in MLT compatible RMU function. It provides drop testing capabilities eliminating the need for a bypass pair or external RMU. As with the external RMU, it requires two locally switched VF channels for operation as follows:

- One channel for data communications to the MLT (ith link-1)
- A second channel for a talk monitor line (ith link-2).

You must connect these two channels to dial up lines from the switch. You can use any two channels for this function. The ITH requires no external wiring at the RT.

In universal configurations, two channels of a COT POTS channel unit will be cross-connected to the switch. In integrated configurations, two POTS channels must be assigned in the switch. At the RT, you must electronically cross-connect the two channels to the ITH links using the **ENT-CRS-T0** command.

**NOTE:**

**Example:** If channels 671 and 672 were selected, then the **ENT-CRS-T0** commands that you would use to connect the ITH to these channels is as follows:

- Data Communication Channel (Address 1 — feeder address)  
vrtdp-7-95 to (Address 2 — ITH address) ithlink-1
- Talk Monitor Channel (Address 1 — feeder address)  
vrtdp-7-96 to (Address 2 — ITH address) ithlink-2

The ITH links can *only* be assigned to TR-08 VRTs. However, the ITH can test drops from either TR-303 or TR-08 system or collocated DLC systems.

The ITH also provides local test access to subscriber circuits comparable to that provided by the *SLC* Series 5 system craft interface unit. Using the ITH along with the CIT and the test jacks located on the UIP, operating personnel can access locally switched nonlocally switched and nonswitched subscriber circuits. It can then test and align them using external test equipment. Using the ITH along with the CIT and the test jacks located on the UIP, the system can provide the following test accesses:

- Full splitting metallic access
- Half splitting bit stream access (toward the channel unit)
- Half splitting access to the E&M signaling leads (toward the channel unit).

The ITH circuit packs are nonservice affecting and are not protected. You can equip the ITH with different circuit packs depending on the application. See Chapter 8 for ITH circuit pack configurations.

### Lucent/Tautron Model 7000 *ngRTH* Test Head

The Lucent/Tautron Model 7000 *ngRTH* test head can be used instead of the DC test pair arrangement shown in Figure 7-10 on page 7-56. Figure 7-12 shows the *ngRTH* test head testing environment. This test head can be collocated with the *SLC-2000* RT (Software Release R3.2, or R4.5 or later) or COT (Software Release 3.3.1 or later). It is used by the appropriate testing OS at a maintenance center to test subscriber circuits. The maintenance centers can include Lucent Technologies mechanized loop test (MLT) system, Bellcore's integrated test system (ITS), Lucent Technologies switched access remote test system (SARTS), and a talk/monitor connection. For POTS testing, the *ngRTH* test head accesses the circuits through the test access paths (TAPs) and/or the bypass pair connection after MLT in the maintenance center has configured a test access using the pair gain test control (PGTC). It tests *out* towards the subscriber loop. For special service testing and Quick ISDN testing, the *ngRTH* test head sets up the test access through the *SLC-2000* metallic test access unit (MTAU) and connects to the TAP for testing *out* towards the subscriber loop and *in* towards the channel unit. After accessing the circuit, it can perform metallic-access electrical and transmission tests.

As shown in Figure 7-12, the *ngRTH* test head provides for the following connections on the *SLC-2000* system:

- Miscellaneous connections for alarm power and ringing
- MTAU connection for special services and Quick ISDN test control
- A POTS dial-up line for MLT communications and an asynchronous link for special services testing operations system (TOS) communications.
- A POTS line connection for Talk/Monitor functions.

The *ngRTH* test head provides integrated test capabilities that allow it to test the following types of *SLC-2000* subscriber circuits:

- **POTS Circuits.** It performs electrical measurements on the access circuit to determine the type, location, and severity of faults. It also provides a talk and monitor path that allows operating personnel to alternately talk to the customer and monitor the circuit under test. It supports all MLT interactive tests.
- **Special Service Circuits.** It performs electrical measurements on the accessed circuit, transmits and measures frequency level, measures noise, impulse noise and return loss, and provides monitor/talk, loopback and quiet termination functions. These tests may be applied to any of the 2-wire or 4-wire circuits selected. Special services testing is supported from Lucent Technologies SARTS system and other GR-834 compatible special services testing OSSs.
- **ISDN Circuits.** It performs a limited set of loop measurements on an ISDN line. This test performs AC and DC measurements on the loop without providing a detailed analysis. Also, the test looks for the DC signatures of the line unit(s) and/or network termination units of the accessed digital

subscriber line. This test verifies the condition of the customer's ISDN metallic loop. Testing of ISDN loops is supported from the SARTS testing OSS using the *ngRTH* test head's Quick ISDN testing feature.

The test head also includes a craft interface that allows you to connect a laptop computer for local maintenance and administration.

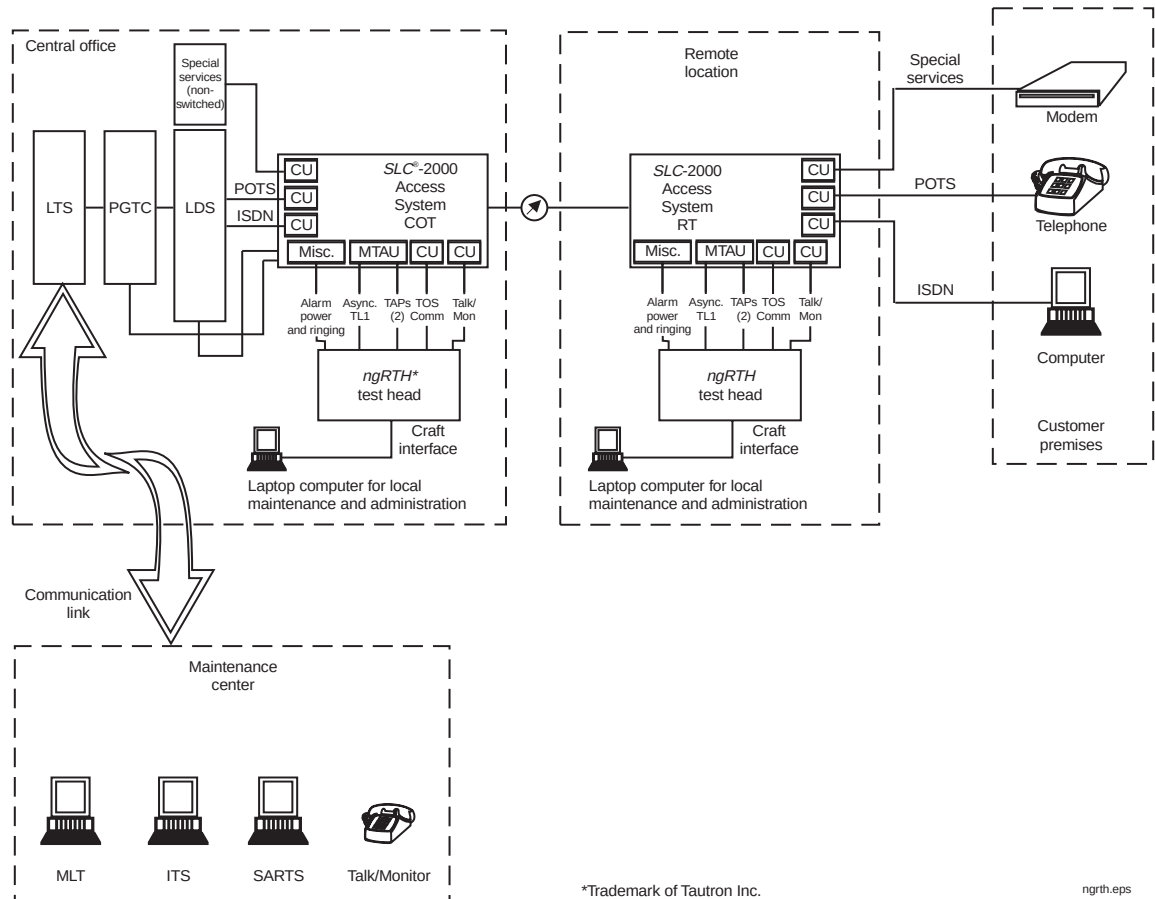


**Figure 7-12. Tautron ngRTH Test Head Testing Environment**

## Integrated Configurations

Figure 7-13 shows the testing arrangement for integrated *SLC*-2000 systems. This testing arrangement is the same as that for integrated *SLC* 96 and *SLC* Series 5 Carrier System. The loop is tested with a loop testing OS such as MLT and the LDS performs channel testing. The LDS supports channel testing for services provided by the following channel units:

- POTS and *SPOTS* channel units
- Coin channel units
- Multiparty channel units
- FSR channel units.

The switch is connected to the CO based test head, such as the MLT, LTS, or LTF, through the NTT. The test bus control unit (TBCU) is the integrated *SLC* carrier system metallic test interface. Either a metallic DC bypass pair or a digital bypass pair connects the TBCU to the RT.

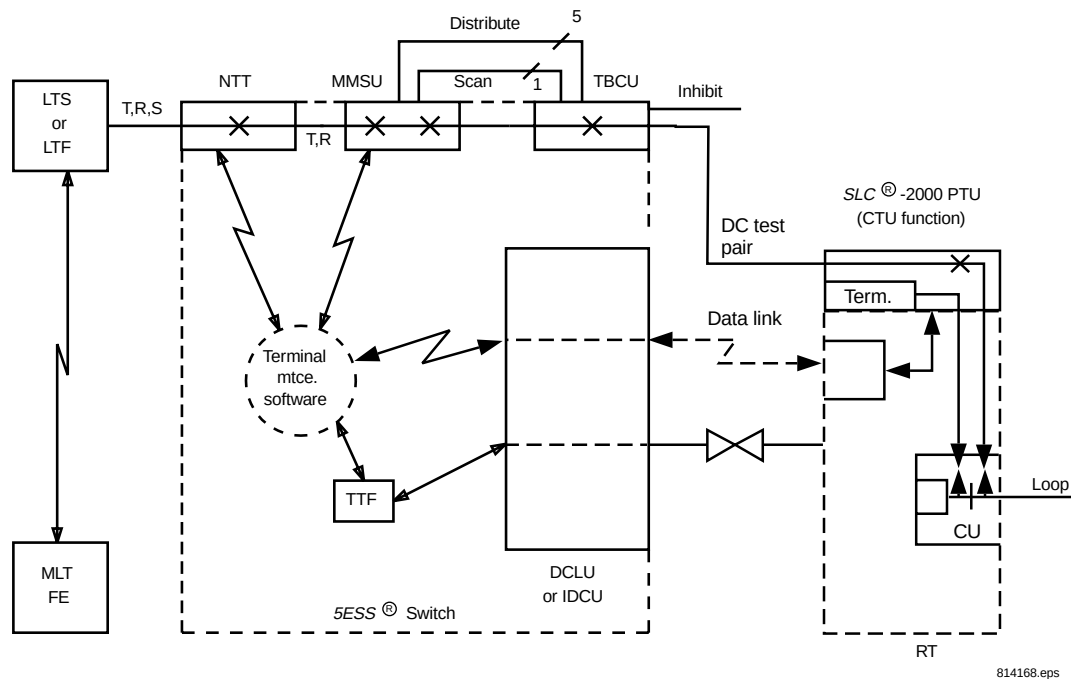


**Figure 7-13. Integrated DLC Testing — Locally Switched Circuits**

In response to a test request from the OS, the switch sets up a metallic path from the NTT through the modular metallic service unit (MMSU) to the TBCU. The TBCU has four major functions:

- It provides a means for the test head to determine that an integrated *SLC* carrier system line has been accessed.
- It provides indications for a successful access, whether the carrier system is in major alarm, or if the bypass pair is busy.
- It connects the test bus to the bypass pair for testing the subscriber loop beyond the RT for loop testing (relays in the RT PTU and relays in the channel unit connect the bypass pair to the loop under test).
- It receives the results of the digital channel tests from the transmission test facility (TTF) and presents the results to the test head when requested by the loop OSS.

Instead of using the bypass pair as shown in Figure 7-13, you can equip the RT with an external RMU or use the optional ITH for loop testing. The RMU and ITH work the same way as described in the universal configuration.

### **Routine Drop Testing**

Routine drop testing is only provided by the Teradyne *4TEL* testing system. A *4TEL* 270/275 RMU is required at the RT. In addition to the normal RMU connections to the RT for demand testing, you must connect the RMU to the LAN circuit pack through a backplane connector on the ARM shelf (EIA RS-232). This data communications connection allows the RMU to autonomously communicate with the *SLC*-2000 RT to set up test access for routine testing. The RMU performs the routine drop tests and stores the results. The Teradyne service area computer (SAC) obtains the test results from the RMU, typically by using a dial-up line, and analyzes the test results.

### **Routine Automatic Line Insulation Test (ALIT)**

The *5ESS* switch can perform routine ALITs on drops connected to integrated *SLC*-2000 systems equipped with either a metallic bypass pair or a digital bypass pair. The *5ESS* switch stores the ALIT test results. The predictor test system retrieves and analyzes the test results to detect trends in loop degradation. It then predicts failures in subscriber loops before they occur. For further details of the ALIT capability, see 235-105-220, *5ESS Switch Corrective Maintenance*.

### **Remote Demand Special Service Circuit Testing**

The *SLC*-2000 system is compatible with special services OSS when an RTU is collocated at the RT. The RT provides a TR-834 compliant interface to an external RTU. The LAN circuit pack provides communication between the RT and the RTU.

## **Local Test Access**

The ITH provides local test access to subscriber circuits comparable to that provided by the *SLC* Series 5 system craft interface unit. Using the ITH along with the CIT and the bantam test jacks located on the UIP, operating personnel can access locally switched, nonlocally switched, and nonswitched subscriber circuits. Operating personnel can then test and align them using external test equipment. Chapter 5 describes the UIP in detail. The maintenance section of the UIP contains the CIT connector, the DDS clock connector, and the local test access jacks. Using the ITH along with the CIT and the bantam test jacks located on the UIP, the system can provide the following test accesses:

- Full splitting metallic access
- Half splitting bit stream access (toward the channel unit)
- Half splitting access to the E&M signaling leads (toward the channel unit).

## **Integrated Services Digital Network (ISDN) (U-DSL) Testing**

When configured for TR-303 operation, the *SLC*-2000 Access System supports 4:1 TDM ISDN. The following test capabilities for U-DSL ISDN channels are provided.

- Split out metallic access for drop tests. Split access can be provided via the LDS or via the LAN plug-in. Testing of the ISDN drop is provided by a testing OS using a collocated or centralized RMU connected to the *SLC*-2000 RT via DC or digital bypass pair.
- Loopbacks in various combinations of B1, B2, and D channels, controlled from the LDS user interface.
- Corrupted cyclic-redundancy-code (CRC) tests, controlled from the LDS user interface.
- ISDN performance monitoring tests, controlled from the LDS user interface.



## Protection Switching

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### Automatic Protection Switching

The protection switching feature improves network reliability because it minimizes outages and service degradations by automatically switching traffic to an alternate path. The *SLC-2000* Access System supports the following:

- OC-3 line protection switching (linear configurations)
- Circuit pack protection switching
- SONET path protection switching (ring configurations)
- Synchronization reference switching
- EOC/TMC path switching.

### Automatic Protection Switching — Circuit Packs

The timing generator circuit packs and most transmission circuit packs in the ARM shelf are 1×1 protected and use nonreversible switching. The ACTIVE indicators on the circuit pack faceplates show the circuit packs that are carrying service. This aids personnel in circuit pack replacement procedures. The DSX-1 LIU and VTU circuit packs are 1 × n (where n = 1-7) protected and use reversible switching.

The user can inhibit equipment automatic protection switching using the CIT or UIP. The CIT and UIP also allow the user to force equipment protection switching. In addition, TL1 commands on the OS/NE interface are supported for the SONET subsystem.

The bandwidth management complex contains two sides: **CORE (1)** and **CORE (2)**. The system designates one of the COREs as *active*. The circuit packs in the active CORE will have a lighted green ACTIVE indicator. The system designates the other CORE as *standby* to provide protection for the slots in the active CORE. If the system detects a fault on a circuit pack in the active CORE, it switches all activity from the active CORE to the standby CORE.

After the system has been turned up, it executes an *automatic side switch* of the CORE at 3:00 a.m. each day for internal diagnostic purposes. For the TR-303 VRT, active jobs may be terminated with a processing failure response when the daily side switch occurs.

### Path Protection Switching (Self-Healing Rings)

The self-healing ring application is based on a path switching scheme. Path protection switching offers 60-ms restoration time and simple network administration for access applications. The ring facility is two fibers in each direction, with traffic rotating in opposite directions. Each low-speed input is duplicated and transmitted in both directions around the ring. The receiving end

monitors the quality of both signals and selects the better of the two to transmit on its low-speed interface. Path selection occurs on the VT1.5 level for DS1 services and STS-1 path level for DS3 services.

Path protection switching is revertible, to simplify network maintenance procedures. When used in ring applications, the high-speed optical line interface unit (OLIU) circuit packs connected to the ring also use revertible protection switching. Path switching is triggered by incoming loss of signal (LOS), alarm indication signal (AIS), or STS-1 path bit error rate (BER) exceeding  $10^{-3}$ . User control of path protection is provided with standard lockout, force switch, and manual switch commands.

### **Line Protection Switching**

Line protection switching occurs in response to automatically detected faults and to external commands from the user at a local/remote CIT, UIP, or operations system. The *SLC-2000* Access System provides SONET OC-3/OC-12 and IS-3 standard line protection switching for the transmission interfaces in linear configurations. The SONET subsystem uses the following standard protection switching priorities:

- Inhibit automatic protection switch (APS)
- Lockout of protection
- Forced switch
- Automatic switch: signal fail
- Automatic switch: signal degrade
- Manual switch.

The *SLC-2000* Access System employs unidirectional 1+1 nonrevertible line switching. Bidirectional line switching is a provisionable option. The SONET standard automatic protection switch procedures are used.

Automatic line switches are initiated by signal fail and signal degrade conditions on the received SONET signal. The SONET signal BER is calculated from violations in the SONET line overhead B2 parity byte. Signal fail is declared for incoming loss of signal, loss of frame, line AIS, or a BER exceeding  $10^{-3}$ , while a BER exceeding a provisionable threshold of  $10^{-5}$  to  $10^{-9}$  causes the signal degrade condition. Line protection is completed within 60 milliseconds of a hard failure such as a fiber cut.

The external timing references — DS1 loop timing input to the LIU, DS1 input to the TGS, and composite clock — are protected also. For details, refer to the section on synchronization in Chapter 8.

The metallic feeder interface is protected using circuit pack protection switching. The metallic feeder may be protected using external span protection equipment (Chapter 8).

### **TR-303 Embedded Operations Channel (EOC) and Time Slot Management Channel (TMC) Path Protection Switching**

Both the EOC and the TMC have an active path and a standby path. Whether a data link path is active or standby depends on the performance of the paths and the status of path switching. In normal operation, only the active path is used to transport messages. Path switching messages are sent on both the active and standby paths.

The TR-303 declares that a data link is failed when the VRT fails to establish multiple frame operation of that link. When an active path is failed, an automatic path switch is initiated. The EOC/TMC path protection switching is non-revertible. That is, when the condition that caused the path protection switch clears, the currently active EOC/TMC path remains active.

The following capabilities are supported by the *SLC-2000* system:

- Automatically switch the EOC/TMC path based on the path performance or when requested by the LDS.
- Switch to the standby EOC/TMC data link when activated by the **SW-DX-T0** command entered from the DLC subsystem CIT. See 363-208-003, *SLC-2000 Access System Commands and Messages*, for details on this command.

For automatic path switching, messages will be exchanged between the VRT and the LDS on the EOC if the EOC path is to be switched, and on the TMC if the TMC path is to be switched. For all other capabilities, the OS/LDS will send operations messages to the *SLC-2000* system via the EOC.

A dedicated DS0 is used for each TMC and EOC data link path. In the *SLC-2000* R4.0 and later system, DS0 12 of logical DS1 number 1 and logical DS1 number 2 are used for the EOC while DS0 24 of logical DS1 number 1 and logical DS1 number 2 are used for the TMC. (A logical DS1 is defined relative to a VRT, whereas a physical DS1 is defined relative to the whole *SLC-2000* system RT/HDT.)

## Performance Management

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The SLC-2000 Access System provides performance monitoring of SONET OC-3/OC-12, STS-1, and VT-1.5, RT feeder DS1 (R4.0 and later), and RT-ONU DS1 (R4.0 and later). Performance monitoring is also available on ISDN circuits in TR-303 systems. The performance monitoring parameters and storage characteristics of SONET entities comply with Bellcore SONET parameter storage standards. RT and ISDN performance monitoring parameters comply with Bellcore TR-303 parameter storage standards.

Performance management output can be accessed on demand, either locally, remotely, or from a centralized location. Parameter threshold-crossing alerts (TCAs) are provisionable. Event history reports provide a log of significant events such as alarms, TCAs, protection switches, and service-affecting manual commands. This maintenance history information can be reviewed using the CIT.

## Performance Monitoring

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The SLC-2000 system uses performance monitoring (PM) to support *proactive* maintenance. Proactive maintenance refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming, but conditions showing the potential for failures in the future.

Proactive maintenance consists of monitoring performance parameters associated with sections, lines, and paths within the networks connected to the SLC-2000 system. Each parameter has a *threshold* that, when exceeded, indicates degraded service. When a threshold is crossed, the system reports the crossing to any OS connected to an X.25 or TBOS link.

The system has the capability to initialize the DS1 current registers through the CIT locally or remotely at any time, as well as to report the contents of any DS1 register at any time. ISDN performance registers can be initialized and retrieved remotely over the EOC only. Refer to 363-208-003, *SLC-2000 Access System Commands and Messages*, for commands supporting this function.

When the system detects a trouble condition, it stops accumulating affected performance parameters. Parameters that continue to provide useful information are accumulated during the trouble condition. When system events distort PM counts, all current counts are marked as either partial or corrupt to reflect this distortion.

## **Performance Monitoring — DLC Subsystem**

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**NOTE:**

For a complete list of DLC commands and reports, see 363-208-003, *SLC-2000 Access System Commands and Messages*.

### **Release 3.2 (COT and RT)**

SLC-2000 Software Release 3.2 supports the ability to retrieve the following performance monitoring parameter on feeder DS1s:

- **Controlled slip seconds (CSS).** A CSS is a second in which one or more frames worth of data are lost or duplicated because of synchronization problems.

You can retrieve this parameter by using the **RTRV-PM-T1** CIT command. The system will report the following:

- The date and time that the counts were last initialized
- The number of CSSs occurring on each in-service DS1.

The system automatically initializes the CSS parameter 24 hours after the last time they were initialized. For more details on the **RTRV-PM-T1** command and its output report, see 363-208-003, *SLC-2000 Access System Commands and Messages*.

### **Release 4.0 or Later (RT/HDT)**

#### **DS1 Performance Monitoring**

SLC-2000 Software Release 4.0 or later supports the following performance parameters for extended superframe (ESF) DS1s in any feeder configuration:

- **Coding violation (CV).** A CRC-6 violation.
- **Severely errored framing second (SEFS).** A second in which one or more OOF/COFA events occur.
- **Controlled slip second (CSS).** A second in which one or more frames worth of data are lost or duplicated due to synchronization problem.
- **Errored second (ES).** A second in which any one or more of the following have been detected:
  - One or more CRC-6 violations.
  - One or more OOF/COFA events.
  - One or more controlled slips.

- **Severely errored second (SES).** A second in which any one or more of the following have been detected:
  - 320 or more CRC-6 violations.
  - One or more OOF/COFA events.
- **Unavailable second (UAS)** A second in which any one or more of the following have been detected:
  - CGA due to Blue (AIS).
  - CGA due to loss of signal (LOS) or loss of frame (LOF).
  - Ten consecutive SESs were detected and have not been cleared; the condition is cleared if no SESs are found in ten consecutive seconds.
- **Degraded minute (DM).** A minute in which 93 or more CVs have been detected, excluding all CVs in any SESs or UASs that occur during the 1-minute interval.

The SLC-2000 RT allows accumulated DS1 performance data for DS1s providing TR-303 service to be sent on demand to the LDS and reports DS1 threshold-crossing alerts. The LDS additionally can set and retrieve DS1 performance alert thresholds, reset performance parameter counts, inhibit reporting of DS1 threshold-crossing alerts, and change the start time of the daily counts.

The SLC-2000 RT supports the following performance parameters for SF DS1s (TR-08 or INA DS1s) in any feeder configuration:

- **Coding violation (CV).** A frame synchronization bit error.
- **Severely errored framing second (SEFS).** A second in which one or more OOF/COFA events occur.
- **Controlled slip second (CSS).** A second in which one or more frames worth of data are lost or duplicated due to synchronization problem.
- **Errored second (ES).** A second in which any one or more of the following have been detected:
  - One or more FBEs.
  - One or more OOF/COFA events.
  - One or more controlled slips.
- **Severely errored second (SES).** A second in which any one or more of the following have been detected:
  - 320 or more CRC-6 violations.
  - One or more OOF/COFA events.

- **Unavailable second (UAS).** A second in which any one or more of the following have been detected:
  - CGA due to Blue (AIS).
  - CGA due to Loss of Signal (LOS) or Loss of Frame (LOF).
  - Ten consecutive SESs were detected and have not been cleared; the condition is cleared if no SESs are found in ten consecutive seconds.

This data is available only through the CIT or TL1 interfaces to the RT and is not automatically transmitted to the LDS.

The *SLC-2000* RT allows accumulated DS1 performance data to be sent on demand to the LDS and reports DS1 threshold-crossing alerts. The LDS can then set and retrieve DS1 performance alert thresholds, reset performance parameter counts, inhibit reporting of DS1 threshold-crossing alerts, and change the start time of the daily counts.

### **MSDT/V-DT DS1 Performance Monitoring**

The MSDT DS1 performance monitoring (PM) feature works with the following optical network units (ONUs):

- *SLC-2000* MSDT (Release 4.0 and later)
- *DDM-2000* FiberReach Narrowband Shelf (Release 4.4 or later).



**NOTE:**

See Chapter 2 for a definition of V-DT.

This feature enables operating personnel to determine the quality of the DS1 link between the *SLC-2000* HDT and the remote MSDT/V-MSDT/V-DT. The HDT and the MSDT/V-DT independently monitor the quality of their respective ends of the DS1 signal and count the number of seconds that contain excessive errors.

This feature requires a *SPQ809* or later MSDT or DT Server in the HDT and one of the following circuit packs at the ONU:

- ***SLC-2000* MSDT** — MC97793A1 or later BIU
- ***DDM-2000* FiberReach NBS** — FHB2 or later DSXBIU.

Earlier versions of the Server and BIU cards in a *SLC-2000* MSDT cannot provide this feature. The specific data accumulated by the HDT and MSDT are as follows:

- **Coding violations (CV).** A CRC-6 violation on the DS1 link.
- **Severely errored framing seconds (SEFS).** Number of seconds that an out-of-frame (OOF) or a change of frame alignment (COFA) occurred.
- **Errored seconds (ES).** Number of seconds that any CV, OOF, or COFA occurred.
- **Severely errored seconds (SES).** Number of seconds that 320 or more CVs or any OOF or COFA occurred.

- **Unavailable seconds (UAS).** Number of seconds in which no signal was detected or when ten consecutive seconds of SES errors occurred.
- **Degraded minute (DM).** A minute in which 93 or more CVs occurred that are not reflected in the SES or UAS counts.

The SLC-2000 system provides the following performance registers for each DS1:

- Current and previous 15 minutes or 60 minutes
- Current and previous day
- A group of thirty-one 15-minute registers, representing the most recent 8-hour period, when monitoring period is 15 minutes
- Twenty-four 1-hour registers when monitoring period is 60 minutes.

At 15-minute intervals — on the hour and at 15, 30, and 45 minutes past the hour — the MDC in the HDT will accumulate the DS1 PM data from each MSDT or DT Server and its associated MSDT/V-DT. The MDC maintains 8 hours worth of PM data, represented as 32 sets of values. The data gathered through midnight is also maintained as a total for the previous day. All of this historical data, including the values for the current 15-minute period, can be retrieved by operating personnel on demand using the CIT interface command **RTRV-PM-T1**. This command allows retrieval of the data from the HDT end by specifying a *cu* address, or retrieval of the data from the MSDT/V-DT by specifying a *biu* address. This history data is maintained for all of the counters defined above, except for the coding violation (CV) counts.

The other MSDT/V-DT PM command available at the CIT interface is the **INIT-REG-T1** command. With this command, operating personnel can cause the current counts at either the HDT or MSDT/V-DT end to be cleared to zero. The command allows for clearing either the 15-minute or day counters. This command has no effect on the history data kept by the MDC.

While accumulating data, the server and BIU or DSXBIU cards also compare the data for the current 15-minute interval and current day against a set of predefined thresholds. If any count exceeds its threshold, the system generates an event report on the TL1 interface indicating the counter that exceeded its threshold. No threshold detection is provided for the coding violation (CV) counts, since this count is used to drive other counts having thresholds. The predefined thresholds and maximum values for each counter are shown in Table 7-13.



**Table 7-13. Performance Monitoring Predefined Thresholds and Counter Maximum Values**

| <b>Counter</b> | <b>Maximum Value<br/>(Minute/Day)</b> | <b>15-Minute<br/>Threshold</b> | <b>Day<br/>Threshold</b> |
|----------------|---------------------------------------|--------------------------------|--------------------------|
| CV             | 1,200,000 / 28,800,000                | None                           | None                     |
| ES             | 3600 / 86400                          | 65                             | 648                      |
| SES            | 3600 / 86400                          | 10                             | 100                      |
| SEFS           | 3600 / 86400                          | 2                              | 17                       |
| UAS            | 3600 / 86400                          | 3                              | 10                       |
| DM             | 60 / 1440                             | 4                              | 4                        |

### ISDN Performance Monitoring

The SLC-2000 RT supports performance monitoring of the ANSI standard U-DSL (digital subscriber line) when operating with a TR-303 interface to the LDS. The system monitors the following parameters:

- Errored seconds (ES)
- Severely errored seconds (SES)
- Coding violations (CV).

The system keeps counts for both directions (upstream and downstream) during the following time intervals:

- ***Current and previous hour*** — ES, SES, CV
- ***Current and previous interval*** — ES, SES, CV
- ***Seven additional hourly histories*** — ES only
- ***Seven additional interval histories*** — ES only
- ***Current and previous day*** — ES, SES.

You can provision thresholds and retrieve performance monitoring data and threshold crossings reports and reset individual or all performance registers using the TR-303 message-based interface.

### Performance Parameter Thresholds

The DLC subsystem provides performance thresholds to alert maintenance staff of degraded transmission. Whenever the threshold for a parameter is exceeded, the DLC subsystem generates a threshold-crossing alert (TCA) to alert the OS

(via the EOC interface) to the condition. A summary of all TCAs is available in the performance monitoring TCA summary report. DS1 current quarter-hour and current day thresholds for each parameter are provisionable, via the CIT, on a per shelf basis. Therefore, if values other than the defaults are to be used, only one value needs to be set for each parameter. The generation of TCAs can be disabled independently for each performance parameter. ISDN PM thresholds are initialized during provisioning of the ISDN line over the EOC. Performance data is still collected if thresholding is disabled. Refer to 363-208-003, *SLC-2000 Access System Commands and Messages*, for the commands to operate this feature.

## **Performance Monitoring—SONET Subsystem**

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The SONET subsystem supports the performance monitoring parameters shown in Table 7-14. For more detailed information on SONET subsystem performance monitoring, see 363-206-202, *DDM-2000 OC-3 Multiplexer, User/Service Manual*, 363-206-280, *DDM-2000 OC-3 Multiplexer, User/Service Manual, Releases 8 or Higher*, or 363-206-285 *DDM-2000 OC-3 Multiplexer, Releases 13 or Higher, User/Service Manual*.

### **Optical Parameters**

The optical parameters (OC-3 Optics in Table 7-14) are initiated when a slot is equipped with an OLIU circuit pack. The SONET subsystem supports the following parameters:

- Laser bias current
- Optical transmit power.

### **OC-3 Section Parameters**

Section parameters for OC-3 interfaces are initiated when a slot is equipped with an OLIU circuit pack. The system monitors the following parameter:

- **Severely errored frame seconds (SEFS).** This parameter counts the number of seconds during which an out-of-frame, loss-of-signal, or OLIU circuit pack failure occurred.

### **OC-3/EC-1 Line Parameters**

Line parameters for OC-3 interfaces are initiated when a slot is equipped with an OLIU circuit pack. Line parameters for an EC-1 high-speed interface are initiated when the slot is equipped with an STS1E circuit pack set for high speed. Line parameters for EC-1 low-speed interfaces are initiated when a slot is equipped with an STS1E circuit pack set for low-speed and the port is in the in-service (IS) state.

**Table 7-14. Performance Monitoring Parameters**

| <b>Facility</b>         | <b>Measured Parameter</b>                                                                                                                                                                                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OC-3 Optics             | Optical Transmit Power (21G/21G-U OLIU only)<br>Laser Bias Current (21G/21G-U OLIU only)                                                                                                                                                                                      |
| OC-3 Section            | Severely Errored Frame Seconds (SEFS)                                                                                                                                                                                                                                         |
| OC-3 Line               | B2 Coding Violations (CV)<br>B2 Errored Seconds (ES)<br>B2 Errored Seconds Type A (ESA)<br>B2 Errored Seconds Type B (ESB)<br>B2 Severely Errored Seconds (SES)<br>B2 Unavailable Seconds (UAS)<br>Line Protection Switch Counts (PSC-L)<br>STS Pointer Justification Counts* |
| OC-12 Line              | STS Pointer Justification Counts*                                                                                                                                                                                                                                             |
| EC-1 Line <sup>†</sup>  | B2 Coding Violations (CV) EC-1<br>B2 Errored Seconds (ES)<br>B2 Errored Seconds Type A (ESA)<br>B2 Errored Seconds Type B (ESB)<br>B2 Severely Errored Seconds (SES)<br>B2 Unavailable Seconds (UAS)<br>STS Pointer Justification Counts*                                     |
| STS-1 Path              | B3 Coding Violations (CV)<br>B3 Errored Seconds (ES)<br>B3 Errored Seconds Type A (ESA)<br>B3 Errored Seconds Type B (ESB)<br>B3 Severely Errored Seconds (SES)<br>B3 Unavailable Seconds (UAS)                                                                               |
| VT1.5 Path <sup>‡</sup> | V5 Errored Seconds (ES)<br>V5 Severely Errored Seconds (SES)<br>V5 Unavailable Seconds (UAS)                                                                                                                                                                                  |
| DS1 Path <sup>§</sup>   | ES-P Errored Seconds<br>SES-P Severely Errored Seconds<br>UAS-P Unavailable Seconds<br>ES-PFE Errored Seconds<br>SES-PFE Severely Errored Seconds<br>UAS-PFE Unavailable Seconds (UAS)                                                                                        |

\* Available with SONET Subsystem R11 or later.

† SONET OC-3 Release 5.1 for rings and Release 6.0 for linear networks.

‡ SONET OC-3 Releases 6.0 and 7.0 and later only (feature package option).

§ SONET OC-3 Release 5.1 for rings and Release 6.0 for linear networks (feature package option).

*Continued on next page*

**Table 7-14. Performance Monitoring Parameters (Continued)**

| <b>Facility</b>                                                        | <b>Measured Parameter</b>                                                                                                                                                                       |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enhanced DS1 Path <sup>*</sup>                                         | Coding Violation, Path (CVP)<br>Coding Violations, Path Far-end (CVPFE)                                                                                                                         |
| DS1 Line <sup>*</sup>                                                  | Errored Seconds, Line (ESL)<br>Enhanced Line Signal Threshold (BERL)                                                                                                                            |
| DS3 Path for P-Bit, F&M Bit, and C-Bit from Fiber and DSX <sup>*</sup> | CV-P Coding Violations<br>Severely Errored Frame Seconds (SEFS)<br>ES-P Errored Seconds<br>SES-P Severely Errored Seconds<br>UAS-P Unavailable Seconds                                          |
| DS3 Line <sup>*</sup>                                                  | Line Coding Violations (CVL)<br>Errored Seconds (ESL)<br>Severely Errored Seconds (SESL)                                                                                                        |
| OC-1 Section <sup>*</sup>                                              | SE Frame Seconds (SEFS)                                                                                                                                                                         |
| OC-1 Line <sup>*</sup>                                                 | B2 Coding Violations (CV)<br>B2 Errored Seconds (ES)<br>B2 Errored Seconds Type A (ESA)<br>B2 Errored Seconds Type B (ESB)<br>B2 Severely Errored Seconds (SES)<br>B2 Unavailable Seconds (UAS) |

<sup>\*</sup> SONET Release 9.0 and later only.

---

The system monitors the following parameters:

- Line coding violations (B2 Parity)
- Errored seconds
- Severely errored seconds
- Unavailable seconds
- Line protection switch counts.

### STS-1 Path Parameters

The system monitors STS-1 path parameters for the following interfaces:

- **OC-3 Interfaces.** The collection of STS-1 path parameters depends on the application.
  - **Default STS-1 cross-connections:** Monitoring is initiated only when either slot pair is equipped with MXRVO circuit packs.
  - **Manual STS-1 cross-connections:** Monitoring is initiated only when an STS-1 cross-connection is made to an MXRVO circuit pack and the channel is in the IS state.
  - **Manual VT1.5 cross-connections:** Monitoring is initiated only when the first VT1.5 cross-connection associated with that STS-1 signal is made and the VT channel is in the IS state. This applies to STS-1 paths on both OLIU and STS1E low-speed circuit packs.
- **EC-1 low-speed interfaces.** The collection of STS-1 path parameters is initiated only when a slot is equipped with an STS1E circuit pack set for low speed and a VT1.5 cross-connection is made.
- **EC-1 high-speed interfaces.** The collection of STS-1 path parameters is initiated only when a slot is equipped with an STS1E circuit pack set for high speed.

The system monitors the following STS-1 path parameters:

- STS-1 path coding violations (B3 Parity)
- Errored seconds
- Severely errored seconds
- Unavailable seconds.

## VT1.5 Path Parameters

The system monitors VT1.5 path parameters for the following interfaces:

- **EC-1 high-speed interfaces.** VT1.5 monitoring is initiated when a DS1 slot is equipped with a DS1 or DS1PM circuit pack (assuming an associated STS1E circuit pack set for high speed is present).
- **OC-3 interfaces.** VT1.5 monitoring is initiated when the associated VT1.5 or STS-1 cross-connection is made to a DS1 or DS1PM circuit pack.

The system monitors the following VT1.5 path parameters:

- Errored seconds
- Severely errored seconds
- Unavailable seconds.

## DS1 Path Parameters

DS1 path parameters are initiated only when a slot is equipped with a DS1PM circuit pack (assuming associated MXRVO or STS1E circuit packs are present), the DS1 port is in the IS or NMON state, and the DS1 port is provisioned for performance monitoring. The system monitors the following DS1 path parameters:

- Errored seconds
- Severely errored seconds
- Unavailable seconds.

## Performance Parameter Thresholds

The SONET subsystem provides performance thresholds to alert maintenance staff of degraded transmission. Whenever the threshold for a parameter is exceeded, the SONET subsystem generates a threshold-crossing alert (TCA) to alert the OS (via the TBOS or TL1/X.25 interface) to the condition. A summary of all TCAs is available in the performance monitoring TCA summary report. Current quarter-hour and current day thresholds for each parameter are provisionable via the CIT; therefore, if values other than the defaults are to be used, only one value needs to be set for each parameter. The generation of TCAs can be disabled independently for each performance parameter. Performance data is still collected if thresholding is disabled. See Chapter 8 for SONET PM default values. Refer to 363-208-003, *SLC-2000 Access System Commands and Messages*, for the commands to control this feature.

## TCA Transmission to OS

To trigger proactive maintenance activity at the OS, each SONET subsystem TBOS display contains one summary-level performance monitoring TCA point.

When the TL1/X.25 interface to the *NMA OS* is used, threshold crossings are reported to the *NMA OS* via **rept-evt** messages.

## Reports

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This section provides information for reports available through the CIT. For SONET reports available through the X.25 link, refer to 824-102-148, *2000 Family of Products Operations Systems Engineering Guide*.

### Alarms and Status Report

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The system provides a report that lists all active alarm and status conditions. The report includes the identity of the condition (circuit pack failure, incoming OC-3/OC-12 signal failure, etc.) along with a time stamp indicating when the condition was detected.

See the **rtrv-alm** command in 363-208-003, *SLC-2000 Access System Commands and Messages*, for a complete list of the alarm and status conditions that are reported by the system.

### Provisioning Reports

---

Provisioning reports list the current state of all provisionable options in the system. See 363-208-003, *SLC-2000 Access System Commands and Messages*, for commands associated with provisioning reports.

### Performance Monitoring Reports

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#### TCA Summary Report

The TCA summary report lists the sum of the number of threshold crossings within the last 8 hours for quarter-hour thresholds and the number of threshold-crossings for the current day and current quarter hour for daily thresholds. For Release 4.0 and later, the system sends this report over the EOC interface. This snapshot provides an overall view of system performance. If there are TCAs identified, it identifies the performance status report to look at for a detailed view of those parameters. See the **rtrv-pm-tca** command in 363-208-003, *SLC-2000 Access System Commands and Messages*.

#### Performance Status Reports

The system provides reports that contain a snapshot of all current and previous performance monitoring registers. The time at which registers were last re-initialized is included. The option to display a specified subset of parameters (for

example, line parameters only, data for only one OC-3 line or DS1 port, etc.) is also provided. See 363-208-003, *SLC-2000 Access System Commands and Messages*, for the performance status report commands. Equivalent reporting information is available through TL1/X.25 commands. Refer to 824-102-148, *2000 Family of Products Operations Systems Engineering Guide*.

## State Report

---

The state report lists the state of all slots and low-speed ports on the system. DS1 and EC-1 ports can be in the AUTO (available for automatic provisioning), IS (in service), or NMON (not monitored) states. When a good signal from the digital cross-connect (DSX) is detected, a port in the AUTO state automatically transitions to the IS state and is monitored for failures. When a port is in the NMON state, the signal coming from the DSX is not monitored. This report also includes the protection switching state ("active" or "standby") and protection switching priority of all protected lines and equipment in the system. See the **rtrv-state** command for the SONET subsystem, and **RTRV-STATE-EQPT** and **RTRV-STATE-VEQPT** commands for the DLC subsystem in 363-208-003, *SLC-2000 Access System Commands and Messages*.

## Maintenance History Report

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A maintenance history report containing the past 500 (60 in SONET OC-3 Releases 2.0 and 3.0) alarm, status, protection switching, and CIT (for example, provisioning, loopback request, manual protection, etc.) events is provided for the SONET subsystem and the DLC subsystem (500 events each). This summary contains real time and date stamps indicating when each condition was detected and when it cleared; CIT events contain a time stamp indicating when the command was entered. Alarm and status entries in the retrieve history report are not subject to holdoff and clear delay. See the **rtrv-hsty** command in 363-208-003, *SLC-2000 Access System Commands and Messages*.

## Path State Report (SONET Subsystem Only)

---

This report applies to SONET OC-3 Release 5.1 and later ring releases. The report lists each STS-1 and VT1.5 active and standby path in a path-switched ring configuration. The active paths are identified and the protection switching status of each path is provided. See the **rtrv-state-path** command in 363-208-003, *SLC-2000 Access System Commands and Messages*.

## Equipment Report (SONET Subsystem Only)

---

This report displays the equipage and version information for one or more slots. Refer to the **rtrv-eqpt** command in 363-208-003, *SLC-2000 Access System Commands and Messages*.



### **Network Map Report (SONET Subsystem Only)**

This report shows the names ("Target Identifiers," or "TIDs") of other DDM-2000 systems in the maintenance subnetwork and the gateway network element (GNE) for the subnetwork. Refer to the **rtrv-nmap** command in 363-208-003, *SLC-2000 Access System Commands and Messages*.

### **Version/Equipment List (Inventory)**

The *SLC-2000* Access System provides a full inventory report on all circuit pack hardware and software installed in local and remote systems. Some older *SLC* Series 5 Carrier System channel units do not support this capability (see Chapter 4). The following information is provided:

- Circuit pack name
- Ten-character *COMMON LANGUAGE CLEI*\* code
- Six-digit equipment catalog item (ECI) code
- Ten-character apparatus code
- Six-character series number
- Twelve-character serial number (includes date of manufacture)
- Six-digit program version (software generic) code
- Five-character program identification (PID) code for replaceable erasable programmable read-only-memory (EPROM) chips.

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\* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

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### Overview

This chapter summarizes the information needed to engineer, order, and deploy *SLC*<sup>®</sup>-2000 Access Systems. Considerations to keep in mind when planning the network include software compatibility, minimum/maximum system configurations, single versus collocated systems, remote site growth, services required, central office interfaces required, and synchronization requirements.

The engineering effort involved in the planning and design of the *SLC*-2000 Access System is similar to that for the *SLC* Series 5 Carrier System with the DDM-2000 multiplexer. However, the following differences should be considered in the planning phase:

- The line capacity to physical space ratio of the *SLC*-2000 Access System is more than twice that of the *SLC* Series 5 Carrier System.
- The *SLC*-2000 Access System is optimized for plain old telephone service (POTS). Line sizes quoted are maximum capacities for a concentrated or mixed mode system equipped with quad POTS/*SPOTS*<sup>®</sup> channel units. The line sizes change when single- or dual-channel units are used; however, time slot interchange (TSI) can be used to avoid wasting bandwidth.
- Unlike previous digital loop carrier (DLC) systems, the *SLC*-2000 Access System does not contain integrated power and ringing supplies. The system is designed for power distribution from a central, redundant power plant serving all DLC systems at a remote terminal (RT) site. Power is cabled to the frame in RT bay arrangements; cabinet arrangements are bulk powered. The central office terminal (COT) uses the -48 V office supply.

## **General Planning Considerations**

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The *SLC-2000* Access System remote terminal/host digital terminal (RT/HDT) provides a customer interface to switching, networking, or other customer serving equipment. Customer applications, such as integrated services digital network (ISDN), integrated network access (INA) grooming, and special services, determine the configuration of the *SLC-2000* Access System and how the DS1 resources will be allocated. Statistical data and central office interfaces (TR-08 vs. TR-303) should be used to determine present and projected customer service requirements for the areas to be served by the *SLC-2000* Access System.

TR-08 virtual remote terminals (VRTs) may be configured for either Mode 1 (1:1) or Mode 2 (2:1) concentration with Mode 1 VRTs requiring up to 4 DS1s to be assigned for each 96 lines and Mode 2 VRTs requiring up to 2 DS1s to be assigned for each 96 lines. High-usage areas may require a Mode 1 configuration. Medium customer usage areas may be served by a combination of Mode 1 and Mode 2 systems. Low customer usage areas may be served by a Mode 2 configuration that allows a 2:1 concentration.

With a TR-303 interface to the central office, the concentration for POTS service may be engineered from approximately 1:1 with a maximum of 28 DS1s to 17.4:1 with a minimum of 2 DS1s connected to the TR-303 VRT. When the *SLC-2000* TR-303 RT is fully equipped with AUA94 channel units, the concentration for ISDN B-channels may be engineered from 1.4:1 with the maximum of 28 DS1s to 17.4:1 with 6 DS1s connected to the TR-303 VRT. As customer usage increases, feeder time slots should be added to decrease the concentration.

Refer to Chapter 2 for a definition of VRT and a description of bandwidth management and time slot interchange (TSI). Chapter 3 contains cross-connect information and considerations.

## **Fiber Distribution Planning and Engineering**

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The fiber-in-the-loop (FITL) feature provides customer services needed now and lays a fiber optic backbone for future applications. However, relevant data should be provided to support the need for this type of equipment and for the desired system configuration (adequate switching fabric, networking equipment, etc.) to provide the required services at the serving node (central office).

For engineering the Multi-Services Distant Terminal (MSDT), refer to 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service, and Ordering Manual*.

For engineering the DDM-2000 FiberReach Narrowband Shelf, refer to 363-206-300, *DDM-2000 FiberReach Terminal, Applications, Planning, and Ordering Guide*.

For engineering the fiber services module (FSM), refer to Appendix D of this document.

The *SLC-2000* Access System interface for fiber distribution is described in the sections on remote terminal engineering.

### **Engineering Restrictions for the AUA232, AUA57, and MCU5405 Test Channel Units**

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An metallic distribution shelf (MDS) assembly shelf that contains one or more Multi-Services Distant Services (MSDT) or distant terminal (DT) Servers cannot contain channel units other than the following:

- **AUA57 FSR:** In the absence of a bank mounted ringing source, the AUA57 connects a voiceband data link from the maintenance center to a general purpose remote measurement unit (RMU) equipped with an analog modem.
- **AUA232 DSU dataport:** The AUA232 allows for efficient data connection to a special service RMU equipped with a digital interface.
- **MCU<sup>\*</sup> 5405 DC bypass:** If the feeder is fiber, the MCU5405 provides the RT end of the equivalent of a DC bypass pair, that allows the HDT to convey to mechanized loop testing (MLT), using the pair gain test controller (PGTC) or test bus control unit (TBCU), the results of channel and drop test unit (CDTU) tests at the MSDT/NBS.

You can install these channel units in an MSDT-serving shelf where the RT site is entirely dedicated to FITL service. They terminate CO/RT circuits associated with maintenance. You can only install these channel units in the following valid MSDT or DT Server slots on an MDS assembly shelf depending on the software release:

- **Release 4.4 or Earlier:** slots 1, 5, 13, and 17
- **Release 4.5 or Later:** slots 1, 5, 9, 13, 17, and 21.

Cross-connections for the AUA232 and AUA57 should be made as if the channel units were installed in the first slot in the MSDT/V-MSDT/V-DT instead of the MDS assembly (for example, **ENT-CRS-T0::v3dp-1-1, dtdp-1-1-1-1**).



**NOTE:**

See Chapter 2 for a definition of *virtual-MSDT* (V-MSDT) and *virtual-DT* (V-DT).

The MCU5405 channel unit requires two cross-connections. When used in the fiber-configured shelf, the first and third drops of the physical slot should be used instead of the first two. For example, the commands might be

**ENT-CRS-T0::inads0-1-1, dtdp-1-1-1-1** and

**ENT-CRS-T0::inads0-1-2, dtdp-1-1-1-3** to install cross-connections.

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## **Remote Terminal (RT) Site Growth**

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The *SLC-2000* Access System is designed for applications where there is localized growth at the RT site for DS0 services and business services such as DSX-1 distribution. Configuring the *SLC-2000* Access System for a synchronous optical network (SONET) ring network offers the lowest cost solution. Also, this configuration supports in-service upgrades. With protection switching, a node can be added upstream (on the SONET feeder side) without taking the system out of service. This application provides DS0 services for the number of lines shown in Table 8-1 depending on the software release and the type of distribution. The system will also provide DS1 digital service for up to 28 lines. The *SLC-2000* Access System is connected to a SONET COT or a DDM-2000 multiplexer in the service node.

For applications where the line demand exceeds the limit of a single *SLC-2000* Access System, line capacity of the RT site may be increased by adding another *SLC-2000* Access System. On a SONET ring network, short-range optical line interface units (OLIUs) can connect another *SLC-2000* Access System [an access resource manager (ARM) shelf equipped with control (OHCTL, SYSCTL, and TGS) and transmission (OLIUs) circuit packs and at least one MDS assembly] to an existing *SLC-2000* Access System. This optical shelf interconnection (using the OLIU) passes three synchronous transport signal level one (STS-1) signals and the SONET data communications channel (DCC) between both systems, providing operations, administration, maintenance, and provisioning (OAM&P) connectivity.

The SONET topology can be grown from a minimum of a 2-node point-to-point or ring up to a 10-node SONET network linear taper configuration or 50-node SONET network ring configuration (SONET Subsystem R11 or later). With a typical OC-3 feeder, there is a maximum of 84 DS1s available to be distributed among the nodes to provide customer services. The DS1s are distributed using VT1.5 or STS-1 cross-connections.

**Table 8-1. SLC-2000 RT Distribution**

| <b>SLC-2000 RT<br/>Software Release</b> | <b>Type of Distribution<br/>(Note)</b>                | <b>Maximum Number of Lines<br/>Served by an RT</b> |                                     |
|-----------------------------------------|-------------------------------------------------------|----------------------------------------------------|-------------------------------------|
|                                         |                                                       | <b>POTS/Special<br/>Service Lines</b>              | <b>ISDN Lines<br/>(TR-303 Only)</b> |
| R3.2 or earlier                         | Metallic or FITL Distribution or<br>a Mixture of both | 768                                                | —                                   |
| R4.0 or R4.1                            | Metallic Distribution Only                            | 768                                                | 384                                 |
|                                         | FITL Distribution Only                                | 768                                                | 256                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 368*                                |
| R4.2 and R4.3                           | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 768                                                | 256                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 704*                                |
| R4.4                                    | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 768                                                | 320                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 768                                                | 712*                                |
| R4.5 and Later                          | Metallic Distribution Only                            | 768                                                | 768                                 |
|                                         | FITL Distribution Only                                | 1152                                               | 480                                 |
|                                         | Mix of Metallic and FITL<br>Distribution              | 1104†                                              | 732*                                |

\* Maximum number of ISDN lines is figured with seven shelves provisioned for metallic distribution and one shelf provisioned for FITL distribution.

† Maximum number of POTS or Special Services lines is figured with seven shelves provisioned for FITL distribution and one shelf provisioned for metallic distribution.

As shown in Table 8-1, the types of distribution can include the following:

- Metallic only
- FITL only
- A mix of metallic and FITL.

The maximum number of lines served by a single RT/HDT depends on the software release. The following examples show a mixture of metallic and FITL distribution:

- Example 1 (Release 4.2):** Your system must provide metallic distribution for 480 POTS lines and 96 ISDN lines. It also must provide FITL distribution for 96 POTS lines and 32 ISDN lines. Here is one possible configuration (Figure 8-1). MDS assembly shelves 1, 2, 3, 4, 5, and 6 are provisioned for metallic distribution. Shelves 1, 2, 3, 4, and 5 contain quad POTS channel units totaling 480 lines. Shelf 6 contains quad ISDN channel units providing 96 ISDN lines. Shelves 7 and 8 are provisioned for FITL. Each shelf contains 4 24-line MSDT Servers hosting four MSDTs for a total of eight MSDTs. Shelf 7 hosts four MSDTs each containing six quad POTS channel units for a total of 96 POTS lines. Shelf 8 hosts four MSDTs each containing four dual ISDN channel units for a total of 32 ISDN lines (the MSDT is restricted to dual ISDN units in the first four slots — see Chapter 4).

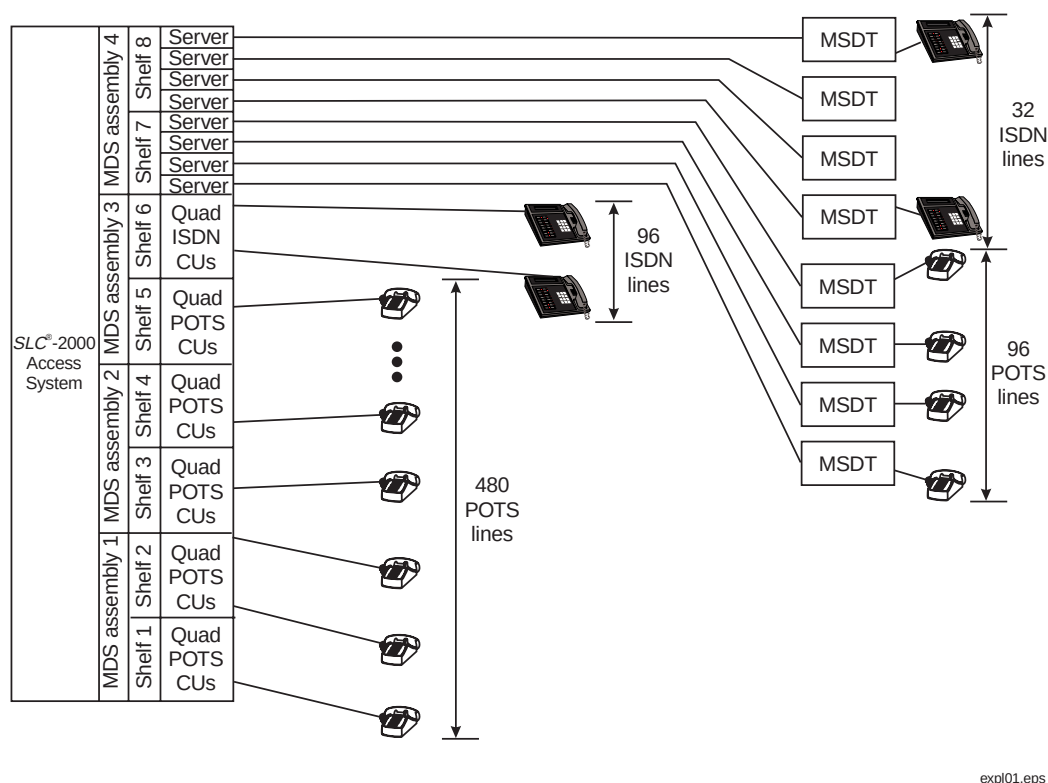
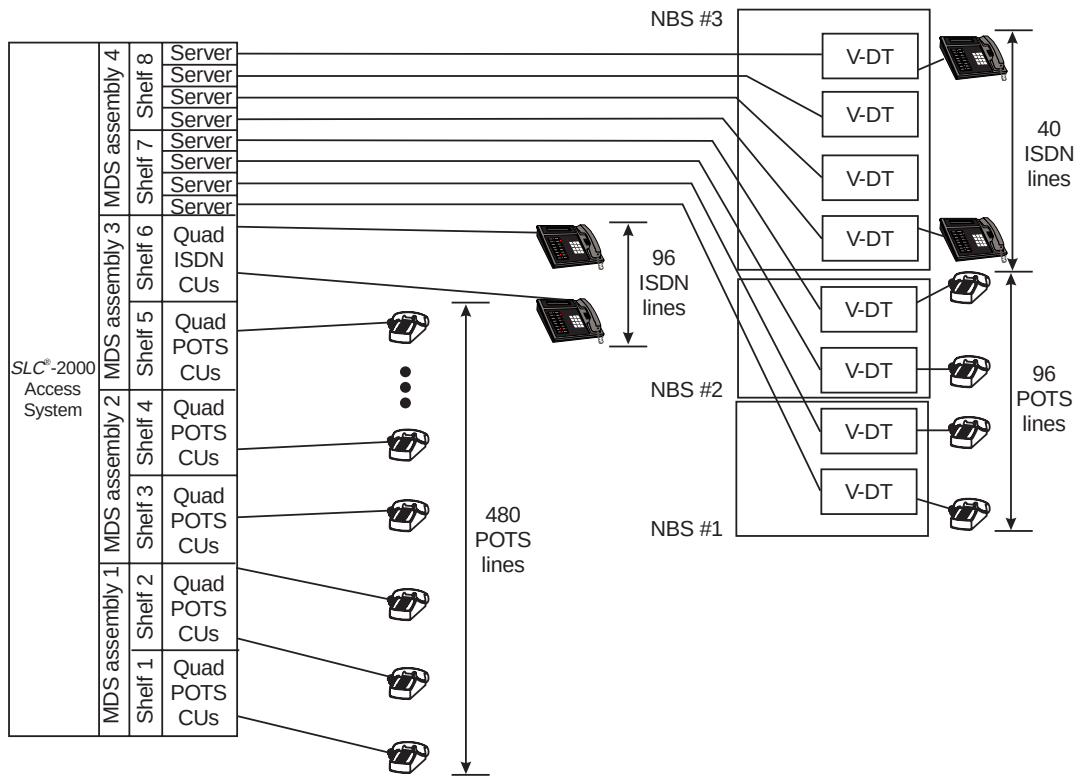


**Figure 8-1. Example 1 — Mixed Distribution — Release R4.2**

- Example 2 (Release 4.4):** Your system must provide metallic distribution for 480 POTS lines and 96 ISDN lines. It also must serve FITL distribution for 96 POTS lines and 40 ISDN lines. Here is one possible configuration (Figure 8-2). MDS assembly shelves 1, 2, 3, 4, 5, and 6 are provisioned for metallic distribution. Shelves 1, 2, 3, 4, and 5 contain quad POTS channel units totaling 480 lines. Shelf 6 contains quad ISDN channel units providing 96 ISDN lines. Shelves 7 and 8 are provisioned for FITL. Each shelf contains four 24-line DT Servers hosting four V-DTs for a total of three NBSs. Shelf 7 host two NBSs provisioned for the quad mode. NBS #1 and NBS #2 each contain 2 V-DTs, with each V-DT containing six quad POTS channel units for a total of 48 POTS lines per NBS or 96 POTS lines for both NBSs. Shelf 8 hosts NBS #3 provisioned for the octet mode. The octet NBS contains four V-DTs. Each V-DT contains two quad ISDN channel units and one dual ISDN channel unit for a total of ten ISDN lines per V-DT. The complete NBS containing four V-DTs provides 40 ISDN lines.



expl02.eps

**Figure 8-2. Example 2 — Mixed Distribution — Release R4.4**

- Example 3 (Release 4.5):** Your system must provide FITL distribution to serve 9 NBSs for a total of 360 ISDN lines. In addition to the FITL distribution, it must also provide metallic distribution for 192 POTS lines. Here is one possible configuration (Figure 8-3). MDS assembly shelves 1 and 2 are provisioned for metallic distribution. These shelves contains quad POTS channel units and serves 192 POTS lines (96 lines per MDS assembly shelf). Shelves 3, 4, 5, 6, 7, and 8 contain DT Servers and are provisioned for FITL. Release 4.5 allows each shelf to contain six 24-line Servers instead of the four 24-line Servers of the earlier software releases. If each DT Server is provisioned for the octet mode, it can provide ten ISDN lines. With each shelf containing six DT Servers, then it will provide 60 ISDN lines ( $10 \times 6 = 60$ ). If six shelves are provisioned for FITL, then the system will provide 360 ISDN lines ( $6 \times 60 = 360$ ).

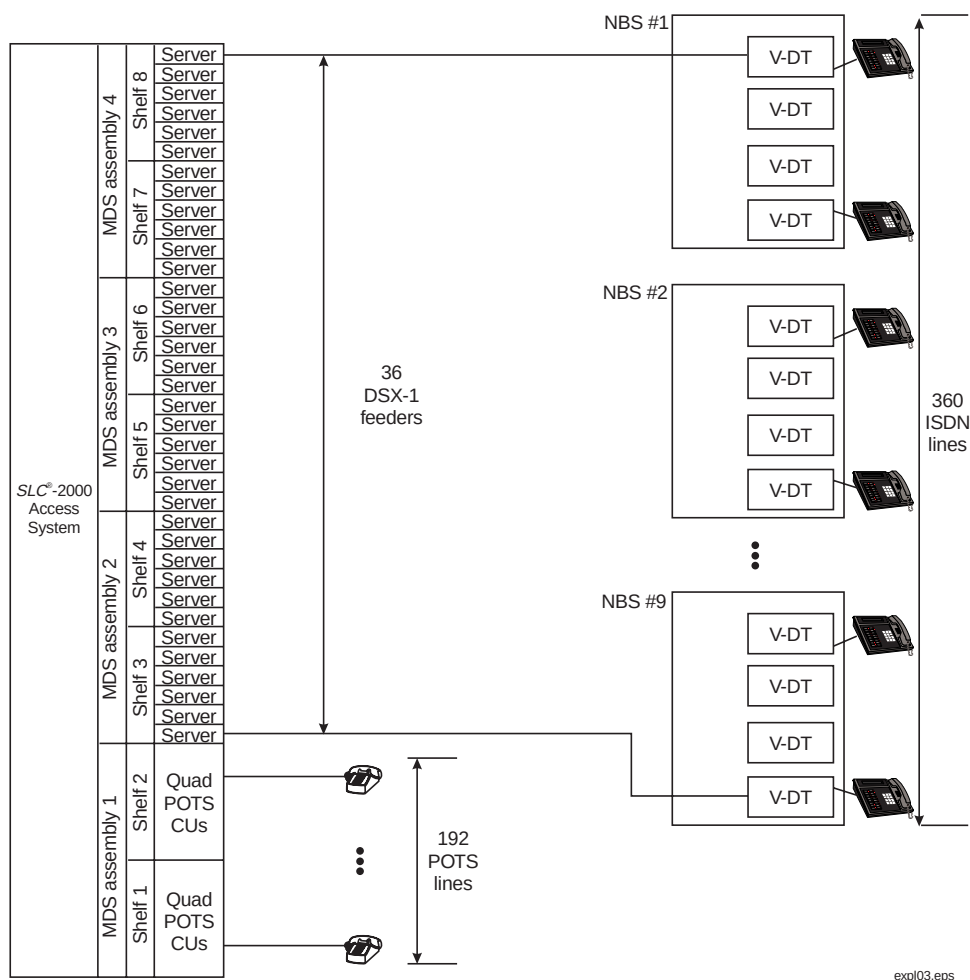


**Figure 8-3. Example 3 — Mixed Distribution — Release R4.5**

## **Traffic Engineering**

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Traffic engineering of the SLC-2000 Access System determines the proper number of DS1 feeders to be allocated for the desired level of service, types of service to be engineered, and selected interfaces (INA, TR-08, TR-303). Projected growth for the RT should be considered when engineering the SLC-2000 Access System. ***The procedures described in this section apply to the RT/HDT and SLC-2000 MSDT or DDM-2000 FiberReach Narrowband Shelf only.*** Any blocking imposed by the central office due to DS1 concentration should be considered separately.

### **Principles of the SLC-2000 Traffic Model**

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The principles that apply to the SLC-2000 traffic model include the following:

- A total of 28 DS1 feeders may be engineered per RT (R3.2 and R4.0 and later).
- Up to eight TR-08 VRTs may be engineered per RT (R3.2 and R4.0 and later).
- TR-303 VRTs may be engineered per RT:
  - ***Software Release 4.0 and 4.1:*** One TR-303 VRT per RT.
  - ***Software Release 4.2 and Later:*** Two TR-303 VRTs per RT.
- DS1 feeders assigned to TR-08 VRTs may be configured for Mode 1 or Mode 2 (concentrated). These are calculated separately and added to the total number of DS0s required (R3.2 and R4.0 and later).
- A TR-303 VRT requires a minimum of two DS1 feeders to support the primary and secondary data links to the switch (R4.0 and later).
- Total traffic measured in hundred call-seconds (CCS) for the TR-303 VRT is defined as originating plus terminating CCS for a 4-week high busy average (R4.0 and later).
- When using ISDN, two B-channels are available for each ISDN circuit [digital subscriber line (DSL)]. The traffic model assumes that both channels will be used. The total of ISDN lines that you can engineer depends on the software release and the channel unit providing the service:
  - ***Release 4.0 and later:*** 384 ISDN lines using AUA94 channel units.
  - ***Release 4.1 and later:*** 768 ISDN lines using SPQ<sup>®</sup>494 channel units (see Note).



**NOTE:**

Lucent Technologies recommends the use of Software Release 4.2 or later if you are equipping more than 200 ISDN lines.

- The D-channel of the DSL requires a nailed-up quarter DS0. Four quarter DS0s can be packed into one DS0. These must be added separately to the total number of DS0s required (R4.0 and later).
- Semipermanent assignments for switch-destined DS0s (nailed up or hairpinned) and semipermanent connections carried on INA spans are calculated separately (R3.2 and R4.0 and later).
- When ISDN is engineered in the *SLC-2000* MSDT or the DDM-2000 FiberReach Narrowband Shelf, engineered restrictions defined in Chapter 4 and in 363-205-004 must be taken into consideration.

### ***SLC-2000 Access System Traffic Capacity***

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The *SLC-2000* Access System traffic is defined as the sum of originating plus terminating plus ineffective (false starts and permanents) half-calls (two half-calls are required to complete a line-to-line call). The high day busy hour (HDBH) calling rate capacity of a fully equipped *SLC-2000* Access System exceeds the requirements in LSSGR Section 17 (TR-TSY-000517) "Traffic Capacity and Environment."

A fully equipped *SLC-2000* Access System contains 16 metallic distribution controllers (MDCs). Each MDC (group of up to 48 lines) has a calling rate capacity of 750 half-calls (originating + terminating + ineffective) per hour. Both of these capacities apply over an originating/terminating call mix that ranges from 100 percent originating to 100 percent terminating, using an ineffective rate of 9 percent.



**NOTE:**

A system operating in VFDE mode (Software Release R4.6 or later) will have a lower call rate because of added TR-303 TMC messaging.

The *SLC-2000* Access System calling rate capacities stated above apply to the entire *SLC-2000* system or MDC as appropriate. If you configure multiple VRTs (either TR-08 or TR-303), the sum of the calling rates from all of the VRTs must fall within the stated capacities.

The *SLC-2000* Access System calling rate capacity is determined by the *SLC-2000* Access System common control processors and must be considered independently from the calling rate capacity of the local digital switch (LDS) and the network's traffic capacity. Each area must be properly engineered to achieve desired service levels.

### ***TR-08 VRTs — Traffic Engineering***

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All *SLC-2000* Access System releases support TR-08 VRTs, with simple guidelines based on the mode. If the TR-08 VRT is configured for Mode 1 concentration, assign 4 DS1 feeders for each 96 lines. If the TR-08 VRT is

configured for Mode 2 concentration, assign 2 DS1 feeders for each 96 lines. See Chapter 2 for more information on TR-08 VRTs. Chapter 3 has details on TR-08 VRT cross-connections.

### **TR-303 VRT Traffic Engineering**

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With the introduction of the TR-303 VRT in R4.0, the traffic engineering of the *SLC-2000* Access System must include the following:

- How many lines are to be connected to the TR-303 VRT
- The percentage of the VRT to be allocated to ISDN service
- The level of concentration to be used (in other words, how many DS1 feeders will be allocated to the VRT).

This section provides the details of the traffic model used to calculate the traffic capacity required for the TR-303 VRT.

The *SLC-2000* RT must be sized in conjunction with the central office switch to meet the standards of service provided by the telephone operating company. To determine the equipment needed to meet a desired level of service, the projected level of telephone traffic must be estimated. The Erlang "B" formula is used to calculate the number of DS0s required when "full availability" service is provided.

For TR-303 VRTs, TR-NWT-000303 requires that documentation be provided for meeting a grade of service of P.005 to all customers in any class of service.\* Therefore, the Erlang "B" formulas provided in this section for the *SLC-2000* TR-303 VRT will be based on the P.005 grade of service. If other grades of service are desired, contact your Regional Technical Assistance Center (RTAC).

### **TR-303 Traffic Model**

Data to consider when engineering the TR-303 VRT in R4.0 and later include the following:

- The CCS/line for locally switched (POTS) service and total number of POTS lines
- The CCS/line for ISDN service and total number of ISDN DSLs (lines)
- The number of DS1 feeders dedicated to INA digroups
- The number of DS1 feeders dedicated to TR-08 VRTs in a mixed system configuration
- The number of DS0s dedicated to special service circuits.

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\* R-474 of TR-NWT-000303 states that "A uniform grade of service shall be provided to all customers in any class of service. This requires that a concentrated RDT shall have no more than four 1-hour occurrences in a 12-month period when the probability that a call will not be immediately served due to a lack of facilities exceeds 0.5% [P(B)-0.005]."



### **Calculating DS1 Feeders for the TR-303 VRT**

1. Determine the total projected originating plus terminating (O+T) CCS for POTS lines on the TR-303 VRT.
2. Determine the total projected CCS for ISDN lines (O+T) and multiply by 2.
3. Add the total CCS for POTS and total CCS for ISDN to determine the total CCS of the TR-303 VRT.
4. From Table 8-2, determine the number of DS0s (per grade of service = 0.005).
5. To this number, add four DS0s for the primary and secondary embedded operations channel (EOC) and time slot management channel (TMC).
6. Calculate the number of DS0s needed for ISDN D-channels by dividing the number of DSLs by four and rounding up. Add this to the total number of DS0s.
7. Add three DS0s for each nailed-up ISDN basic rate interface transmission extension (BRITE) circuit.
8. Add one or two DS0s for each nailed-up or hairpinned special service circuit. [Two DS0s are required when using the Digital Data System (DDS).]
9. Divide the total number of DS0s required for the TR-303 VRT by 24. If the result is not an integer, round the result up to the next even number to determine the total number of DS1 feeders required for the TR-303 VRT. This total must be at least two DS1s but not more than 28 DS1s.

### **Mixed System Traffic Engineering**

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When engineering a *SLC-2000* Access System for a mixed configuration (some combination of INA, TR-303, and/or TR-08), the procedure is as follows:

1. Determine the number of feeders required for the TR-303 VRT.
2. Determine the number of feeders required for each TR-08 VRT (Mode 2 requires two feeders, Mode 1 requires four feeders).
3. Determine the number of INA feeders used by the system.
4. Add the total number of feeders required for the TR-303 VRT and other services. This total for the RT must be at least two DS1s but not more than 28 DS1s.

**Table 8-2. DS0 Loading Capacity (Erlang B Assumption)**

| Grade of Service |         |         | Grade of Service |                 |               | Grade of Service |                 |               |
|------------------|---------|---------|------------------|-----------------|---------------|------------------|-----------------|---------------|
| 0.005            |         |         | 0.005            |                 |               | 0.005            |                 |               |
| DS0s             | CCS     | Erlangs | DS0s             | CCS             | Erlangs       | DS0s             | CCS             | Erlangs       |
| 1                | 0.181   | 0.005   | 25               | 539.884         | 14.997        | 49               | 1264.066        | 35.113        |
| 2                | 3.794   | 0.105   | 26               | 568.618         | 15.795        | 50               | 1295.343        | 35.982        |
| 3                | 12.564  | 0.349   | 27               | 597.529         | 16.598        | 51               | 1326.682        | 36.852        |
| 4                | 25.243  | 0.701   | 28               | 626.605         | 17.406        | 52               | 1358.082        | 37.724        |
| 5                | 40.753  | 1.132   | 29               | 655.839         | 18.218        | 53               | 1389.540        | 38.598        |
| 6                | 58.386  | 1.622   | 30               | 685.220         | 19.034        | 54               | 1421.054        | 39.474        |
| 7                | 77.669  | 2.157   | 31               | 714.742         | 19.854        | 55               | 1452.623        | 40.351        |
| 8                | 98.276  | 2.730   | 32               | 744.398         | 20.678        | 56               | 1484.245        | 41.229        |
| 9                | 119.973 | 3.333   | 33               | 774.180         | 21.505        | 57               | 1515.920        | 42.109        |
| 10               | 142.584 | 3.961   | 34               | 804.082         | 22.336        | 58               | 1547.644        | 42.990        |
| 11               | 165.975 | 4.610   | 35               | 834.100         | 23.169        | 59               | 1579.418        | 43.873        |
| 12               | 190.040 | 5.279   | 36               | 864.228         | 24.006        | 60               | 1611.239        | 44.757        |
| 13               | 214.697 | 5.964   | 37               | 894.460         | 24.846        | 61               | 1643.106        | 45.642        |
| 14               | 239.875 | 6.663   | 38               | 924.794         | 25.689        | 62               | 1675.019        | 46.528        |
| 15               | 265.520 | 7.376   | 39               | 955.223         | 26.534        | 63               | 1706.975        | 47.416        |
| 16               | 291.582 | 8.100   | 40               | 985.745         | 27.382        | 64               | 1738.975        | 48.305        |
| 17               | 318.023 | 8.834   | 41               | 1016.356        | 28.232        | 65               | 1771.016        | 49.195        |
| 18               | 344.809 | 9.578   | 42               | 1047.052        | 29.085        | 66               | 1803.098        | 50.086        |
| 19               | 371.909 | 10.331  | 43               | 1077.831        | 29.940        | 67               | 1835.220        | 50.978        |
| 20               | 399.298 | 11.092  | 44               | <b>1108.688</b> | <b>30.797</b> | 68               | <b>1867.380</b> | <b>51.872</b> |
| 21               | 426.954 | 11.860  | 45               | 1139.621        | 31.656        | 69               | 1899.579        | 52.766        |
| 22               | 454.857 | 12.635  | 46               | 1170.629        | 32.517        | 70               | 1931.814        | 53.662        |
| 23               | 482.990 | 13.416  | 47               | 1201.707        | 33.381        | 71               | 1964.086        | 54.558        |
| 24               | 511.337 | 14.204  | 48               | 1232.853        | 34.246        | 72               | 1996.393        | 55.455        |

*Continued on next page*

**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                 |               | Grade of Service |                 |               | Grade of Service |                 |                |
|------------------|-----------------|---------------|------------------|-----------------|---------------|------------------|-----------------|----------------|
| 0.005            |                 |               | 0.005            |                 |               | 0.005            |                 |                |
| DS0s             | CCS             | Erlangs       | DS0s             | CCS             | Erlangs       | DS0s             | CCS             | Erlangs        |
| 73               | 2028.734        | 56.354        | 97               | 2813.655        | 78.157        | 121              | 3611.162        | 100.310        |
| 74               | 2061.110        | 57.253        | 98               | 2846.668        | 79.074        | 122              | 3644.600        | 101.239        |
| 75               | 2093.518        | 58.153        | 99               | 2879.702        | 79.992        | 123              | 3678.053        | 102.168        |
| 76               | 2125.959        | 59.054        | 100              | 2912.757        | 80.910        | 124              | 3711.521        | 103.098        |
| 77               | 2158.431        | 59.956        | 101              | 2945.832        | 81.829        | 125              | 3745.003        | 104.028        |
| 78               | 2190.935        | 60.859        | 102              | 2978.927        | 82.748        | 126              | 3778.499        | 104.958        |
| 79               | 2223.469        | 61.763        | 103              | 3012.042        | 83.668        | 127              | 3812.010        | 105.889        |
| 80               | 2256.032        | 62.668        | 104              | 3045.176        | 84.588        | 128              | 3845.534        | 106.820        |
| 81               | 2288.625        | 63.573        | 105              | 3078.330        | 85.509        | 129              | 3879.071        | 107.752        |
| 82               | 2321.247        | 64.479        | 106              | 3111.502        | 86.431        | 130              | 3912.623        | 108.684        |
| 83               | 2353.896        | 65.386        | 107              | 3144.693        | 87.353        | 131              | 3946.187        | 109.616        |
| 84               | 2386.573        | 66.294        | 108              | 3177.902        | 88.275        | 132              | 3979.765        | 110.549        |
| 85               | 2419.277        | 67.202        | 109              | 3211.128        | 89.198        | 133              | 4013.355        | 111.482        |
| 86               | 2452.007        | 68.111        | 110              | 3244.373        | 90.121        | 134              | 4046.959        | 112.416        |
| 87               | 2484.763        | 69.021        | 111              | 3277.635        | 91.045        | 135              | 4080.575        | 113.349        |
| 88               | 2517.545        | 69.932        | 112              | 3310.914        | 91.970        | 136              | 4114.204        | 114.283        |
| 89               | 2550.352        | 70.843        | 113              | 3344.210        | 92.895        | 137              | 4147.845        | 115.218        |
| 90               | 2583.183        | 71.755        | 114              | 3377.523        | 93.820        | 138              | 4181.498        | 116.153        |
| 91               | 2616.039        | 72.668        | 115              | 3410.853        | 94.746        | 139              | 4215.164        | 117.088        |
| 92               | <b>2648.918</b> | <b>73.581</b> | 116              | <b>3444.198</b> | <b>95.672</b> | 140              | <b>4248.841</b> | <b>118.023</b> |
| 93               | 2681.820        | 74.495        | 117              | 3477.560        | 96.599        | 141              | 4282.530        | 118.959        |
| 94               | 2714.746        | 75.410        | 118              | 3510.937        | 97.526        | 142              | 4316.231        | 119.895        |
| 95               | 2747.694        | 76.325        | 119              | 3544.330        | 98.454        | 143              | 4349.943        | 120.832        |
| 96               | 2780.664        | 77.241        | 120              | 3577.738        | 99.382        | 144              | 4383.667        | 121.769        |

*Continued on next page*

**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                 |                | Grade of Service |                 |                | Grade of Service |                 |                |
|------------------|-----------------|----------------|------------------|-----------------|----------------|------------------|-----------------|----------------|
| 0.005            |                 |                | 0.005            |                 |                | 0.005            |                 |                |
| DS0s             | CCS             | Erlangs        | DS0s             | CCS             | Erlangs        | DS0s             | CCS             | Erlangs        |
| <b>145</b>       | 4417.402        | 122.706        | <b>169</b>       | 5230.129        | 145.281        | <b>193</b>       | 6047.902        | 167.997        |
| <b>146</b>       | 4451.148        | 123.643        | <b>170</b>       | 5264.110        | 146.225        | <b>194</b>       | 6082.070        | 168.946        |
| <b>147</b>       | 4484.905        | 124.581        | <b>171</b>       | 5298.100        | 147.169        | <b>195</b>       | 6116.244        | 169.896        |
| <b>148</b>       | 4518.673        | 125.519        | <b>172</b>       | 5332.098        | 148.114        | <b>196</b>       | 6150.426        | 170.845        |
| <b>149</b>       | 4552.452        | 126.457        | <b>173</b>       | 5366.105        | 149.058        | <b>197</b>       | 6184.614        | 171.795        |
| <b>150</b>       | 4586.242        | 127.396        | <b>174</b>       | 5400.120        | 150.003        | <b>198</b>       | 6218.809        | 172.745        |
| <b>151</b>       | 4620.042        | 128.334        | <b>175</b>       | 5434.144        | 150.948        | <b>199</b>       | 6253.011        | 173.695        |
| <b>152</b>       | 4653.852        | 129.274        | <b>176</b>       | 5468.175        | 151.894        | <b>200</b>       | 6287.220        | 174.645        |
| <b>153</b>       | 4687.673        | 130.213        | <b>177</b>       | 5502.215        | 152.839        | <b>201</b>       | 6321.435        | 175.595        |
| <b>154</b>       | 4721.504        | 131.153        | <b>178</b>       | 5536.263        | 153.785        | <b>202</b>       | 6355.657        | 176.546        |
| <b>155</b>       | 4755.346        | 132.093        | <b>179</b>       | 5570.319        | 154.731        | <b>203</b>       | 6389.885        | 177.497        |
| <b>156</b>       | 4789.197        | 133.033        | <b>180</b>       | 5604.383        | 155.677        | <b>204</b>       | 6424.120        | 178.448        |
| <b>157</b>       | 4823.058        | 133.974        | <b>181</b>       | 5638.454        | 156.624        | <b>205</b>       | 6458.361        | 179.399        |
| <b>158</b>       | 4856.929        | 134.915        | <b>182</b>       | 5672.534        | 157.570        | <b>206</b>       | 6492.608        | 180.350        |
| <b>159</b>       | 4890.810        | 135.856        | <b>183</b>       | 5706.621        | 158.517        | <b>207</b>       | 6526.862        | 181.302        |
| <b>160</b>       | 4924.700        | 136.797        | <b>184</b>       | 5740.716        | 159.464        | <b>208</b>       | 6561.122        | 182.253        |
| <b>161</b>       | 4958.600        | 137.739        | <b>185</b>       | 5774.818        | 160.412        | <b>209</b>       | 6595.388        | 183.205        |
| <b>162</b>       | 4992.509        | 138.681        | <b>186</b>       | 5808.928        | 161.359        | <b>210</b>       | 6629.660        | 184.157        |
| <b>163</b>       | 5026.427        | 139.623        | <b>187</b>       | 5843.045        | 162.307        | <b>211</b>       | 6663.939        | 185.109        |
| <b>164</b>       | <b>5060.355</b> | <b>140.565</b> | <b>188</b>       | <b>5877.170</b> | <b>163.255</b> | <b>212</b>       | <b>6698.223</b> | <b>186.062</b> |
| <b>165</b>       | 5094.292        | 141.508        | <b>189</b>       | 5911.302        | 164.203        | <b>213</b>       | 6732.514        | 187.014        |
| <b>166</b>       | 5128.238        | 142.451        | <b>190</b>       | 5945.441        | 165.151        | <b>215</b>       | 6801.113        | 188.920        |
| <b>167</b>       | 5162.193        | 143.394        | <b>191</b>       | 5979.588        | 166.100        | <b>215</b>       | 6801.113        | 188.920        |
| <b>168</b>       | 5196.156        | 144.338        | <b>192</b>       | 6013.741        | 167.048        | <b>216</b>       | 6835.421        | 189.873        |

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**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                 |                | Grade of Service |                 |                | Grade of Service |                 |                |
|------------------|-----------------|----------------|------------------|-----------------|----------------|------------------|-----------------|----------------|
| 0.005            |                 |                | 0.005            |                 |                | 0.005            |                 |                |
| DS0s             | CCS             | Erlangs        | DS0s             | CCS             | Erlangs        | DS0s             | CCS             | Erlangs        |
| 217              | 6869.736        | 190.826        | 241              | 7694.920        | 213.748        | 265              | 8522.927        | 236.748        |
| 218              | 6904.055        | 191.779        | 242              | 7729.367        | 214.705        | 266              | 8557.482        | 237.708        |
| 219              | 6938.381        | 192.733        | 243              | 7763.819        | 215.662        | 267              | 8592.042        | 238.668        |
| 220              | 6972.713        | 193.686        | 244              | 7798.276        | 216.619        | 268              | 8626.605        | 239.628        |
| 221              | 7007.050        | 194.640        | 245              | 7832.738        | 217.576        | 269              | 8661.173        | 240.588        |
| 222              | 7041.392        | 195.594        | 246              | 7867.204        | 218.533        | 270              | 8695.744        | 241.548        |
| 223              | 7075.741        | 196.548        | 247              | 7901.675        | 219.491        | 271              | 8730.320        | 242.509        |
| 224              | 7110.095        | 197.503        | 248              | 7936.151        | 220.449        | 272              | 8764.900        | 243.469        |
| 225              | 7144.454        | 198.457        | 249              | 7970.631        | 221.406        | 273              | 8799.484        | 244.430        |
| 226              | 7178.819        | 199.412        | 250              | 8005.116        | 222.364        | 274              | 8834.071        | 245.391        |
| 227              | 7213.189        | 200.366        | 251              | 8039.606        | 223.322        | 275              | 8868.663        | 246.352        |
| 228              | 7247.564        | 201.321        | 252              | 8074.100        | 224.281        | 276              | 8903.259        | 247.313        |
| 229              | 7281.945        | 202.276        | 253              | 8108.599        | 225.239        | 277              | 8937.858        | 248.274        |
| 230              | 7316.332        | 203.231        | 254              | 8143.102        | 226.197        | 278              | 8972.462        | 249.235        |
| 231              | 7350.723        | 204.187        | 255              | 8177.610        | 227.156        | 279              | 9007.069        | 250.196        |
| 232              | 7385.120        | 205.142        | 256              | 8212.122        | 228.114        | 280              | 9041.680        | 251.158        |
| 233              | 7419.522        | 206.098        | 257              | 8246.638        | 229.073        | 281              | 9076.295        | 252.119        |
| 234              | 7453.929        | 207.054        | 258              | 8281.159        | 230.032        | 282              | 9110.914        | 253.081        |
| 235              | 7488.341        | 208.009        | 259              | 8315.685        | 230.991        | 283              | 9145.537        | 254.043        |
| 236              | <b>7522.758</b> | <b>208.966</b> | 260              | <b>8350.214</b> | <b>231.950</b> | 284              | <b>9180.163</b> | <b>255.005</b> |
| 237              | 7557.181        | 209.922        | 261              | 8384.748        | 232.910        | 285              | 9214.793        | 255.966        |
| 238              | 7591.608        | 210.878        | 262              | 8419.287        | 233.869        | 286              | 9249.427        | 256.929        |
| 239              | 7626.041        | 211.834        | 263              | 8453.829        | 234.829        | 287              | 9284.064        | 257.891        |
| 240              | 7660.478        | 212.791        | 264              | 8488.376        | 235.788        | 288              | 9318.705        | 258.853        |

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**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                  |                | Grade of Service |                  |                | Grade of Service |                  |                |
|------------------|------------------|----------------|------------------|------------------|----------------|------------------|------------------|----------------|
| 0.005            |                  |                | 0.005            |                  |                | 0.005            |                  |                |
| DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        |
| <b>289</b>       | 9353.350         | 259.815        | <b>313</b>       | 10185.870        | 282.941        | <b>337</b>       | 11020.228        | 306.117        |
| <b>290</b>       | 9387.999         | 260.778        | <b>314</b>       | 10220.599        | 283.906        | <b>338</b>       | 11055.030        | 307.084        |
| <b>291</b>       | 9422.651         | 261.740        | <b>315</b>       | 10255.332        | 284.870        | <b>339</b>       | 11089.834        | 308.051        |
| <b>292</b>       | 9457.306         | 262.703        | <b>316</b>       | 10290.069        | 285.835        | <b>340</b>       | 11124.641        | 309.018        |
| <b>293</b>       | 9491.966         | 263.666        | <b>317</b>       | 10324.808        | 286.800        | <b>341</b>       | 11159.451        | 309.985        |
| <b>294</b>       | 9526.628         | 264.629        | <b>318</b>       | 10359.550        | 287.765        | <b>342</b>       | 11194.264        | 310.952        |
| <b>295</b>       | 9561.295         | 265.592        | <b>319</b>       | 10394.296        | 288.730        | <b>343</b>       | 11229.080        | 311.919        |
| <b>296</b>       | 9595.964         | 266.555        | <b>320</b>       | 10429.044        | 289.696        | <b>344</b>       | 11263.898        | 312.886        |
| <b>297</b>       | 9630.638         | 267.518        | <b>321</b>       | 10463.796        | 290.661        | <b>345</b>       | 11298.719        | 313.853        |
| <b>298</b>       | 9665.314         | 268.481        | <b>322</b>       | 10498.551        | 291.626        | <b>346</b>       | 11333.543        | 314.821        |
| <b>299</b>       | 9699.995         | 269.444        | <b>323</b>       | 10533.308        | 292.592        | <b>347</b>       | 11368.369        | 315.788        |
| <b>300</b>       | 9734.678         | 270.408        | <b>324</b>       | 10568.069        | 293.557        | <b>348</b>       | 11403.198        | 316.756        |
| <b>301</b>       | 9769.365         | 271.371        | <b>325</b>       | 10602.833        | 294.523        | <b>349</b>       | 11438.030        | 317.723        |
| <b>302</b>       | 9804.056         | 272.335        | <b>326</b>       | 10637.600        | 295.489        | <b>350</b>       | 11472.865        | 318.691        |
| <b>303</b>       | 9838.749         | 273.299        | <b>327</b>       | 10672.370        | 296.455        | <b>351</b>       | 11507.702        | 319.658        |
| <b>304</b>       | 9873.447         | 274.262        | <b>328</b>       | 10707.142        | 297.421        | <b>352</b>       | 11542.541        | 320.626        |
| <b>305</b>       | 9908.147         | 275.226        | <b>329</b>       | 10741.918        | 298.387        | <b>353</b>       | 11577.384        | 321.594        |
| <b>306</b>       | 9942.851         | 276.190        | <b>330</b>       | 10776.697        | 299.353        | <b>354</b>       | 11612.229        | 322.562        |
| <b>307</b>       | 9977.558         | 277.154        | <b>331</b>       | 10811.478        | 300.319        | <b>355</b>       | 11647.076        | 323.530        |
| <b>308</b>       | <b>10012.269</b> | <b>278.119</b> | <b>332</b>       | <b>10846.263</b> | <b>301.285</b> | <b>356</b>       | <b>11681.927</b> | <b>324.498</b> |
| <b>309</b>       | 10046.982        | 279.083        | <b>333</b>       | 10881.050        | 302.251        | <b>357</b>       | 11716.779        | 325.466        |
| <b>310</b>       | 10081.699        | 280.047        | <b>334</b>       | 10915.840        | 303.218        | <b>358</b>       | 11751.635        | 326.434        |
| <b>311</b>       | 10116.420        | 281.012        | <b>335</b>       | 10950.633        | 304.184        | <b>359</b>       | 11786.493        | 327.403        |
| <b>312</b>       | 10151.143        | 281.976        | <b>336</b>       | 10985.429        | 305.151        | <b>360</b>       | 11821.353        | 328.371        |

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**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                  |                | Grade of Service |                  |                | Grade of Service |                  |                |
|------------------|------------------|----------------|------------------|------------------|----------------|------------------|------------------|----------------|
| 0.005            |                  |                | 0.005            |                  |                | 0.005            |                  |                |
| DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        |
| <b>361</b>       | 11856.216        | 329.339        | <b>385</b>       | 12693.660        | 352.602        | <b>409</b>       | 13532.413        | 375.900        |
| <b>362</b>       | 11891.082        | 330.308        | <b>386</b>       | 12728.583        | 353.572        | <b>410</b>       | 13567.387        | 376.872        |
| <b>363</b>       | 11925.950        | 331.276        | <b>387</b>       | 12763.508        | 354.542        | <b>411</b>       | 13602.364        | 377.843        |
| <b>364</b>       | 11960.820        | 332.245        | <b>388</b>       | 12798.435        | 355.512        | <b>412</b>       | 13637.343        | 378.815        |
| <b>364</b>       | 11960.820        | 332.245        | <b>389</b>       | 12833.365        | 356.482        | <b>413</b>       | 13672.323        | 379.787        |
| <b>366</b>       | 12030.569        | 334.182        | <b>390</b>       | 12868.296        | 357.453        | <b>414</b>       | 13707.306        | 380.758        |
| <b>367</b>       | 12065.447        | 335.151        | <b>391</b>       | 12903.230        | 358.423        | <b>415</b>       | 13742.291        | 381.730        |
| <b>368</b>       | 12100.327        | 336.120        | <b>392</b>       | 12938.167        | 359.394        | <b>416</b>       | 13777.277        | 382.702        |
| <b>369</b>       | 12135.210        | 337.089        | <b>393</b>       | 12973.105        | 360.364        | <b>417</b>       | 13812.266        | 383.674        |
| <b>370</b>       | 12170.095        | 338.058        | <b>394</b>       | 13008.046        | 361.335        | <b>418</b>       | 13847.257        | 384.646        |
| <b>371</b>       | 12204.983        | 339.027        | <b>395</b>       | 13042.989        | 362.305        | <b>419</b>       | 13882.249        | 385.618        |
| <b>372</b>       | 12239.873        | 339.996        | <b>396</b>       | 13077.934        | 363.276        | <b>420</b>       | 13917.244        | 386.590        |
| <b>373</b>       | 12274.766        | 340.966        | <b>397</b>       | 13112.881        | 364.247        | <b>421</b>       | 13952.241        | 387.562        |
| <b>374</b>       | 12309.661        | 341.935        | <b>398</b>       | 13147.830        | 365.218        | <b>422</b>       | 13987.239        | 388.534        |
| <b>375</b>       | 12344.558        | 342.904        | <b>399</b>       | 13182.782        | 366.188        | <b>423</b>       | 14022.240        | 389.507        |
| <b>376</b>       | 12379.458        | 343.874        | <b>400</b>       | 13217.735        | 367.159        | <b>424</b>       | 14057.242        | 390.479        |
| <b>377</b>       | 12414.360        | 344.843        | <b>401</b>       | 13252.691        | 368.130        | <b>425</b>       | 14092.247        | 391.451        |
| <b>378</b>       | 12449.264        | 345.813        | <b>402</b>       | 13287.649        | 369.101        | <b>426</b>       | 14127.253        | 392.424        |
| <b>379</b>       | 12484.171        | 346.783        | <b>403</b>       | 13322.609        | 370.072        | <b>427</b>       | 14162.262        | 393.396        |
| <b>380</b>       | <b>12519.080</b> | <b>347.752</b> | <b>404</b>       | <b>13357.571</b> | <b>371.044</b> | <b>428</b>       | <b>14197.272</b> | <b>394.369</b> |
| <b>381</b>       | 12553.991        | 348.722        | <b>405</b>       | 13392.535        | 372.015        | <b>429</b>       | 14232.284        | 395.341        |
| <b>382</b>       | 12588.905        | 349.692        | <b>406</b>       | 13427.501        | 372.986        | <b>430</b>       | 14267.298        | 396.314        |
| <b>383</b>       | 12623.821        | 350.662        | <b>407</b>       | 13462.470        | 373.957        | <b>431</b>       | 14302.314        | 397.286        |
| <b>384</b>       | 12658.739        | 351.632        | <b>408</b>       | 13497.440        | 374.929        | <b>432</b>       | 14337.332        | 398.259        |

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**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                  |                | Grade of Service |                  |                | Grade of Service |                  |                |
|------------------|------------------|----------------|------------------|------------------|----------------|------------------|------------------|----------------|
| 0.005            |                  |                | 0.005            |                  |                | 0.005            |                  |                |
| DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        |
| <b>433</b>       | 14372.351        | 399.232        | <b>457</b>       | 15213.370        | 422.594        | <b>481</b>       | 16055.376        | 445.983        |
| <b>434</b>       | 14407.373        | 400.205        | <b>458</b>       | 15248.434        | 423.568        | <b>482</b>       | 16090.480        | 446.958        |
| <b>435</b>       | 14442.396        | 401.178        | <b>459</b>       | 15283.500        | 424.542        | <b>483</b>       | 16125.585        | 447.933        |
| <b>436</b>       | 14477.422        | 402.151        | <b>460</b>       | 15318.568        | 425.516        | <b>484</b>       | 16160.692        | 448.908        |
| <b>437</b>       | 14512.449        | 403.124        | <b>461</b>       | 15353.638        | 426.490        | <b>485</b>       | 16195.800        | 449.883        |
| <b>438</b>       | 14547.478        | 404.097        | <b>462</b>       | 15388.709        | 427.464        | <b>486</b>       | 16230.910        | 450.859        |
| <b>439</b>       | 14582.509        | 405.070        | <b>463</b>       | 15423.782        | 428.438        | <b>487</b>       | 16266.022        | 451.834        |
| <b>440</b>       | 14617.541        | 406.043        | <b>464</b>       | 15458.856        | 429.413        | <b>488</b>       | 16301.135        | 452.809        |
| <b>441</b>       | 14652.576        | 407.016        | <b>465</b>       | 15493.933        | 430.387        | <b>489</b>       | 16336.250        | 453.785        |
| <b>442</b>       | 14687.612        | 407.989        | <b>466</b>       | 15529.011        | 431.361        | <b>490</b>       | 16371.366        | 454.760        |
| <b>443</b>       | 14722.650        | 408.962        | <b>467</b>       | 15564.090        | 432.336        | <b>491</b>       | 16406.484        | 455.736        |
| <b>444</b>       | 14757.690        | 409.936        | <b>468</b>       | 15599.172        | 433.310        | <b>492</b>       | 16441.603        | 456.711        |
| <b>445</b>       | 14792.732        | 410.909        | <b>469</b>       | 15634.254        | 434.285        | <b>493</b>       | 16476.724        | 457.687        |
| <b>446</b>       | 14827.775        | 411.883        | <b>470</b>       | 15669.339        | 435.259        | <b>494</b>       | 16511.846        | 458.662        |
| <b>447</b>       | 14862.820        | 412.856        | <b>471</b>       | 15704.425        | 436.234        | <b>495</b>       | 16546.970        | 459.638        |
| <b>448</b>       | 14897.867        | 413.830        | <b>472</b>       | 15739.513        | 437.209        | <b>496</b>       | 16582.095        | 460.614        |
| <b>449</b>       | 14932.916        | 414.803        | <b>473</b>       | 15774.602        | 438.183        | <b>497</b>       | 16617.222        | 461.590        |
| <b>450</b>       | 14967.967        | 415.777        | <b>474</b>       | 15809.693        | 439.158        | <b>498</b>       | 16652.350        | 462.565        |
| <b>451</b>       | 15003.019        | 416.751        | <b>475</b>       | 15844.786        | 440.133        | <b>499</b>       | 16687.480        | 463.541        |
| <b>452</b>       | <b>15038.073</b> | <b>417.724</b> | <b>476</b>       | <b>15879.880</b> | <b>441.108</b> | <b>500</b>       | <b>16722.612</b> | <b>464.517</b> |
| <b>453</b>       | 15073.129        | 418.698        | <b>477</b>       | 15914.976        | 442.083        | <b>501</b>       | 16757.744        | 465.493        |
| <b>454</b>       | 15108.187        | 419.672        | <b>478</b>       | 15950.074        | 443.058        | <b>502</b>       | 16792.879        | 466.469        |
| <b>455</b>       | 15143.246        | 420.646        | <b>479</b>       | 15985.173        | 444.033        | <b>503</b>       | 16828.014        | 467.445        |
| <b>456</b>       | 15178.307        | 421.620        | <b>480</b>       | 16020.274        | 445.008        | <b>504</b>       | 16863.151        | 468.421        |

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**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| Grade of Service |                  |                | Grade of Service |                  |                | Grade of Service |                  |                |
|------------------|------------------|----------------|------------------|------------------|----------------|------------------|------------------|----------------|
| 0.005            |                  |                | 0.005            |                  |                | 0.005            |                  |                |
| DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        | DS0s             | CCS              | Erlangs        |
| 505              | 16898.290        | 469.397        | 529              | 17742.042        | 492.835        | 553              | 18586.571        | 516.294        |
| 506              | 16933.430        | 470.373        | 530              | 17777.216        | 493.812        | 554              | 18621.776        | 517.272        |
| 507              | 16968.572        | 471.349        | 531              | 17812.391        | 494.789        | 555              | 18656.982        | 518.249        |
| 508              | 17003.715        | 472.325        | 532              | 17847.567        | 495.766        | 556              | 18692.189        | 519.227        |
| 509              | 17038.859        | 473.302        | 533              | 17882.745        | 496.743        | 557              | 18727.397        | 520.205        |
| 510              | 17074.005        | 474.278        | 534              | 17917.924        | 497.720        | 558              | 18762.607        | 521.184        |
| 511              | 17109.152        | 475.254        | 535              | 17953.104        | 498.697        | 559              | 18797.818        | 522.162        |
| 512              | 17144.301        | 476.231        | 536              | 17988.285        | 499.675        | 560              | 18833.030        | 523.140        |
| 513              | 17179.451        | 477.207        | 537              | 18023.468        | 500.652        | 561              | 18868.243        | 524.118        |
| 514              | 17214.602        | 478.183        | 538              | 18058.653        | 501.629        | 562              | 18903.458        | 525.096        |
| 515              | 17249.755        | 479.160        | 539              | 18093.838        | 502.607        | 563              | 18938.674        | 526.074        |
| 516              | 17284.910        | 480.136        | 540              | 18129.025        | 503.584        | 564              | 18973.891        | 527.053        |
| 517              | 17320.065        | 481.113        | 541              | 18164.213        | 504.561        | 565              | 19009.109        | 528.031        |
| 518              | 17355.223        | 482.090        | 542              | 18199.403        | 505.539        | 566              | 19044.328        | 529.009        |
| 519              | 17390.381        | 483.066        | 543              | 18234.593        | 506.516        | 567              | 19079.549        | 529.987        |
| 520              | 17425.541        | 484.043        | 544              | 18269.785        | 507.494        | 568              | 19114.771        | 530.966        |
| 521              | 17460.702        | 485.020        | 545              | 18304.979        | 508.472        | 569              | 19149.994        | 531.944        |
| 522              | 17495.865        | 485.996        | 546              | 18340.173        | 509.449        | 570              | 19185.218        | 532.923        |
| 523              | 17531.029        | 486.973        | 547              | 18375.369        | 510.427        | 571              | 19220.444        | 533.901        |
| 524              | <b>17566.195</b> | <b>487.950</b> | 548              | <b>18410.566</b> | <b>511.405</b> | 572              | <b>19255.670</b> | <b>534.880</b> |
| 525              | 17601.361        | 488.927        | 549              | 18445.765        | 512.382        | 573              | 19290.898        | 535.858        |
| 526              | 17636.530        | 489.904        | 550              | 18480.964        | 513.360        | 574              | 19326.127        | 536.837        |
| 527              | 17671.699        | 490.881        | 551              | 18516.165        | 514.338        | 575              | 19361.357        | 537.815        |
| 528              | 17706.870        | 491.858        | 552              | 18551.367        | 515.316        | 576              | 19396.589        | 538.794        |

*Continued on next page*

**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| <u>Grade of Service</u> |                  |                | <u>Grade of Service</u> |                  |                | <u>Grade of Service</u> |                  |                |
|-------------------------|------------------|----------------|-------------------------|------------------|----------------|-------------------------|------------------|----------------|
| <u>0.005</u>            |                  |                | <u>0.005</u>            |                  |                | <u>0.005</u>            |                  |                |
| <u>DS0s</u>             | <u>CCS</u>       | <u>Erlangs</u> | <u>DS0s</u>             | <u>CCS</u>       | <u>Erlangs</u> | <u>DS0s</u>             | <u>CCS</u>       | <u>Erlangs</u> |
| <b>577</b>              | 19431.821        | 539.773        | <b>601</b>              | 20277.744        | 563.271        | <b>625</b>              | 21124.296        | 586.786        |
| <b>578</b>              | 19467.055        | 540.752        | <b>602</b>              | 20313.005        | 564.250        | <b>626</b>              | 21159.582        | 587.766        |
| <b>579</b>              | 19502.290        | 541.730        | <b>603</b>              | 20348.267        | 565.230        | <b>627</b>              | 21194.869        | 588.746        |
| <b>580</b>              | 19537.526        | 542.709        | <b>604</b>              | 20383.530        | 566.209        | <b>628</b>              | 21230.157        | 589.727        |
| <b>581</b>              | 19572.763        | 543.688        | <b>605</b>              | 20418.794        | 567.189        | <b>629</b>              | 21265.446        | 590.707        |
| <b>582</b>              | 19608.001        | 544.667        | <b>606</b>              | 20454.059        | 568.168        | <b>630</b>              | 21300.736        | 591.687        |
| <b>583</b>              | 19643.241        | 545.646        | <b>607</b>              | 20489.325        | 569.148        | <b>631</b>              | 21336.028        | 592.667        |
| <b>584</b>              | 19678.481        | 546.624        | <b>608</b>              | 20524.592        | 570.128        | <b>632</b>              | 21371.320        | 593.648        |
| <b>585</b>              | 19713.723        | 547.603        | <b>609</b>              | 20559.860        | 571.107        | <b>633</b>              | 21406.613        | 594.628        |
| <b>586</b>              | 19748.966        | 548.582        | <b>610</b>              | 20595.130        | 572.087        | <b>634</b>              | 21441.907        | 595.609        |
| <b>587</b>              | 19784.210        | 549.561        | <b>611</b>              | 20630.400        | 573.067        | <b>635</b>              | 21477.202        | 596.589        |
| <b>588</b>              | 19819.455        | 550.540        | <b>612</b>              | 20665.671        | 574.046        | <b>636</b>              | 21512.498        | 597.569        |
| <b>589</b>              | 19854.701        | 551.519        | <b>613</b>              | 20700.944        | 575.026        | <b>637</b>              | 21547.795        | 598.550        |
| <b>590</b>              | 19889.949        | 552.499        | <b>614</b>              | 20736.218        | 576.006        | <b>638</b>              | 21583.093        | 599.530        |
| <b>591</b>              | 19925.197        | 553.478        | <b>615</b>              | 20771.492        | 576.986        | <b>639</b>              | 21618.393        | 600.511        |
| <b>592</b>              | 19960.447        | 554.457        | <b>616</b>              | 20806.768        | 577.966        | <b>640</b>              | 21653.693        | 601.491        |
| <b>593</b>              | 19995.698        | 555.436        | <b>617</b>              | 20842.045        | 578.946        | <b>641</b>              | 21688.994        | 602.472        |
| <b>594</b>              | 20030.950        | 556.415        | <b>618</b>              | 20877.322        | 579.926        | <b>642</b>              | 21724.296        | 603.453        |
| <b>595</b>              | 20066.203        | 557.395        | <b>619</b>              | 20912.601        | 580.906        | <b>643</b>              | 21759.599        | 604.433        |
| <b>596</b>              | <b>20101.457</b> | <b>558.374</b> | <b>620</b>              | <b>20947.881</b> | <b>581.886</b> | <b>644</b>              | <b>21794.903</b> | <b>605.414</b> |
| <b>597</b>              | 20136.712        | 559.353        | <b>621</b>              | 20983.162        | 582.866        | <b>645</b>              | 21830.208        | 606.395        |
| <b>598</b>              | 20171.968        | 560.332        | <b>622</b>              | 21018.444        | 583.846        | <b>646</b>              | 21865.514        | 607.375        |
| <b>599</b>              | 20207.226        | 561.312        | <b>623</b>              | 21053.727        | 584.826        | <b>647</b>              | 21900.821        | 608.356        |
| <b>600</b>              | 20242.484        | 562.291        | <b>624</b>              | 21089.011        | 585.806        | <b>648</b>              | 21936.129        | 609.337        |

*Continued on next page*

**Table 8-2. DS0 Loading Capacity (Erlang B Assumption) (Continued)**

| <u>Grade of Service</u> |            |                | <u>Grade of Service</u> |            |                | <u>Grade of Service</u> |                  |                |
|-------------------------|------------|----------------|-------------------------|------------|----------------|-------------------------|------------------|----------------|
| <u>0.005</u>            |            |                | <u>0.005</u>            |            |                | <u>0.005</u>            |                  |                |
| <u>DS0s</u>             | <u>CCS</u> | <u>Erlangs</u> | <u>DS0s</u>             | <u>CCS</u> | <u>Erlangs</u> | <u>DS0s</u>             | <u>CCS</u>       | <u>Erlangs</u> |
| <b>649</b>              | 21971.437  | 610.318        | <b>656</b>              | 22218.626  | 617.184        | <b>663</b>              | 22465.861        | 624.052        |
| <b>650</b>              | 22006.747  | 611.299        | <b>657</b>              | 22253.943  | 618.165        | <b>664</b>              | 22501.184        | 625.033        |
| <b>651</b>              | 22042.058  | 612.279        | <b>658</b>              | 22289.260  | 619.146        | <b>665</b>              | 22536.508        | 626.014        |
| <b>652</b>              | 22077.370  | 613.260        | <b>659</b>              | 22324.578  | 620.127        | <b>666</b>              | 22571.833        | 626.995        |
| <b>653</b>              | 22112.682  | 614.241        | <b>660</b>              | 22359.898  | 621.108        | <b>667</b>              | 22607.159        | 627.977        |
| <b>654</b>              | 22147.996  | 615.222        | <b>661</b>              | 22395.218  | 622.089        | <b>668</b>              | <b>22642.486</b> | <b>628.958</b> |
| <b>655</b>              | 22183.311  | 616.203        | <b>662</b>              | 22430.539  | 623.071        | *                       |                  |                |

\* Four DS0s are reserved for the TMC and EOC and cannot be allocated for service in a TR-303 VRT

## **DSX-1 Metallic Feeder Topology**

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For Release 3.2 and later, the *SLC-2000* provides an optional DSX-1 feeder interface for metallic T1 facility applications (when the feeder has not been upgraded to fiber). The DSX-1 feeder replaces the SONET feeder (they cannot be mixed in the *SLC-2000* Access System) as the interface to the DLC subsystem. The DSX-1 feeder is not protected (except for circuit pack failure), but it can be protected with external span protection switching shelves and equipment such as the following:

- Alcatel 302MA01 Opt A1 (T1), 19-inch mounting shelf, provides 1:12 protection
- Alcatel 302MA07 (T1), 19-inch mounting shelf, provides dual group 1:5 protection
- Larus 2212-2 WL5, 23-inch mounting shelf, provides dual group 1:6 protection
- Larus 2212-2 WL1, 23-inch mounting shelf, provides 1:13 protection.

For TR-303 systems requiring facility protection, the Larus shelves must be used.

The number of span protection shelves required per *SLC-2000* system depends on the mode selected for *SLC-2000* system operation. (See the previous section on traffic engineering in this chapter.) The maximum capacity of a *SLC-2000* Access System is 28 DSX-1 facilities. If the system is configured only for TR-08 Mode 2, it requires only 16 DSX-1 facilities (max). A mixed mode system could be configured for 1 to 28 DSX-1 facilities, depending on the mixture.

T1 repeaters are required to power the T1 facility. At the central office, repeaters normally are installed in an office repeater bay (ORB). At the RT/HDT, a DDM Plus shelf can house repeaters for up to 28 T1 lines.

The *SLC-2000* system metallic DSX-1 feeder configurations include standard DSX-1 and power looping interfaces. The DSX-1 interface is intended to be used as an intrasite or intraoffice interconnect and supports a limited transmission distance depending on the type of cable used. The DSX-1 interface is designed for the outside plant environment.

## Synchronization

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### SONET Feeder Synchronization

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#### Synchronization Considerations

Network synchronization is critical for operation of the SONET subsystem and for error-free DS0 and DS1 services. Synchronization should be carefully planned in the deployment of *SLC-2000* Access Systems. Certain SONET characteristics, such as bit stuffing algorithms and pointer processing mechanisms (in the SONET transmission format), are sensitive to poor design in the network synchronization environment. Proper synchronization engineering will ensure transmission quality and network performance by reducing timing slip and limiting network degradation from synchronization network faults that are passed on.

The *SLC-2000* and *DDM-2000* OC-3 Multiplexer systems support the same synchronization features and, therefore, can be networked together — the two systems are interchangeable elements of SONET networks. The *SLC-2000* system works with *DDM-2000* OC-12 Multiplexers just like it works with *DDM-2000* OC-3 Multiplexers. For OC-12 networks, consult the *DDM-2000* documentation.



**NOTE:**

The following dataport, P-Phone, and ISDN channel units will operate correctly only when the *SLC-2000* configuration is running with composite clock (CORE synchronization mode set to composite clock):

- AUA34( )
- SPQ334
- AUA52( )
- AUA152
- AUA252( )
- SPQ328
- SPQ429
- SPQ452
- AUA200
- AUA90
- AUA92
- AUA93
- AUA94( )
- SPQ494.

## Synchronization Sourcing

The SLC-2000 Access System allows the feeder DS1 signals within the SONET feeder signal to terminate on different network elements. These elements may be in different central offices. Therefore, the timing for all digital signals carrying DS0 services that terminate on the SLC-2000 system must be derived from a Stratum 3 or better timing source and traceable to the same primary reference. If these timing qualifications are not met, data slips may occur as the signal is transmitted from node to node.



### CAUTION:

*Loss of timing traceability may cause clicking on voice calls, distortion of video, retransmission on data calls, or dropout of data/facsimile (FAX) calls. When these problems occur on subscriber lines terminated on a SLC-2000 Access System and no alarms exist in the system, check the timing of the central office equipment. In linear drop and ring configurations, check the timing and alarm status of the upstream RT/HDT nodes also.*

## Synchronization Interfaces

Each SLC-2000 Access System in a SONET feeder configuration can be provisioned to one of three timing modes:

- Free running from an internal oscillator.
- Loop timing from an incoming optical interface. This timing reference is used to generate all outgoing signals and is also known as "line timing" for multispan applications.
- External timing from the digital synchronization network via building integrated timing supply (BITS). The BITS provides timing references in the form of DS1 and 64-kHz composite clock.

These timing modes are supported by the following circuit packs that can be installed in the synchronous timing generator (TGS) slots of the ARM shelf:

- **TGS Circuit Packs:** In free running mode, no mode switching is performed. The TGS derives its timing from a crystal oscillator that has an end of life performance of  $\pm 15$  ppm. Only one SONET network element in a subnetwork can be provisioned in the free running mode. All other SONET network elements in the subnetwork must be line/loop timed to this free running system to avoid performance degradation. There are two versions of the TGS circuit packs: the BBF2 and BBF2B. The BBF2B circuit pack can be used in any BBF2 application and is preferred for use in ring networks.
- **TG3 Stratum 3 Circuit Pack (SONET Subsystem R13 or later):** In free running mode, no mode switching is performed. The TG3 derives its timing from a crystal oscillator that has an end of life performance of  $\pm 4.6$  ppm. Only one SONET network element in a subnetwork can be provisioned in

the free running mode. All other SONET network elements in the subnetwork must be line/loop timed to this free running system to avoid performance degradation.



**NOTE:**

In the "SONET Feeder Synchronization" section of this chapter, unless otherwise specified, the BBF2B TGS and BBF4 TG3 circuit packs are referred to generically as the TG circuit pack.

The following explains these timing modes and their related modes:

- **Free Running.** For free-running operation, the TG circuit pack derives timing as described above. For an RT, the free-running mode is intended only for turn-up. The free-running mode can only be used in COT applications that require no digital services such as DDS and ISDN. In Release 3.1, a DS1 timing output must be used to generate a composite clock input for the system. Using the **SET - SYNCN** DLC subsystem CIT command in DLC subsystem Release 3.2 and later, the TSI CORE synchronization mode should be provisioned for SONET timing.
- **Loop Timing.** The reference signal feeding the phase-locked loop is selected from the internal oscillator or a loop-timing clock derived from the incoming optical line. In the loop-timing mode, the SONET line being selected for transmission is also selected as the timing reference. In addition, if equipped with the BBF2B TGS or BBF4 TG3, the SONET line in Function Unit A selected for transmission can optionally be selected for the timing reference. This selection is under the control of the on-board microcontroller and the system controller (SYSCTL) circuit pack and is dependent on the timing mode selected by the user via on-board selection switches or software commands and the status of the references. Loss of both loop-timing references causes the TG circuit pack to go into the holdover mode to maintain system timing. This mode should only be used in RT applications. Using the **SET - SYNCN** DLC subsystem CIT command in DLC subsystem Release 3.2 and later, the TSI CORE synchronization mode should be provisioned for SONET timing.
- **DS1 External.** This mode must be used for COTs that terminate digital services such as DDS and ISDN. It must also be used for at least one node in a ring. Each TG circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to its companion TG circuit pack in the same shelf. If the microprocessor on one TG circuit pack detects an incoming DS1 reference failure, it will signal the microprocessor on the companion TG circuit pack. Thus, each TG circuit pack has two DS1 references to choose from, one which is input directly and the other which is cross-fed. Both TG circuit packs will normally select the same DS1 input. A loss of both DS1 references results in the TG circuit pack entering the holdover mode. COT applications that terminate digital services such as DDS or ISDN require a 64-kHz composite clock input. The composite clock provides phase alignment for digital DS0 services. Each TSI circuit pack receives both

composite clock inputs. The active TSI chooses one input and distributes timing to the MDS assemblies. If both composite clocks are lost, the TSIs receive timing from the TG circuit packs. In Release 3.1, a composite clock is always required at the COT regardless of the services it terminates. Using the **SET - SYNCN** DLC subsystem CIT command is supported by DLC subsystem Release 3.2 and later and if digital services are not terminated at the COT, you can provision the TSI CORE synchronization mode for SONET timing. Otherwise, set the CORE synchronization mode for composite clock (COMPCLK) in Release 3.2.

- **Holdover.** The TGS circuit pack has an internal temperature-compensated, voltage-controlled crystal oscillator (TCVCXO) that maintains shelf timing within  $\pm 4.6$  ppm for 24 hours in the event of an unprotected timing DS1 reference failure. The TG3 derives its timing from Stratum 3 clock stability that limits the frequency drift to a maximum of  $\pm 0.37$  ppm over 24 hours.
- **DS1 Synchronization Output.** The DS1 output port of the TG circuit pack is permanently provisioned to MULT mode when the timing mode hardware switches on the circuit pack are set to "DS1 external".
- **MULT Mode.** The MULT mode supplies timing to other network elements in the same network bay frame. Because there is only one *SLC-2000* Access System in a bay, the DS1 outputs are not used for cascading timing in a bay.
- **TG Circuit Pack.** The TG circuit pack can be provisioned to provide either a DS1 output for MULT mode or for network synchronization (SYNC OUT) mode.

Release 3.2 and later provides an **RTRV - PM - T1** command on the DLC subsystem CIT that retrieves DS1 controlled slip seconds (CSS) counts on the feeder DS1 signals received by the *SLC-2000* system. The presence of slips on a DS1 signal normally means that there is an external timing problem (for example, the timing source for the DS1 signal is not traceable to the same source as the other feeder DS1s). If slips are detected on all in-service feeder DS1 signals, the timing problem may be internal or there may be a problem with the SONET subsystem timing. For example, the CORE synchronization mode might not be provisioned correctly. (See the **SET - SYNCN** DLC subsystem CIT command in the *SLC-2000 Access System Command and Message Manual*.) If the CORE synchronization mode is provisioned for "composite clock" (COMPCLK), the presence of slips on all feeder DS1s may indicate a problem with the composite clock input(s).



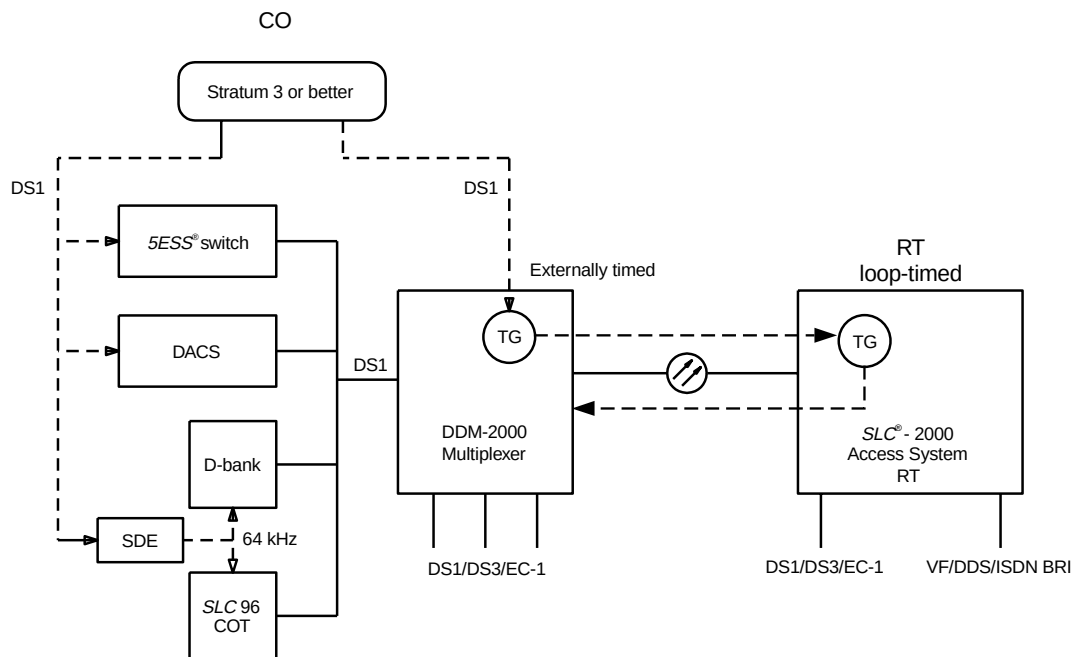
### **TG3 and TGS Compatibility (SONET Subsystem R13 or Later)**

SONET subsystem software release R13 or later allows the use of the TG3 circuit pack as well as the TGS circuit pack. These timing generators must be used according to the stratum timing rules. These rules state that a clock may be synchronized by another clock of equal or higher stratum. The TG3 operates at a higher stratum level than the TGS. This means that a SONET network element containing TGS circuit packs can not supply timing to a network element containing TG3 circuit packs. In a typical network configuration, TG3 packs would be located in the host node. Remote nodes would either contain all TGS or all TG3 packs. In general, remote nodes containing TG3 packs must have traceable timing back to a host containing TG3 packs including all remote nodes in the path. If a network contains two externally-timed host nodes, both hosts must contain TG3 packs to use TG3 packs in the remote nodes. TG3 and TGS circuit packs may not be mixed in the same shelf under normal operating conditions. Mixing is allowed during upgrade procedures only.

### **Network Synchronization Environment**

The free-running, loop-timing, and DS1 external timing modes are supported by the BBF2 and BBF2B TGS circuit packs as well as the BBF4 TG3 circuit pack (SONET subsystem software release R13 or later). They can be combined into various subnetwork configurations, some of which are shown in Figure 8-4. This figure shows two basic single span configurations. In more complex subnetworks such as hubbing, these basic span configurations are duplicated and/or mixed, depending on the application, to produce a subnetwork synchronization configuration. In Figure 8-5, the synchronization distribution expander (SDE) uses a DS1 timing reference to generate the 64 kb/s composite clock that synchronizes the channel banks (D-type or COT).

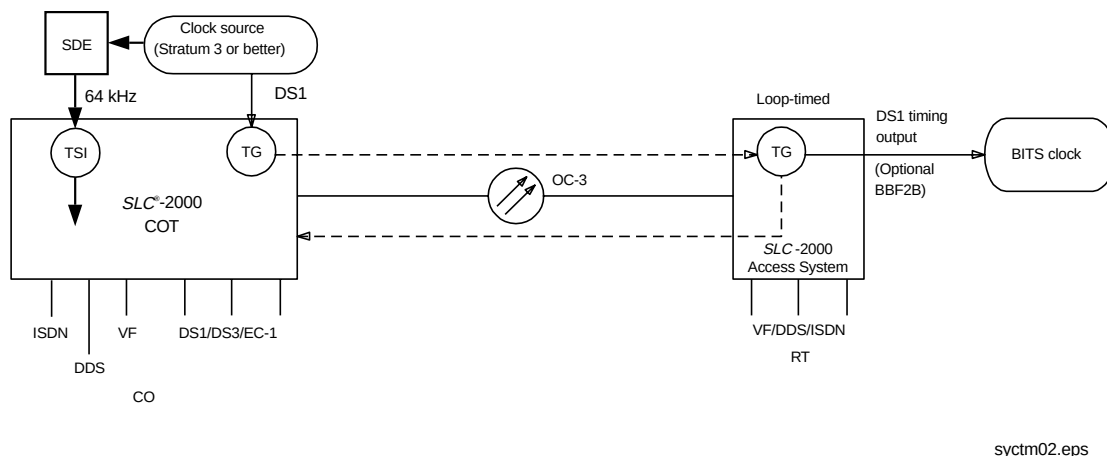
Figure 8-4 shows a sample configuration. The central office (CO) DDM-2000 system is deriving its timing from a Stratum 3 source. The *SLC-2000* RT is loop-timed, the standard arrangement where the CO terminal multiplexer is timed by an office clock source.



syctm01.eps

**Figure 8-4. External/Loop-Timing Configuration (with CO DDM-2000)**

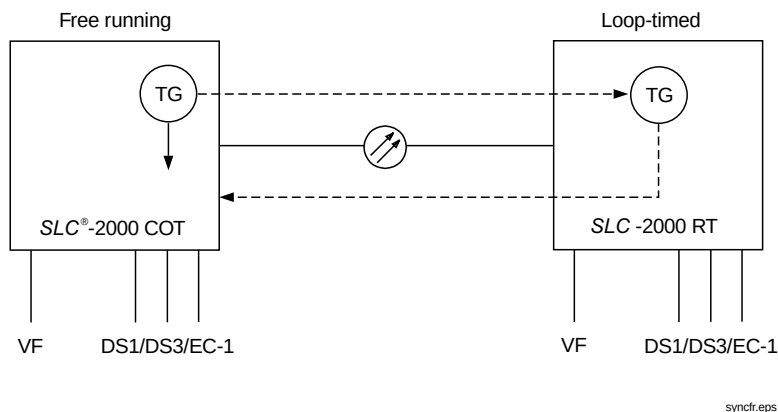
Figure 8-5 shows the CO *SLC*-2000 timed from an external Stratum 3 source. The RT derives its timing from the incoming optical line and, if an optional BBF2B TGS is used, can send a DS1 output to a building integrated timing supply (BITS) clock. At the CO, the timing for the DS1 references and the composite clock inputs must be traceable to the same Stratum 3 or higher source.



syctm02.eps

**Figure 8-5. External/Loop-Timing Configuration (with CO *SLC*-2000)**

Figure 8-6 shows a free-running *SLC*-2000 COT. Note that DDS and ISDN services cannot be used in this configuration. This configuration is only used with Release 3.2 and later software.



syndtr.eps

**Figure 8-6. Free-Running/Loop-Timed Configuration**

Table 8-3 summarizes the *SLC-2000* system synchronization modes for the current software releases.

**Table 8-3.    *SLC*<sup>®</sup>-2000 Synchronization**

| <b>Application</b>                           | <b>Linear<br/>SONET<br/>Software<br/>Release 6.2</b> | <b>Ring<br/>SONET<br/>Software<br/>Releases<br/>7.X and<br/>Later</b> |
|----------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------|
| Free Running                                 | X                                                    | X                                                                     |
| Loop Timing                                  | X                                                    | X                                                                     |
| External Timing                              | X                                                    | X                                                                     |
| DS1 Sync Output (BBF2B)                      | X                                                    | X                                                                     |
| Synchronization Messaging                    | X                                                    | X                                                                     |
| Loop Timing from Fn-C (BBF2B)                | X                                                    | X                                                                     |
| Automatic Synchronization<br>Reconfiguration | X                                                    | X                                                                     |

SONET synchronization messaging is used to communicate the quality of subnetwork timing, internal timing status, and timing states throughout a subnetwork. Transitions to and from holdover or between SONET references, for shelf timing, and to and from DS1 alarm indication signal (AIS), for the DS1 Output, are based on synchronization messages received over the SONET line from which the *SLC-2000* system is extracting timing.

In linear networks with synchronization messaging, the BBF2B circuit pack allows loop timing and automatic switching from either of two incoming optical interfaces, Main OLIU group or Function Unit slot C, when equipped with an OLIU.

In ring networks with synchronization messaging, any TG circuit pack allows loop timing and automatic switching from either of the two ring optical interfaces.

## Synchronization Messaging

The *SLC-2000* system provides a synchronization messaging feature to ensure the integrity of network synchronization during both normal and abnormal conditions. Through the use of synchronization messaging, the current quality of the timing source can be conveyed from one *SLC-2000* system to the next. This capability allows the *SLC-2000* systems to automatically change their timing reference in order to always maintain the highest quality timing available. The capability also allows the *SLC-2000* systems to inform a local BITS clock when the DS1 timing output has been degraded and should no longer be used as a reference. This synchronization messaging feature is based on the scheme developed in the *ANSI*<sup>\*</sup> T1X1 standards committee.

### Applications

The applications that are currently supported with the synchronization messaging feature can be divided into three categories:

- DS1 Timing Output Integrity
- Automatic Synchronization Reconfiguration
- Synchronization Provisioning Integrity.

**DS1 Timing Output Integrity.** The derived DS1 timing outputs are typically used as a synchronization reference to a building integrated timing supply (BITS) clock that provides the timing reference to an externally-timed *SLC-2000* system. The synchronization reference is derived from the SONET transmission facility that is synchronized from an upstream timing reference. In this way, the timing from the BITS clock in one office (master) is distributed to the next office (slave) using the SONET transmission facilities between them as the synchronization vehicle. The BITS are typically capable of synchronizing to a stratum 3 or better accuracy. An ARM shelf equipped with a TG3 is capable of synchronizing to a 4.6 ppm clock (stratum 3 or better). An ARM shelf equipped with a TGS is capable of synchronizing to a 20 ppm clock (between stratum 3 and stratum 4) or better. The stratum timing hierarchy requires that clocks of equal or better stratum level be used to synchronize other clocks. In this way the stratum timing hierarchy is preserved under all failure conditions. Under non-failure conditions, the *SLC-2000* system does not introduce its own internal timing source onto the SONET facility, but merely transfers the quality of its timing reference. A failure of all derived DS1 timing references to the BITS at the master office will cause the BITS to enter holdover mode, whose minimum accuracy is dependent on its internal clock. If the BITS internal clock is of equal or better stratum level than the *SLC-2000* system, the externally-timed *SLC-2000* system will use this reference to synchronize all outgoing SONET transmission facilities. This preserves the required hierarchical structure of the timing network and should be maintained at all times.

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\* Registered trademark of American National Standards Institute, Inc.

If the externally-timed *SLC-2000* system at the master office enters holdover because of a disconnected reference cable or a local BITS failure, the quality of the derived DS1 timing output at the slave office will now be traceable directly to the *SLC-2000* system. The stratum timing hierarchy will be violated if the slave office BITS requires timing accuracy of better stratum level than that provided by the master *SLC-2000* system's internal clock. If the master *SLC-2000* system contains a TG3 circuit pack, stratum 3 accuracy will be maintained indefinitely. This provides acceptable timing for stratum 3 NEs at slave offices. If the master *SLC-2000* system contains a TGS circuit pack, stratum 3 accuracy will be maintained for the first 24 hours of holdover. If a *SLC-2000* system contains a TGS pack, it may change the output of its derived DS1 under some conditions. If the incoming synchronization message is better than internal clock (IC), the derived DS1 will be an "all ones" with framing. This format is suitable for providing synchronization to a BITS of stratum 3 accuracy. If the collocated *SLC-2000* system enters holdover or the incoming synchronization message is internal clock (IC) or worse, the derived DS1 format will change to "all ones" without framing (AIS). This will prevent a BITS from using this input and force the BITS to either select a new input or enter holdover. This change to AIS preserves the stratum timing hierarchy by allowing the BITS to synchronize from a clock of equal or higher quality.

Available in SONET subsystem software release R9.1 or later is the threshold AIS feature. This feature allows the user to select the value of the incoming message that causes the derived DS1 output to output AIS. This feature will allow stratum 2 BITS clock to receive timing from a TGS or TG3 without violating stratum timing rules.

As shown in Figure 8-7a, SONET synchronization messaging notifies the *SLC-2000/DDM-2000* system at the slave site to place alarm indication signal (AIS) on the DS1 timing output. This BITS can then enter holdover or switch to an alternate reference.

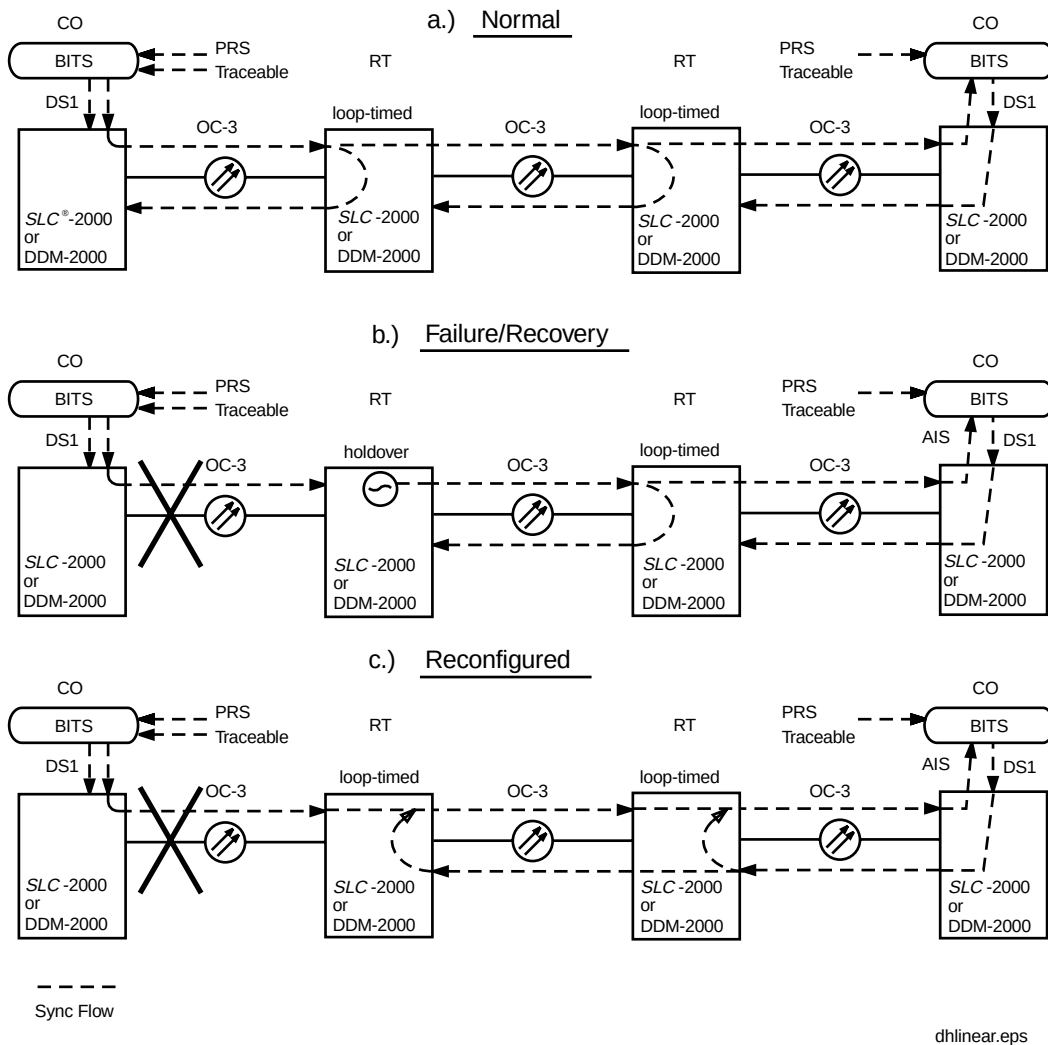


**Figure 8-7. DS1 Timing Output — Dual Homing Linear**

**Automatic Synchronization Reconfiguration.** SONET was designed to operate optimally in a synchronous environment. Although plesiochronous and asynchronous operation can be supported through the use of pointer adjustments, transmission quality is affected by the generation of additional jitter and wander due to pointer adjustments. Because of this, it is desirable to maintain synchronous operation whenever possible. Through the use of synchronization messages, the quality of the different timing references can be made available at each *SLC-2000* system. The *SLC-2000* system can be optioned to determine the best timing reference available to it and switch to that reference. Through this mechanism, the synchronous operation of the subnetwork can be maintained. The switching of timing references is hitless, and the synchronization messages also allow it to be done without creating timing loops in the process. Note that automatic synchronization reconfiguration applies only to switching between available and valid loop timing references and not between timing modes. For example, switching from loop timed to external timed or external timed to loop timed would not be supported.

In the linear dual-homing network in Figure 8-7c, normal operation includes an external timing reference at each of the central offices. The remote terminal sites are each loop timed from the central office *SLC-2000/DDM-2000* system on the left. If a fiber failure occurs between the first two *SLC-2000/DDM-2000* systems, the synchronization autoreconfiguration feature will cause the loop-timed *SLC-2000/DDM-2000* systems to change their direction of loop timing. This prevents any *SLC-2000/DDM-2000* system from operating in holdover for an extended period of time.



Consider the access ring network in Figure 8-8. Under normal operation, the ring has one *SLC-2000/DDM-2000* system externally timed and the others loop timed in the counterclockwise direction. If a fiber failure occurs between the first two *SLC-2000/DDM-2000* systems, the synchronization autoreconfiguration feature will cause the *SLC-2000/DDM-2000* systems to change their loop-timing directions to clockwise. The result is that the ring is again operating synchronously. The ring already provides self-healing of the traffic, so it is especially important to maintain synchronous operation during this type of failure to prevent service degradation due to increased jitter and wander.

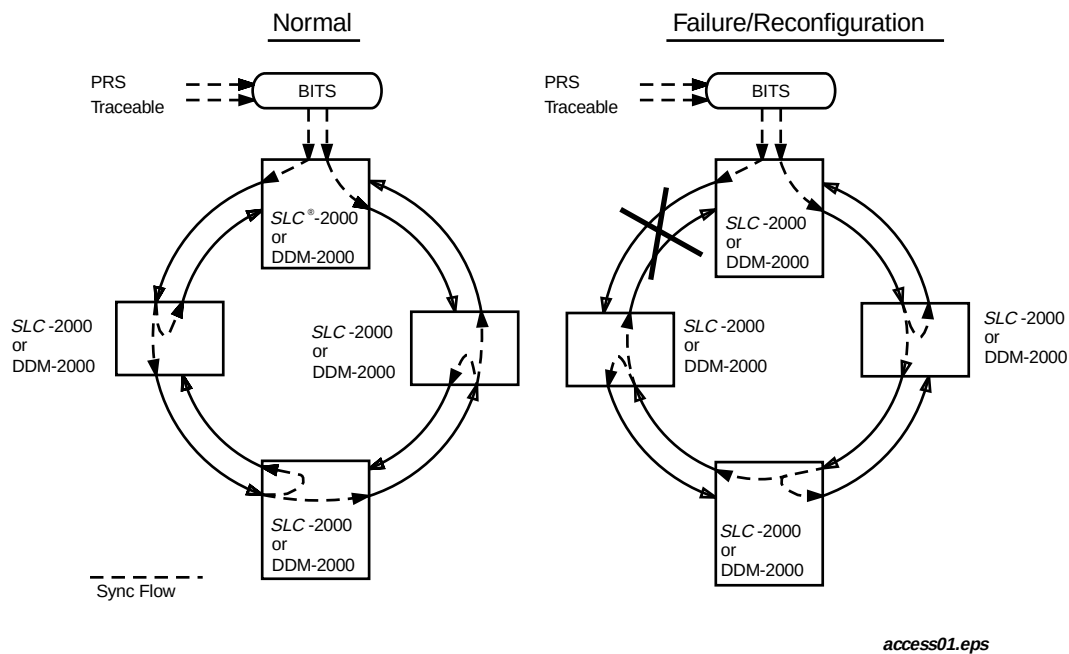


**Figure 8-8. Synchronization Reconfiguration — Access Ring**

**Synchronization Provisioning Integrity.** A welcome side feature of synchronization messaging is that it helps prevent provisioning errors. Provisioned timing loops on the *SLC-2000* systems will be quickly detected through the synchronization messaging algorithm and prevented by forcing a shelf into holdover. The system can then be reprovisioned correctly.

### **Feature Details and Options**

As mentioned previously, SONET synchronization messaging is used to communicate the quality of the subnetwork timing throughout the subnetwork. This is done using bits 1 through 3 of the K2 byte found in the SONET overhead. In SONET subsystem Release R9.1 later releases, synchronization messaging can also be done using bits 5-8 of the S1 byte in the SONET overhead. If a *SLC-2000* system is deriving timing from a given SONET interface and synchronization messaging is enabled on that interface (Kbyte messages, and Sbyte messages in SONET subsystem Release 9.1 and later, are provisioned using the **set -ocn** command), the system interprets the received message to determine its internal timing status. The system also determines the state of the DS1 output, if the DS1 output is enabled. The *SLC-2000* system also transmits over the particular SONET interface and all other SONET interfaces that are enabled for synchronization messaging, the appropriate message indicating the quality of its timing and its active timing mode.

Table 8-4 and Table 8-5 list the associated internal timing status and DS1 output states that are associated with synchronization messages received from the SONET interface when synchronization messaging is enabled. These messages can be retrieved using the **rtrv-sync** command. The table lists the messages from low to high quality.

**Table 8-4. Synchronization Messages using K2 Byte**

| Received Message            | Active Timing Mode (Note) | DS1 Output State | Quality Level |
|-----------------------------|---------------------------|------------------|---------------|
| Don't Use                   | Holdover                  | AIS              | 7             |
| Timing Looped Back (TLB)    | Holdover                  | AIS              | 7             |
| Stratum 4*                  | Holdover                  | AIS              | 6             |
| Internal Clock (IC)         | OK to use                 | AIS              | 5             |
| Internal Clock (IC) (w/TG3) | Holdover                  | AIS              | 5             |
| Stratum 3*†                 | OK to use                 | Good             | 4             |
| Stratum 2*                  | OK to use                 | Good             | 3             |
| Sync Quality Unknown (SQU)  | OK to use                 | Good             | 2             |
| Stratum 1*                  | OK to use                 | Good             | 1             |

**Note:** This column applies only when provisioned for loop-timing mode.

\* Presently, *SLC*<sup>®</sup>-2000/DDM-2000 systems cannot generate these messages; but they could be retransmitted and supported for autoreconfiguration if any of these are received by *SLC*-2000/DDM-2000 systems.

† The TG3 circuit pack can generate a stratum 3 signal.

**Table 8-5. Synchronization Messages using S1 Byte (Note 1)**

| <b>Received Message</b>       | <b>Active Timing Mode (Note 2)</b> | <b>DS1 Output State</b> | <b>Quality Level</b> |
|-------------------------------|------------------------------------|-------------------------|----------------------|
| Don't Use                     | Holdover                           | AIS                     | 7                    |
| Traceable SONET Clock         | OK to use                          | AIS                     | 5                    |
| Traceable SONET Clock (w/TG3) | Holdover                           | AIS                     | 5                    |
| Traceable Stratum 3 * †       | OK to use                          | Good                    | 4                    |
| Traceable Stratum 2*          | OK to use                          | Good                    | 3                    |
| Sync Trace Unknown            | OK to use                          | Good                    | 2                    |
| PRS Traceable*                | OK to use                          | Good                    | 1                    |

**Notes:**

1. This table is applicable to SONET subsystem R8.1 or R9.1 or later releases.
2. This column applies only when provisioned for loop-timing mode.

\* Presently, *SLC*<sup>®</sup>-2000/DDM-2000 systems cannot generate these messages; but they could be retransmitted and supported for autoreconfiguration if any of these are received by *SLC*-2000/DDM-2000 systems.

† The TG3 circuit pack can generate a stratum 3 signal.

Synchronization messaging using the SONET K2 byte and S1 byte can be disabled on a per SONET interface using the **set-ocn** command. Zeros will be transmitted on bits 1-3 of the K2 byte if this is done; all ones will be transmitted on bits 5-8 of the S1 byte if this is done. The timing and synchronization status of a shelf can be determined using the **rtrv-sync** command.

The "Don't use" message is sent when the system determines that its timing is not suitable for synchronization, for example; due to failure.

When the *SLC*-2000 system is configured for external timing and its DS1 output port is provisioned for MULT mode, the message Sync Quality Unknown (SQU) for K byte, or Sync Trace Unknown (STU) for S byte, is sent on all the SONET interfaces where synchronization messaging is provisioned. When the capability of communicating with a BITS clock over the DS1 overhead exists, the quality of the reference signal will be transmitted instead; for example, stratum 1.

When the *SLC*-2000 system is configured for external timing and its DS1 output port is provisioned for SYNC OUT mode, the timing looped back (TLB) message for K byte, or "Don't Use" message for S byte, will be sent on the SONET interfaces towards the NE from which the DS1 timing output is being derived. The SQU message for K byte, or STU for S byte, will be sent on all other SONET interfaces where synchronization messaging is provisioned. If the DS1 output is

generating AIS while the system is configured in this way, the message SQU for K byte, or STU for S byte, will be transmitted on all SONET interfaces.

When using the TGS and the *SLC-2000* system is configured for free run or is in holdover mode, the Internal Clock message for K byte, or Traceable SONET Clk for S byte, will be sent on all SONET interfaces where synchronization messaging is provisioned. When using the TG3 and the *SLC-2000* system is configured for free run or is in holdover mode, the stratum 3 message for K byte, or Traceable stratum 3 for S byte, will be sent on all SONET interfaces when synchronization messaging is provisioned.

When the *SLC-2000* system is configured for line timing, the TLB message for K byte, and "Don't Use" for S byte, will be sent on the SONET interfaces towards the NE from which the timing is being derived. The message received on the SONET interface will be sent on all other SONET interfaces where synchronization messaging is provisioned.

With automatic synchronization reconfiguration (not supported in OC-12 linear configurations), the *SLC-2000* systems use and compare the incoming synchronization messages on the SONET interfaces available for loop timing to select the highest quality synchronization reference available. If the received quality levels are the same on the references available for timing, the existing loop-timing reference takes precedence. This feature guarantees the nonrevertive operation of reconfiguration. The loop-timing reference is provisioned by the **set-sync** command.

The existence of automatic synchronization reconfiguration does not change the behavior of the system on traditional line failures, for example, LOF, LOP, LOS, and others.

There are synchronization references in the *SLC-2000* system that can be provisioned as network timing sources but are not considered as timing sources for automatic synchronization reconfiguration. Examples of these are the linear extensions off of a *SLC-2000/DDM-2000* ring. This type of interface is considered a linear interface, and the system treats it as such with regards to synchronization.

Table 8-6 lists the synchronization references available on *SLC-2000/DDM-2000* system topologies.

**Table 8-6. Available Synchronization References**

| <b>System</b> | <b>Manually Provisionable</b> | <b>Automatically Reconfigurable</b> |
|---------------|-------------------------------|-------------------------------------|
| Linear        | Main, Fn-C                    | Main, Fn-C                          |
| Rings         | Main-1, Main-2, Fn-C          | Main-1, Main-2, Fn C*               |

\* SONET subsystem software release R9.0 or later ring releases.

In SONET subsystem Release R9.1 or later ring releases, the sending of DS1 AIS on the output of the BBF2B TGS circuit pack can be provisioned by using the **set - sync** command. Depending on the quality level of the incoming sync messages, this new parameter can be provisioned to send DS1 AIS upon receiving level 5 (default), level 4, level 3, or level 2. Refer to Table 8-4 and Table 8-5 for definitions of quality levels. AIS will be sent as long as the received message is at the provisioned or greater in quality level number.

In SONET subsystem Release R13.0 or later ring releases, the sending of DS1 AIS on the output of the BBF2B TGS and BBF4 TG3 circuit packs follow the same rules as outlined above.

### Examples

In this part, some detailed examples are given to show specifically how the synchronization messages propagate through the *SLC-2000/DDM-2000* network and assist in the recovery from a fiber failure. Through these examples, one can extend the same concept to any other network that may include different topologies, number of sites, failure locations, and number of BITS clocks.



#### NOTE:

All nodes in a ring using automatic synchronization reconfiguration must have the synchronization messaging and automatic synchronization reconfiguration features enabled to prevent alarms.

In all of the following examples, if the sync message parameter within the **set - oc3** command has been provisioned to "S byte" for an optical interface, then the equivalent S byte message will be transmitted from that optical interface. The following are equivalent messages:

K2: Sync Quality Unknown is the same as, S1: Sync Trace Unknown

K2: Timing Looped Back is the same as, S1: Don't Use

K2: Internal Clock is the same as, S1: Traceable SONET Clock

K2: Stratum 3 is the same as, S1: Traceable Stratum 3.

**Synchronization Reconfiguration in an Access Ring.** Figure 8-9a shows the access ring operating in its normal configuration. The DDM-2000/*SLC*-2000 system at the CO is externally timed, and each of the other DDM-2000/*SLC*-2000 systems are line timed in a counterclockwise direction. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The TLB message is sent on the interface that is being used as the line timing reference and, thus, where using that timing would create a timing loop. Synchronization messaging and automatic synchronization have both been enabled for this network.

In Figure 8-9b, a fiber has been cut between sites A and B. Immediately, the DDM-2000/*SLC*-2000 system at site B enters holdover and sends out the internal clock (IC) message if using a TGS, or STRATUM 3 message if using a TG3, to site C. The DDM-2000/*SLC*-2000 system at site B cannot switch to line time from site C because it is receiving the TLB message on that interface.

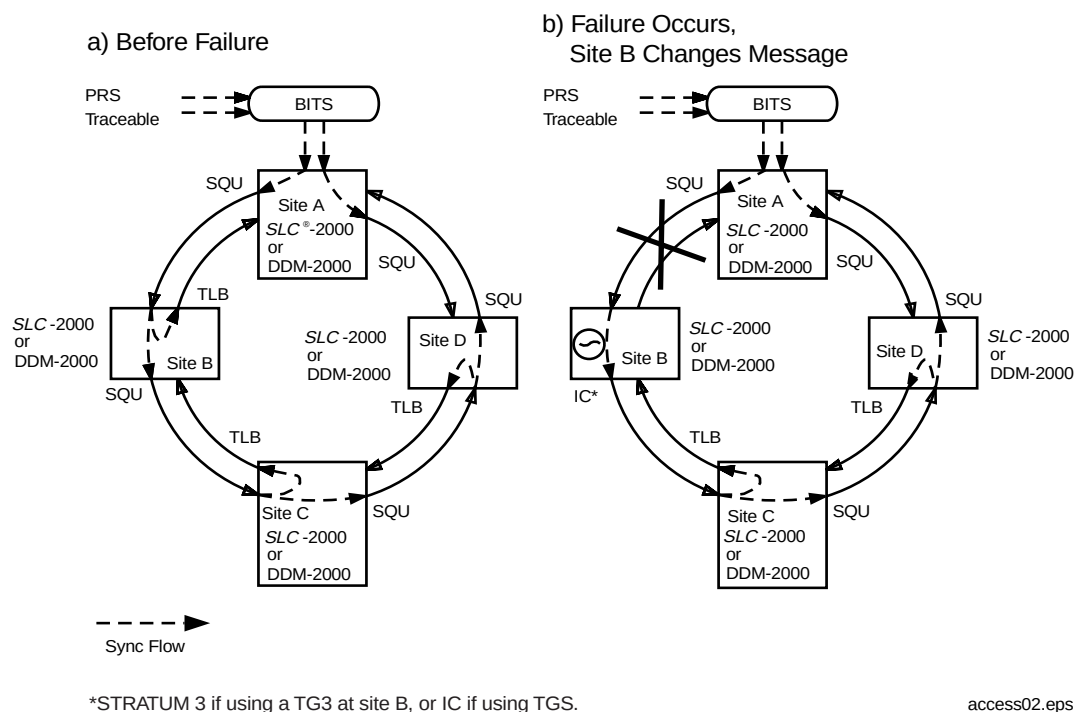


**Figure 8-9. Synchronization Reconfiguration — Access Ring — Sheet 1 of 3**

In Figure 8-9c, the DDM-2000/*SLC*-2000 system at site C detects the incoming IC message and sends out the IC message to site D. The DDM-2000/*SLC*-2000 system at site C cannot switch to line time from the other rotation because it is receiving the TLB message on that interface.

In Figure 8-9d, the DDM-2000/*SLC*-2000 system at site D detects the incoming IC or STRATUM 3 message. Because this DDM-2000/*SLC*-2000 system is receiving the SQU message from site A, it will switch to line time from site A because SQU is higher quality than IC or STRATUM 3. After the switch occurs, the TLB message is sent back to site A and the SQU message is retransmitted to site C.

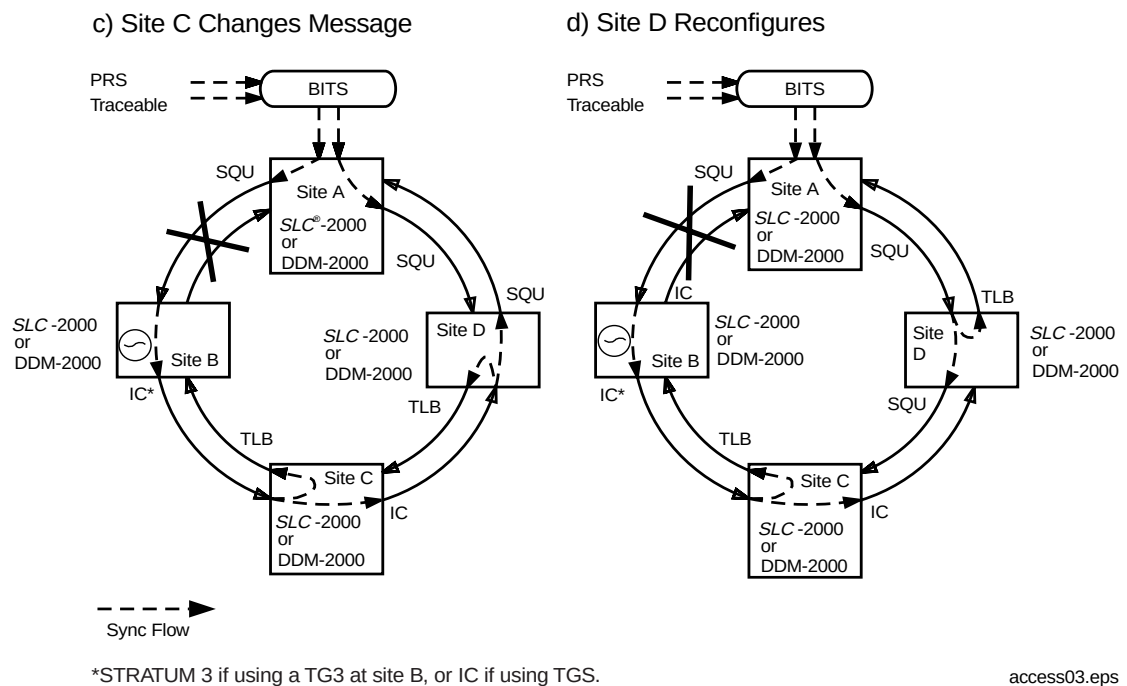


**Figure 8-9. Synchronization Reconfiguration — Access Ring — Sheet 2 of 3**



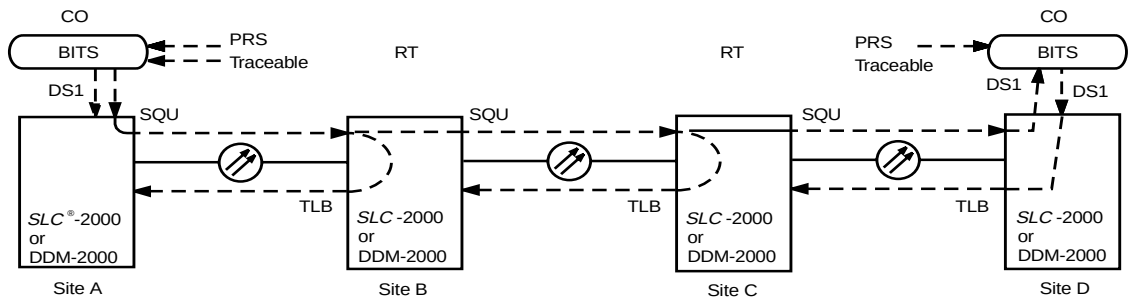
In Figure 8-9f, the DDM-2000/*SLC*-2000 system at site B detects the incoming SQU message from site C. The SQU message is a better quality message than the internal holdover capability, so the DDM-2000/*SLC*-2000 system at site B switches to line time from site C. After the switch occurs, the TLB message is sent back to site C, and the SQU message is forwarded to site A. When the failure clears, the synchronization remains in the new configuration unless it is manually switched back.



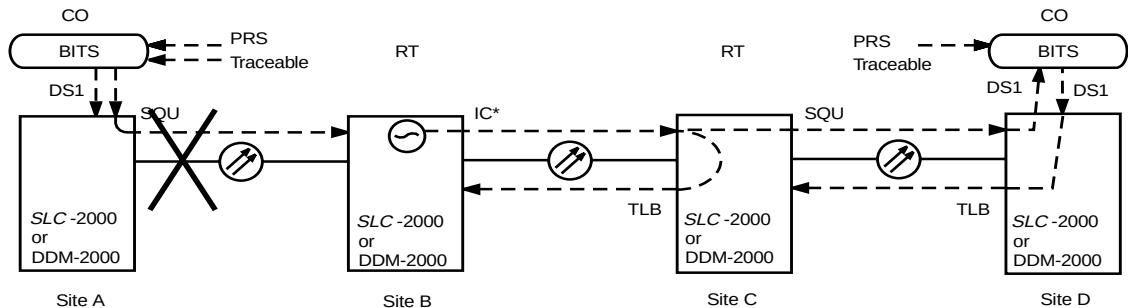
**Synchronization Messaging to Support DS1 Timing Outputs.** Figure 8-10a shows a dual homing linear network operating in its normal configuration. The DDM-2000/*SLC*-2000 system at site A is externally timed, and the DDM-2000/*SLC*-2000 systems at sites B and C are line timed from site A. The DDM-2000/*SLC*-2000 system at site D is also externally timed from another BITS. Both BITS should be PRS traceable. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The TLB message is sent to indicate where line timing has been used, and thus, where using that timing would create a timing loop. Synchronization messaging has been enabled for this network but automatic synchronization reconfiguration has not been enabled.

In Figure 8-10b, a fiber has been cut between sites A and B. Immediately, the DDM-2000/*SLC*-2000 system at site B enters holdover and sends out the IC message to site C.

a) Before Failure



b) After Failure, Site B Changes Message



--- Sync Flow

\*STRATUM 3 if using a TG3 at site B, or IC if using a TG3

tofail01.eps

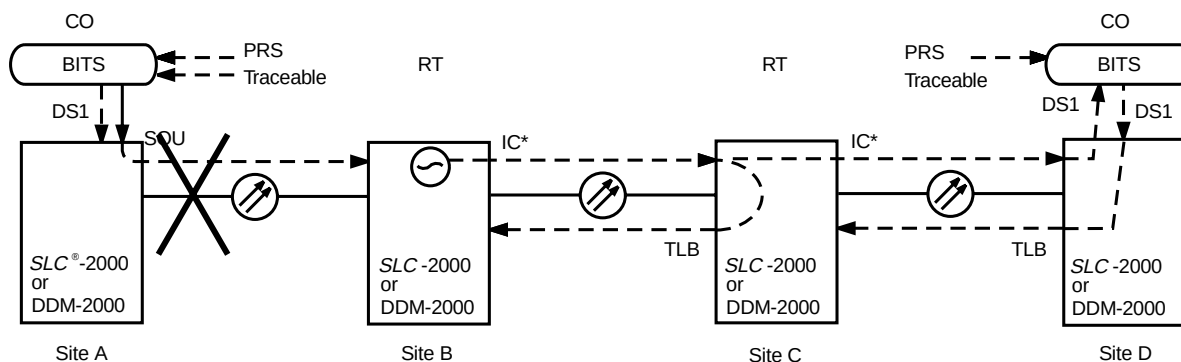
**Figure 8-10. DS1 Timing Output with Fiber Failure — Sheet 1 of 2**

In Figure 8-10c, the *SLC-2000/DDM-2000* system at site C detects the incoming IC message from site B and forwards it on to site D.

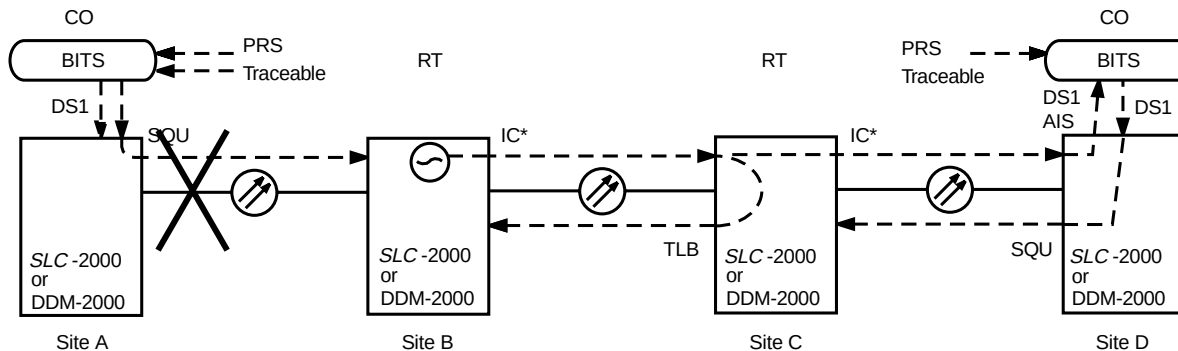
In Figure 8-10d, the *SLC-2000/DDM-2000* system at site D detects the incoming IC or STRATUM 3 message from site C and sends out AIS to the BITS. The BITS will either switch to an alternate reference, if available, or enter holdover.

If the automatic synchronization reconfiguration feature had been enabled in this example, at this point, sites C and B would attempt to switch loop-timing directions to retune from site D.

### c) Site C Changes Message



### d) Site D Changes Message



--- Sync Flow

\*STRATUM 3 if using a TG3 at site B, or IC if using a TG3

tofail02.eps

**Figure 8-10. DS1 Timing Output with Fiber Failure — Sheet 2 of 2**

## **Network Timing Distribution**

DS1 signals have long been used to pass timing information through the network synchronization hierarchy. These DS1 timing references should be transmitted between master and slave clock sources over the most reliable facilities available. In some cases, these DS1 signals also carry traffic. The facility of choice has evolved from T-carrier through asynchronous lightwave systems to SONET lightwave systems. As these systems are upgraded to SONET systems, timing distribution plans should be revisited to ensure the quality of the timing signals is not degraded. With proper planning, SONET can be used to improve the overall quality of the network timing.

## **Interoffice Timing Distribution**

One way SONET can be used to improve the quality of interoffice network timing is through the use of OC-3 timing distribution. The *SLC-2000* system supports the evolution to interoffice OC-3 timing distribution by providing a DS1 timing output derived from the incoming OC-3 signal. The DS1 timing output is traceable to the clock source that times the *SLC-2000* subnetwork and has extremely low jitter and wander. This is true regardless of the number of *SLC-2000* systems connected in the network. This DS1 can be fed to the local BITS clock which subsequently times the local *SLC-2000* system and the other equipment in the office. If a BITS clock is not available in the office, the DS1 timing output can be used to time other equipment (including another *SLC-2000* system) directly. The *SLC-2000* system can provide DS1 timing outputs in all supported topologies (for example, point-to-point, add/drop, and ring).

With OC-3 timing distribution, the OC-3 line signal, rather than a DS1 multiplexed into the SONET payload, will provide a timing transport mechanism better suited to a complex, heavily interconnected SONET network. In this configuration, a DS1 reference from the central office BITS clock still times the OC-3 transmitted to the remote site; at the remote site, a DS1 output reference is created directly from the received OC-3 signal (Figure 8-11).

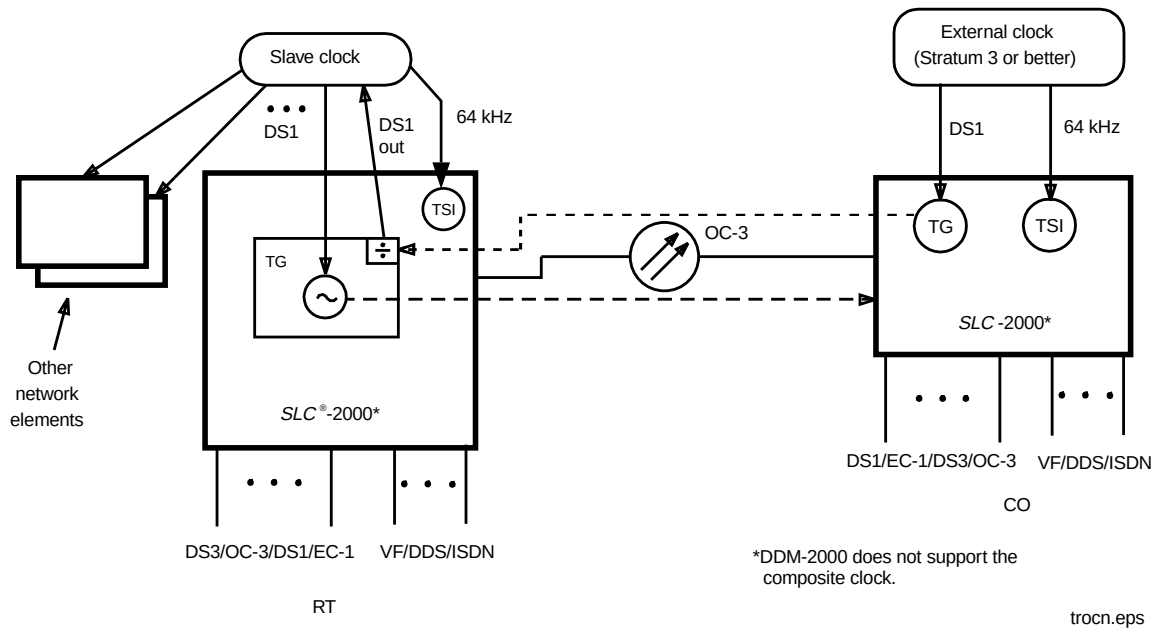


**Figure 8-11. OC-3 Derived DS1 Timing Reference**

OC-3 timing distribution has several potential advantages. It preserves transport bandwidth for customer services and guarantees a high-quality timing signal. Also, as the central office architecture evolves to replace DSX interconnections with SONET EC-1 and IS-3 interconnections and direct OC-3 interfaces, OC-3 distribution becomes more efficient than multiplexing DS1 references into an access facility in the CO.

A previous drawback to using OC-3 timing distribution was that network timing failures could not be communicated to downstream clocks via DS1 AIS, since the DS1 signal does not pass over the OC-3 interface. A standard SONET synchronization messaging scheme to convey synchronization failures is now being finalized. The *SLC-2000* systems already support this synchronization messaging scheme. With this option, clock stratum levels can be passed from network element to network element, allowing downstream clocks to switch timing references without creating timing loops, if a network synchronization failure occurs. If a quality timing reference is no longer available, the *SLC-2000* system sends AIS over the DS1 interface. If the local OC-3 lines fail, the *SLC-2000* system outputs AIS on the DS1 output or an upstream *SLC-2000* system enters holdover.

### **Access Network Timing Distribution**

OC-3 timing distribution also can be used in access networks or to small central offices. In this configuration, a DS1 reference from the central office BITS clock still times the OC-3 transmitted to the remote site. The loop-timing capability of the *SLC-2000* system provides the ability to recover OC-3 timing. The DS1 timing output feature can be used to also extend timing to customer networks or remote sites. In this case, the DS1 timing output can be used to time switch remotes, *SLC-2000* shelves, or other local equipment directly. Ideally, the equipment can provide an external timing reference. Otherwise, the signal must be input to a traffic DS1 port on the external equipment which will tie up some of this bandwidth of the equipment. In this configuration, it is important that the DS1 reference to the *SLC-2000* system in the central office be traceable to the same clock used to source the DS1s being carried to the customer site or small central office. If it is not, slips may occur.

Although an ideal source of timing, OC-3 timing distribution, that is, via a DS1 timing output, cannot be used to provide timing in all applications. In cases where the local equipment is not provided with an external timing reference input, or in some private networks where the timing is to be distributed from another private network location, timing will continue to be distributed via traffic-carrying DS1s. In these applications, a stable DS1 timing source can be achieved by ensuring that all elements in the SONET network are directly traceable to a single master clock via loop timing. In this environment, the high-performance desynchronizer design of the *SLC-2000* system allows a DS1 timing reference to be carried as a multiplexed DS1 payload\*.

It is recommended that, where possible, the DS1 sources (switch, PBX, or other equipment) be traceable to the same timing source used to time the *SLC-2000* SONET network. Multiplexed DS1 reference transport is also consistent with current planning and administration methods. Applications include passing synchronization from the public switched network to a PBX-based private network (Figure 8-12) and synchronizing an end-office remote switch to a larger office host switch.

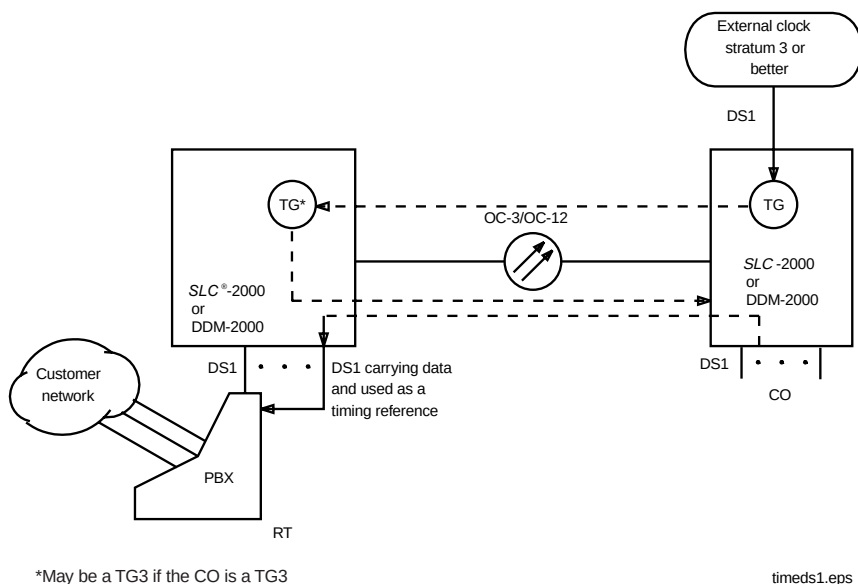


**Figure 8-12. Timing from Multiplexed DS1**

\*

Synchronous operation via loop timing eliminates the generation of VT pointer adjustments, thus maintaining the phase stability needed for a high-quality DS1 timing reference. Cross-connecting at the STS-1 level also eliminates the VT pointer adjustments. While the design of the *SLC-2000* system maintains jitter/wander within standard DS1 interface requirements, even in the presence of VT pointer adjustments, and while the DS1 is likely to be stable enough for most equipment to use as a timing reference, some equipment may have more stringent stability requirements for its timing references.

## **DSX-1 Feeder Synchronization — Release 3.2 and Later**

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When you configure a *SLC-2000* system for DSX-1 feeder, three synchronization mode options are available:

- Loop timing
- Free running
- External (composite clock).

Synchronization is performed by the core and not the TG circuit packs.



**NOTE:**

The following dataport, P-Phone, and ISDN channel units will operate correctly only when the *SLC-2000* configuration is running with composite clock (CORE synchronization mode set to composite clock):

- AUA34( )
- SPQ334
- AUA52( )
- AUA152
- AUA252( )
- SPQ328
- SPQ429
- SPQ452
- AUA200
- AUA90
- AUA92
- AUA93
- AUA94( )
- SPQ494.

You can provision the synchronization mode using the **SET-SYCN** DLC subsystem CIT command. As with SONET feeder, the *SLC-2000* system allows feeder DSX-1 inputs from multiple sources. Therefore, the timing for all of these signals must be derived from the same reference. It is recommended that the timing for all of these signals be derived from a Stratum 3 or better timing source derived from the same primary reference.



Figure 8-13 shows an RT in a DSX-1 feeder configuration loop timing from an externally timed COT (in a DSX-1 feeder configuration).

### Loop Timing Mode

The loop timing mode is used in RT configurations. In this mode, one DSX-1 feeder input is designated as the primary reference input. As long as the received signal on this input is good, the system will use this as its timing reference. By using the **SET - SYNCN** DLC subsystem CIT command, you can provision the primary reference for any feeder DSX-1 input. Feeder DSX-1 number 1 (**a-1-1**) is the default.

Optionally, a second DSX-1 feeder input may be designated as the secondary reference input. This is used as a backup source when the primary reference has failed or is served by a protection LIU. By using the **SET - SYNCN** DLC subsystem command, you can provision the secondary reference with any feeder DSX-1 input. You can also disable the secondary reference by setting the secondary reference to the same value as the primary reference. Feeder DSX-1 number 9 (**a-3-1**) is the default.

If both the primary and secondary references have failed, the system will attempt to loop time from any of the other feeder DS1s on which a good signal is being received. If all feeder inputs have failed, the system will free run (at  $\pm 32$  ppm) using an internal reference on a TSI circuit pack.

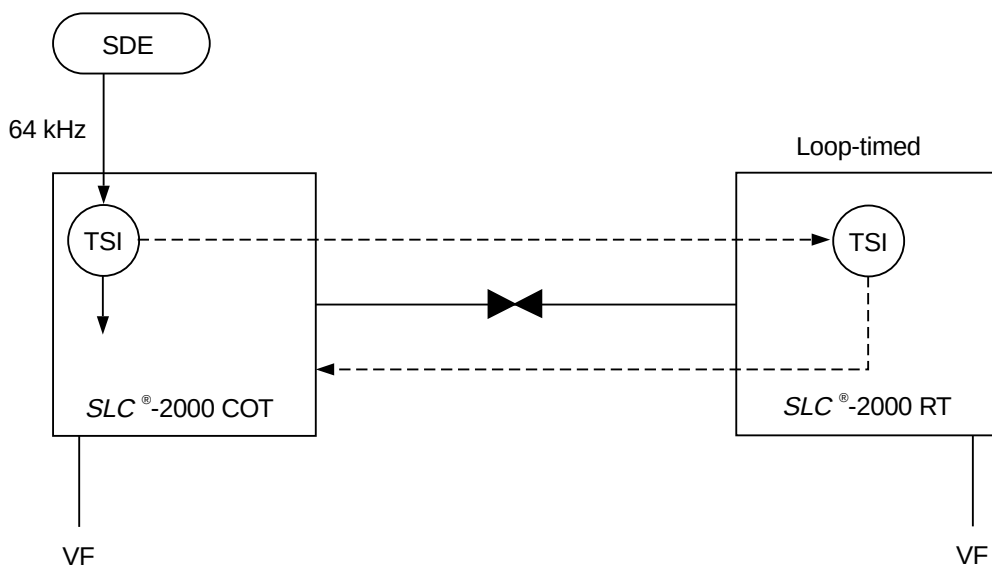


**Figure 8-13. External/Loop-Timed Configuration (DSX-1 Feeder)**

The system uses the following criteria to determine if a signal has failed:

- Loss of Signal (LOS)
- Loss of Frame (LOF)
- High Bit Error Rate ( $10^{-3}$ )
- Alarm Indication Signal (AIS).



**CAUTION:**

*Feeder DS1s served through different LIUs should be chosen as the primary and secondary references to minimize the likelihood that service will be interrupted when a reference input fails.*



**CAUTION:**

*The primary and secondary references should be signals from a reliable timing source such as a local digital switch. If signals from SLC-96 COTs are used, only the A digroups should be used as timing source for the RT.*

### Composite Clock Mode

This mode is intended for COTs that terminate digital services such as DDS or ISDN. The composite clock provides phase alignment for digital DS0 services. Each TSI receives both composite clock inputs. The active TSI chooses one input and distributes timing to the MDS assemblies. If the system loses both composite clocks, it will free run (at  $\pm 32$  ppm).

### Free Running Mode

This mode is intended for COTs that do not terminate digital services such as DDS or ISDN. The system derives its timing from a  $\pm 32$  ppm oscillator on the active TSI circuit pack.

### Timing Problems — Slips

Release 3.2 and later provides a **RTRV-PM-T1** CIT command on the DLC subsystem that retrieves DS1 controlled slip seconds (CSS) counts on the feeder DS1 signals received by the SLC-2000 system. The presence of slips on a DS1 signal normally means that there is an external timing problem (for example, the timing source for the DS1 signal is not traceable to the same source as the other feeder DS1s). If slips are detected on all in-service feeder DS1 signals, the timing problem may be internal. For example, the CORE synchronization mode might not be provisioned correctly. (See the **SET-SYNCN** DLC subsystem CIT command in the *SLC-2000 Access System, Commands and Messages*.) If the CORE synchronization mode is provisioned for composite clock (COMPCLK), the presence of slips on all feeder DS1s may indicate a problem with the composite clock input(s).

## Software Compatibility

### Compatibility with Software Releases of Other Equipment

Software compatibility with software releases of other equipment is listed in Table 8-7. The SLC-2000 Access System releases are compatible only with the DDM-2000 multiplexer releases (SONET Package) listed in this table.

**Table 8-7. SLC-2000 Access System Software Package Compatibilities**

| SLC®-2000<br>Software<br>Release | SONET Releases                                                                 |                               | ITH<br>Package | TR-303 Integrated Applications—Switch<br>Generics (Note) |                    |                 |                  | DDM-2000<br>FiberReach |
|----------------------------------|--------------------------------------------------------------------------------|-------------------------------|----------------|----------------------------------------------------------|--------------------|-----------------|------------------|------------------------|
|                                  | OC-3                                                                           | OC-12*                        |                | 5ESS®<br>Switch                                          | DMS-100†<br>Switch | EWSD‡<br>Switch | GTD-5§<br>Switch |                        |
| R3.1<br>COT¶/RT                  | R6.2 (linear)<br>R7.0 (rings)                                                  | R2.2 (linear)                 | AT2.0.0        | N/A                                                      | N/A                | N/A             | N/A              | N/A                    |
| R3.2<br>COT¶/RT                  | R6.2 (linear)<br>R7.1 (rings)<br>R11.0 (rings)                                 | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0        | N/A                                                      | N/A                | N/A             | N/A              | N/A                    |
| R3.3 COT¶                        | R6.2 (linear)<br>R7.1 (rings)<br>R7.2 (rings)<br>R9.0 (rings)<br>R11.0 (rings) | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0        | N/A                                                      | N/A                | N/A             | N/A              | N/A                    |
| R4.0 RT                          | R6.2 (linear)<br>R7.1 (rings)                                                  | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0        | 5E9.2**<br>or<br>5E9.1††                                 | N/A                | N/A             | N/A              | N/A                    |
| R4.1 RT                          | R6.2 (linear)<br>R7.1 (rings)<br>R7.2 (rings)                                  | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0        | 5E9.2**<br>or<br>5E9.1††                                 | NA004‡‡            | N/A             | N/A              | N/A                    |

**Note:** The following list describes which switch generics are integrated TR-08 compatible:

- 5ESS switch, 5E1.2 and later
- DMS-100 switch
- EWSD switch, R9.0. The TR-303 software compatibility testing with the Siemens EWSD Switch was performed and documented by Siemens. Lucent Technologies assumes no responsibility for the software compatibility when the SLC-2000 Access System is used with the EWSD Switch.
- GTD-5 switch (not compatible with integrated TR-08 configurations).

\* SLC-2000 Access System will interface with OC-12 releases.

† Trademark of Northern Telecom, Ltd.

‡ Registered trademark of Siemens Aktiengesellschaft.

§ Registered trademark of GTE Corporation.

¶ The COT is used in universal applications only and can be used with any switching system.

\*\* 5E9.2 with BWM95-0005 (or higher).

†† 5E9.1 with BWM95-0004 (or higher). IDCU only for TR-303.

‡‡ ECSM-100 interface operating with software release NA004 ( or higher)

*Continued on next page*

**Table 8-7. SLC-2000 Access System Software Package Compatibilities (Continued)**

| <b>SLC®-2000<br/>Software<br/>Release</b> | <b>SONET Releases</b>                                                                                                                          |                               | <b>ITH<br/>Package</b> | <b>TR-303 Integrated Applications—Switch<br/>Generics (Note)</b> |                            |                         |                          | <b>DDM-2000<br/>FiberReach</b> |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------|------------------------------------------------------------------|----------------------------|-------------------------|--------------------------|--------------------------------|
|                                           | <b>OC-3</b>                                                                                                                                    | <b>OC-12*</b>                 |                        | <b>5ESS®<br/>Switch</b>                                          | <b>DMS-100†<br/>Switch</b> | <b>EWSD‡<br/>Switch</b> | <b>GTD-5§<br/>Switch</b> |                                |
| R4.2 RT                                   | R6.2 (linear)<br>R7.0 (rings)<br>R7.1 (rings)<br>R7.2 (rings)<br>R9.0 (rings)                                                                  | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0                | 5E10,<br>5E9.2¶ or<br>5E9.1**                                    | NA004††                    | R13                     | R1.7.2.2<br>EB1          | N/A                            |
| R4.3 RT                                   | R6.2 (linear)<br>R7.0 (rings)<br>R7.1 (rings)<br>R7.2 (rings)<br>R9.0 (rings)                                                                  | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0                | 5E10,<br>5E9.2¶ or<br>5E9.1**                                    | NA004††                    | R13                     | R1.7.2.2<br>EB1          | R2.0                           |
| R4.4 RT                                   | R6.2 (linear)<br>R7.0 (rings)<br>R7.1 (rings)<br>R7.2 (rings)<br>R9.0 (rings)<br>R9.1 (rings)<br>R11.0 (rings)<br>R11.1 (rings)<br>R13 (rings) | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0                | 5E10,<br>5E9.2¶ or<br>5E9.1**                                    | NA004††                    | R13                     | R1.7.2.2<br>EB1          | R2.1                           |

**Note:** The following list describes which switch generics are integrated TR-08 compatible:

- 5ESS switch, 5E1.2 and later
- DMS-100 switch
- EWSD switch, R9.0. The TR-303 software compatibility testing with the Siemens EWSD Switch was performed and documented by Siemens. Lucent Technologies assumes no responsibility for the software compatibility when the SLC-2000 Access System is used with the EWSD Switch.
- GTD-5 switch (not compatible with integrated TR-08 configurations).

\* SLC-2000 Access System will interface with OC-12 releases.

† Trademark of Northern Telecom, Ltd.

‡ Registered trademark of Siemens Aktiengesellschaft.

§ Registered trademark of GTE Corporation.

¶ 5E9.2 with BWM95-0005 (or higher).

\*\* 5E9.1 with BWM95-0004 (or higher). IDCU only for TR-303.

†† ECSM-100 interface operating with software release NA004 (or higher).

*Continued on next page*

**Table 8-7. SLC-2000 Access System Software Package Compatibilities (Continued)**

| <b>SLC®-2000<br/>Software<br/>Release</b> | <b>SONET Releases</b>                                                                                                           |                               | <b>ITH<br/>Package</b> | <b>TR-303 Integrated Applications—Switch<br/>Generics (Note)</b> |                            |                         |                          | <b>DDM-2000<br/>FiberReach</b> |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------|------------------------------------------------------------------|----------------------------|-------------------------|--------------------------|--------------------------------|
|                                           | <b>OC-3</b>                                                                                                                     | <b>OC-12*</b>                 |                        | <b>5ESS®<br/>Switch</b>                                          | <b>DMS-100†<br/>Switch</b> | <b>EWSD‡<br/>Switch</b> | <b>GTD-5§<br/>Switch</b> |                                |
| R4.5 RT                                   | R6.2 (linear)<br>R7.1 (rings)<br>R7.2 (rings)<br>R8.0 (linear)<br>R9.1 (rings)<br>R11.0 (rings)<br>R11.1 (rings)<br>R13 (rings) | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0                | 5E10,<br>5E9.2¶ or<br>5E9.1**                                    | NA004††                    | R13                     | R1.7.2.2<br>EB1          | R2.1<br>R3.0                   |
| R4.6 RT                                   | R6.2 (linear)<br>R7.1 (rings)<br>R7.2 (rings)<br>R8.0 (linear)<br>R9.1 (rings)<br>R11.0 (rings)<br>R11.1 (rings)<br>R13 (rings) | R2.2 (linear)<br>R3.1 (rings) | AT2.0.0                | 5E11SU,‡‡<br>5E10§§,<br>5E9.2¶ or<br>5E9.1**                     | NA004††                    | R13                     | R1.7.2.2<br>EB1          | R2.1<br>R3.0                   |

**Note:** The following list describes which switch generics are integrated TR-08 compatible:

- 5ESS switch, 5E1.2 and later
- DMS-100 switch
- EWSD switch, R9.0. The TR-303 software compatibility testing with the Siemens EWSD Switch was performed and documented by Siemens. Lucent Technologies assumes no responsibility for the software compatibility when the SLC-2000 Access System is used with the EWSD Switch.
- GTD-5 switch (not compatible with integrated TR-08 configurations).

\* SLC-2000 Access System will interface with OC-12 releases.

† Trademark of Northern Telecom, Ltd.

‡ Registered trademark of Siemens Aktiengesellschaft.

§ Registered trademark of GTE Corporation.

¶ 5E9.2 with BWM95-0005 (or higher). This release is not compatible with the VFDE feature.

\*\* 5E9.1 with BWM95-0004 (or higher). IDCU only for TR-303. This release is not compatible with the VFDE feature.

†† ECSM-100 interface operating with software release NA004 ( or higher).

‡‡ The 5ESS switch software release 5E11SU or later is required for the VFDE feature.

§§ The 5ESS switch software release 5E10 is not compatible with the VFDE feature



**NOTE:**

All network elements (NEs) in a ring or linear network, which may be part of a larger network, must be running the same (or compatible) software. For example, in a Release 7 OC-3 ring, you cannot have some nodes running DDM-2000 R7.0 while others are running DDM-2000 R7.1. Also, each SLC-2000 release is compatible only with specific DDM-2000 releases. For example, to interface a Release 7.1 OC-3 ring, the SLC-2000 Access System must be running Release 3.2 or later. In a maintenance subnetwork, which may be a mixture of ring and linear networks, all NEs must be running compatible software.

**SONET Subsystem Software Release R11 and R13  
Features Commonly Used in the SLC-2000 System**

Table 8-8 lists the features of SONET subsystem software release R11 and R13 available for use in the *SLC-2000* system. As shown in Table 8-7, R11 features are compatible with *SLC-2000* Software Release R3.2, R3.3, and R4.4 or later. R13 features are only compatible with *SLC-2000* Software Release R4.4 or later. For a detailed description of each feature, see 363-206-200, *DDM-2000 OC-3 and OC-12 Multiplexers; Applications, Planning and Ordering Guide*. Document 363-206-200 also contains a description of other features compatible with the *SLC-2000* system, but are not commonly used.

**Table 8-8. SONET Subsystem Software Release R11 and R13 Features Available for Use in the SLC-2000 System**

| <b>Feature</b>                                       | <b>SONET Subsystem Software Release</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Direct OC-12 Feeders                                 | R11                                     | This feature allows a <i>SLC</i> <sup>®</sup> -2000 ARM shelf containing 24G-U OLIUs in the MAIN slots to be a node in an OC-12 ring. This eliminates the need for a back-to-back DDM-2000 OC-12 multiplexer. Chapter 2 and 3 of this document explain this feature in detail.                                                                                                                                                                                                                                                                                                    |
| Native Mode LAN Interconnect (NMLI) Services Phase I | R11                                     | Using a BBG19 circuit pack in function group C, the ARM shelf can provide the necessary transport and bandwidth management capabilities to interface with external equipment to meet the business customer local area network (LAN) interconnect service needs. This allow the ARM shelf to provide the high level of reliability and availability for these services as is supported for all other premium business services, including full STS-1 path-switching in ring configurations, Ethernet, Token Ring, ATM, fiber distribution data interface (FDDI), Frame Relay, etc. |

*Continued on next page*

**Table 8-8. SONET Subsystem Software Release R11 and R13 Features Commonly Used in the SLC-2000 System (Continued)**

| <b>Feature</b>                              | <b>SONET Subsystem Software Release</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HighData-Rate Subscriber Line (HDSL)        | R13                                     | This feature provides an interface between the SLC-2000 ARM shelf and compatible <i>PairGain</i> * equipment at the customer premises. It allows the transport of T1 payloads (up to 12 kft) over two metallic twisted-pair lines. The feature supports applications for business customers, private network, cell sites, PBXs, customer premises equipment (CPE), and other applications. This feature is provided with the BBF8 circuit packs installed in the low-speed slots of the ARM shelf. |
| OC-1 FiberReach Ring Hosted by 26G2-U OLIUs | R13                                     | The 26G2-U OLIUs enhances the way an ARM shelf can be used to host an OC-1 FiberReach ring. It also allows cross-connects of DSX-1s from the DS1 low-speed packs into the OC-1 FiberReach ring without the use of a collocated WBS. This provides FITL access from the DT servers in the MDS assembly through the DS1 low speed packs to NBSs on the FiberReach ring. See Chapters 2 and 3 for a detailed description of this feature                                                              |
| DS3 Transmultiplexer (TMUX) Feature         | R13                                     | The TMUX feature allows the use of BBG20 circuit packs in function group C on the ARM shelf. These packs provide an economical means for collection of DS1s at different (or the same) network elements on the ring, and handoff of a fully groomed asynchronous DS3 to the interexchange carrier without the need for external M13 multiplexers.                                                                                                                                                  |

\* Registered trademark of PairGain Technologies, Inc.

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*Continued on next page*

**Table 8-8. SONET Subsystem Software Release R11 and R13 Features Commonly Used in the SLC-2000 System (Continued)**

| <b>Feature</b>                       | <b>SONET Subsystem Software Release</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stratum 3 Timing Generator (TG3)     | R13                                     | You can use BBF4 TG3 circuit packs in place of the BBF2B TGS circuit packs in the ARM shelf. One advantage of using the BBF4 TG3 is that while in the free-running mode, the TG3 derives timing from a high stability temperature-compensated, voltage-controlled crystal oscillator. This oscillator is capable of stratum 3 accuracy. See the "SONET Feeder Synchronization" section in this chapter for synchronization details. |
| Software Download through ITM SNC    | R13                                     | The SONET subsystem can accept software downloads from Lucent Technologies ITM SNC R5.0 when upgrading from R13 to later releases.                                                                                                                                                                                                                                                                                                  |
| Increased Number of Network Elements | R13                                     | Subnetwork sizes of up to 256 network elements are supported by subnetwork partitioning with multiple areas connected through Level 2 intermediate systems (IS).                                                                                                                                                                                                                                                                    |



## **Engineering**

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After determining the general service requirements such as the type of channel units/DS1 circuits required (see Chapter 4), divide the service area into applicable RT/HDT service mode configurations (TR-303, TR-08 Mode 1, TR-08 Mode 2, or a combination), select the feeder topology (SONET or metallic) and system configuration (Chapter 3), and decide what type of *SLC-2000* Access System RT/HDT enclosure (see Chapter 6) would best suit the service area. Determine the circuit packs that are needed and the COT/RT/HDT circuit pack options that must be set.

### **Remote Terminal Site**

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The RT location may be chosen based on existing or proposed plant configurations, economics, and functional requirements. It should provide a safe environment for parking as well as working. The site chosen should provide consistent, easy access and not be located in areas that are prone to flooding or constantly damp.

All RT sites require commercial single phase 120/240 V AC 60 Hz power service. Options are available to provide emergency power to the RT site during periods of extended AC power outage. See 915-710-115 for additional information on auxiliary powering.

The equipment configurations in the next section provide information on equipping *SLC-2000* circuit packs for various feeder, distribution, and test arrangements.

### **Equipment Configurations — ARM Shelf**

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#### **Minimum Configurations — SONET Feeder**

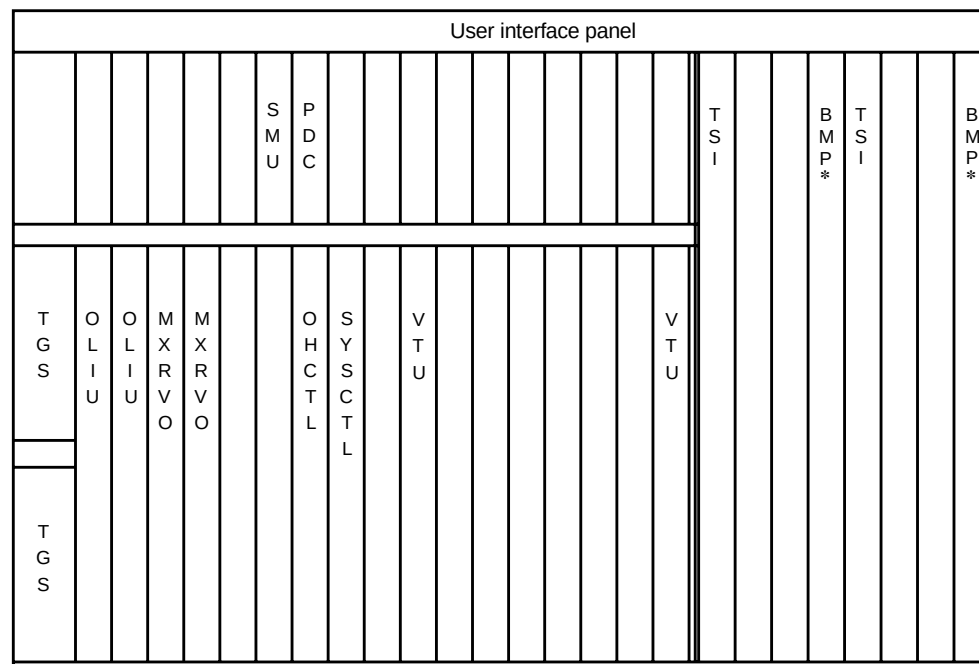
The minimum *SLC-2000* Access System configuration provides DS0 services and supports digital services through DS1 low-speed interfaces.

#### **Configuration for DS0 Services**

Figure 8-14 shows the ARM shelf with minimum start-up configuration for a *SLC-2000* Access System providing DS0 services. This configuration requires the following components:

- ARM shelf assembly (RT: J1C265AA-1 or COT: J1C265AD-1)
- Provisioning and display controller (PDC - BBF240 S3:3 for Release 3.1 and 3.2, BBF241 for Release 4.0 and later)
- System memory unit: SMU - BBF261 (Release 3.1 and later)

- Two time slot interchange units [TSI - *BDK250* circuit pack (Release 3.1 and later)]
- Two bandwidth management processors [BMP - *BDK270* circuit pack (Release 4.0 and later)]
- Two virtual tributary units (VTU - *BBG266*)
- User interface panel (404A UIP display panel)
- DDM-2000 SONET circuit packs
  - Two synchronization timing generators (TGS - *BBF2B*)
  - Two optical line interface units (OLIU - 21G-type, 21D-type, 22F, or 24G-U)
  - Two VT to STS-1 multiplexers (MXRVO - *BBG2*)
  - One SONET subsystem controller [SYSCTL (SONET R7.x and earlier—*BBG5*; SONET R9.0 and later—*BBG8*): DDM-2000 software must be ordered separately]
  - One overhead controller [OHCTL (SONET R7.x and earlier—*BBG7*; SONET R9.0 and later—*BBG9*)].



\* Release 4.0 or later

813847.eps

**Figure 8-14. ARM Shelf (Minimum Configuration for DS0 Services)**

The TGS, OLIU, MXRVO, VTU, and TSI/BMP core circuit packs are protected. Failures of the SMU, PDC, SYSCTL, and OHCTL do not affect call processing service and are not protected.

For Release 3.1 and Release 3.2, this minimum start-up configuration, with one service VTU and one protection VTU, can support up to 96 lines for TR-08 Mode 1 only operation. For TR-08 Mode 2 only operation, this minimum start-up configuration supports up to 192 lines.

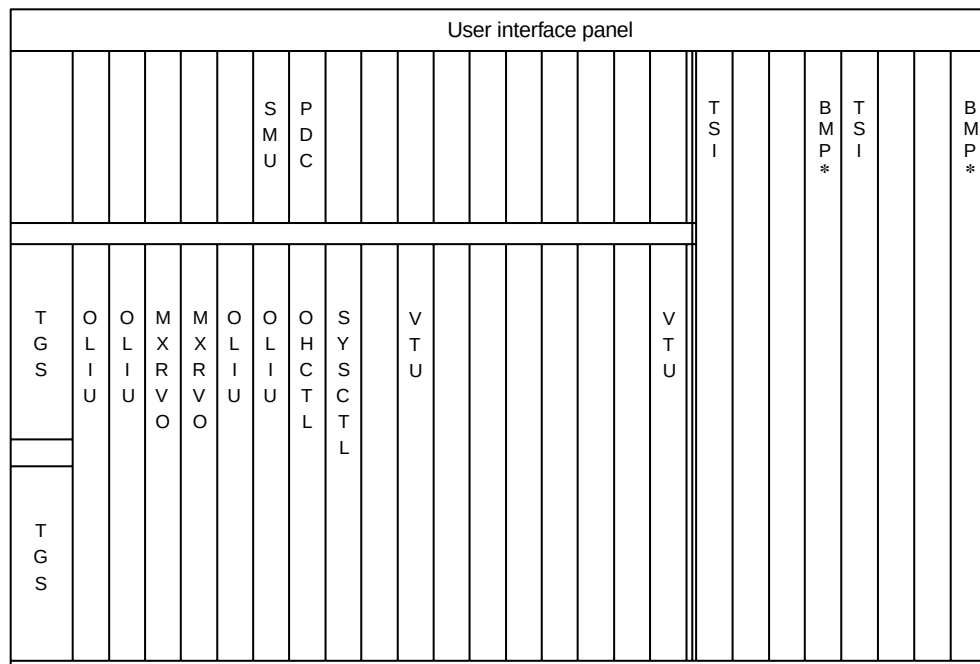
For Release 4.0 and later, this minimum start-up configuration, with one VTU, can also support TR-303 operation or mixed TR-08/TR-303 operation, depending on the cross-connections established. One VTU supports up to 96 DS0s; if the TR-303 interface is used, two DS1s (four DS0s) are required to support the EOC and TMC paths to the central office. Both the TSI/BMP core circuit packs are required to turn up the RT, even though TR-08 operation is provided only on the TSI circuit packs. For TR-303 only operation, this minimum start-up configuration can support up to 768 lines with a concentration of N:44 where N is the number of lines and 44 is the number of available DS0s in a minimal 2-DS1 TR-303 system.

This configuration is used in the SONET point-to-point or ring arrangement.

## Linear Drop (Taper) Applications

Figure 8-15 shows the minimum configuration for linear drop applications using SONET OC-3 feeder facilities. This configuration is the same as the minimum configuration for the RT with DS0 services except that two additional OLIUs are required. Two pairs of OLIU circuit packs are used, with each pair configured for service and protection. The main OLIU pair terminates the OC-3 feeder from the service node; the secondary OLIU pair [in the **FUNCTION (C)** group — Chapter 5] sends the OC-3 signal downstream to the next *SLC-2000* Access System or *DDM-2000* multiplexer in the line.

This configuration does not allow DS1 distribution because the **FUNCTION (C)** group has OLIUS (instead of MXRVOs) installed in it for the linear drop.



\* Release 4.0 and later

813856.eps

**Figure 8-15. ARM Shelf — Minimum Configuration for Linear Drop Applications**

### **Minimum Configurations — DSX-1 Feeder**

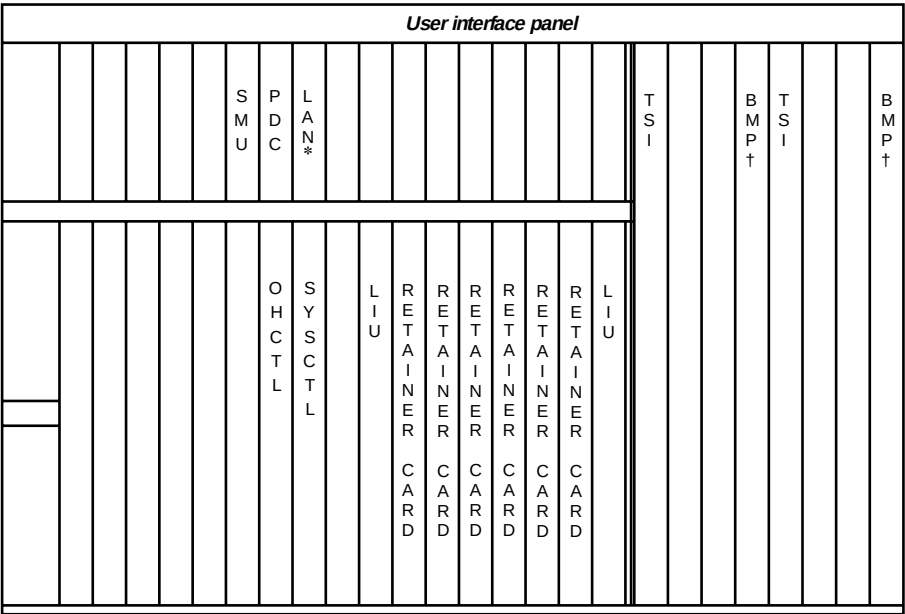
For Release 3.2 and later, the *SLC-2000* Access System offers a cost-effective method of getting started by providing a minimum configuration supported on a DSX-1 metallic feeder interface. This configuration is similar to the configuration for SONET feeder; however, the BBG267 LIUs replace the VTUs and no OLIU, MXRVO, or TGS circuit packs are used. The minimum configuration of one LIU supports the same interfaces and concentrations as the SONET configuration with one VTU. Retainer cards (BBG268) must be used if the protection LIU is equipped. This configuration can be used in the *SLC-2000* COT or RT/HDT.

### **Central Office Interface for DS0 Services**

Figure 8-16 shows the *SLC-2000* COT ARM shelf with minimum start-up configuration for DS0 services. It also shows the BBF250 link to alarms and networks (LAN) card that interfaces the 1A alarm and test unit (ATU) in the COT bay.

The TSI/BMP core circuit packs are protected. Failures of the SMU, PDC, SYSCTL, and OHCTL do not affect call processing service and are not protected.

This configuration is used in a T1 metallic facility arrangement. Protection for the DSX-1 feeder may be provided with an adjacent T1/DS1 repeater shelf.



\*Optional at the RT/HDT.  
† Release R4.0 or later

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**Figure 8-16. SLC<sup>®</sup>-2000 COT ARM Shelf with DSX-1 Feeder (Minimum Configuration for DS0 Service)**

## Maximum Configurations — SONET Feeder

### DS1 Digital Services and DS0 Services

Figure 8-17 shows the circuit packs required to support the maximum configuration for the *SLC-2000* COT or RT/HDT using a SONET feeder. This configuration supports the maximum number of lines shown in Table 8-1 on page 8-5 depending on the software release and the type of service distribution. This configuration also supports up to 28 DS1 pipes. In the maximum configuration, the *SLC-2000* RT/HDT supports combinations of zero to eight TR-08 VRTs and the following TR-303 VRTs depending on the software release:

- **Release 4.0 or Later:** 0 or 1 TR-303 VRT
- **Release 4.2 or Later:** 0, 1, or 2 TR-303 VRTs.

Each VRT may be configured as follows:

1. TR-08 Mode 1, no concentration
2. TR-08 Mode 2, concentration of locally switched VF circuits (RT only)
3. TR-303 interface (RT/HDT only), concentration based on engineering by the telephone company. (See the section on traffic engineering in this chapter.)

Additionally, INA feeder DS1s may be groomed to a digital cross-connect system or D-bank for nonswitched or nonlocally switched circuits.

This configuration is used in the SONET point-to-point arrangement.



<sup>†</sup> Release 4.0 or later (RT/HDT only)

**Figure 8-17. ARM Assembly (Maximum Configuration Including DS1 Digital Services and DS0 Services)**



### **Configuration for Hosting DDM-2000 FiberReach Wideband Shelves (WBSs) using Function Group C**

Figure 8-18 shows the ARM shelf configuration for hosting WBSs from Function Group C. This configuration allows the ARM shelf to host WBSs and eliminates the need for a DDM-2000 OC-3 shelf. However, when using this configuration, the ARM shelf cannot support the 28 DS1 pipes offered in most SONET fed configurations.



**NOTE:**

This configuration does **not** eliminate the need for a collocated WBSs when the HDT hosts a NBS through an OC-1 optical signal.

The ARM shelf hosts the WBSs by becoming part of the OC-1 ring through 27G2 OLIUs installed in Function Group C. This allows a connection for the alarm and support functions of the WBSs into the SONET nodes of the network.

To allow the ARM shelf to host the WBSs, install the following circuit packs in the ARM shelf as shown in Figure 8-18.

- **27G2-U OLIUs:** Install a 27G2-U OLIU in each of the two Function Group C slots (these slots normally contain MXRV0s). The 27G2-U OLIU will support two OC-1 rings.
- **BBF5 JMPR:** You must use these circuit packs with the older J1C265AA-1, L3 ARM shelf. They are not required in the J1C265AA-1, L4 ARM shelf. If needed for your ARM shelf application, install a BBF5 JMPR in slot 4 and slot P of the DS1 Low Speed section of the ARM shelf.



**NOTE:**

Figure 8-18 shows a ARM shelf using a SONET feeder (OLIUs in the MAIN slots) and the maximum 28 DS1 serving the DLC subsystem (7 VTUs and a protection VTU).

See Chapter 3 “System Configurations and Applications” for more information in this configuration. For details on the DDM-2000 FiberReach multiplexer, see Document 363-206-300, *DDM-2000 FiberReach Multiplexer*.

| User interface panel |                  |                  |                       |                       |                       |                       |                       |                            |  |             |             |             |                       |             |             |             |                       |             |  |  |  |                  |             |  |  |  |                  |
|----------------------|------------------|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------|--|-------------|-------------|-------------|-----------------------|-------------|-------------|-------------|-----------------------|-------------|--|--|--|------------------|-------------|--|--|--|------------------|
|                      |                  |                  |                       |                       |                       | S<br>M<br>U           | P<br>D<br>C           | L<br>A<br>N<br>*           |  |             |             |             | J<br>M<br>P<br>R<br>† |             |             |             | J<br>M<br>P<br>R<br>† | T<br>S<br>I |  |  |  | B<br>M<br>P<br>‡ | T<br>S<br>I |  |  |  | B<br>M<br>P<br>‡ |
|                      |                  |                  |                       |                       |                       |                       |                       |                            |  |             |             |             |                       |             |             |             |                       |             |  |  |  |                  |             |  |  |  |                  |
| T<br>G<br>S          | O<br>L<br>I<br>U | O<br>L<br>I<br>U | M<br>X<br>R<br>V<br>O | M<br>X<br>R<br>V<br>O | 2<br>7<br>G<br>2<br>U | 2<br>7<br>G<br>2<br>U | O<br>H<br>C<br>T<br>L | S<br>Y<br>S<br>C<br>T<br>L |  | V<br>T<br>U | V<br>T<br>U | V<br>T<br>U | V<br>T<br>U           | V<br>T<br>U | V<br>T<br>U | V<br>T<br>U |                       |             |  |  |  |                  |             |  |  |  |                  |
|                      |                  |                  |                       |                       |                       |                       |                       |                            |  |             |             |             |                       |             |             |             |                       |             |  |  |  |                  |             |  |  |  |                  |
|                      |                  |                  |                       |                       |                       |                       |                       |                            |  |             |             |             |                       |             |             |             |                       |             |  |  |  |                  |             |  |  |  |                  |
| T<br>G<br>S          |                  |                  |                       |                       |                       |                       |                       |                            |  |             |             |             |                       |             |             |             |                       |             |  |  |  |                  |             |  |  |  |                  |

\* Optional at the RT/HDT

† The BBF5 JMPR packs are required in the J1C265AA-1, L3 Arm Shelf

‡ Release 4.0 or later (RT/HDT only)

wbsfchst.eps

**Figure 8-18. ARM Shelf Configured to Host DDM-2000 FiberReach WBSs**

### **Configuration for Multiplexing DSX-1 Signals Onto an OC-1 Optical Ring 27G2-U OLIUs in the Main Slots (DSX-1 Metallic CO Interface Feeders Only)**

Figure 8-19 shows the configuraton for multiplexing DSX-1 signals from the Servers in the MDS assembly onto an OC-1 ring. It only applies to systems using DSX-1 metallic CO interface feeders. This configuration requires the following equipment and software:

- SLC-2000 Software Release R4.4 or later
- LIUs in the VTU/LIU feeder slots
- 27G2-U OLIUs in the two MAIN slots
- MXRV0s in the two Function Group C slots
- Function Group A slots empty
- DS1 low-speed circuit packs in the DS1 low-speed section of the ARM shelf (the number of DS1 low-speed packs is dependent on the number of servers supported — each pack can support up to four servers)
- SONET subsystem Software Release R9.1 or later.

This configuration allows you to eliminate the collocated DDM-2000 FiberReach WBS when the HDT is hosting a NBS through an OC-1 ring. The 27G2-U OLIUs also allow you to interface two separate OC-1 rings. This application also allows the ARM shelf to serve as a host for the DDM-2000 FiberReach WBSs in the OC-1 rings.

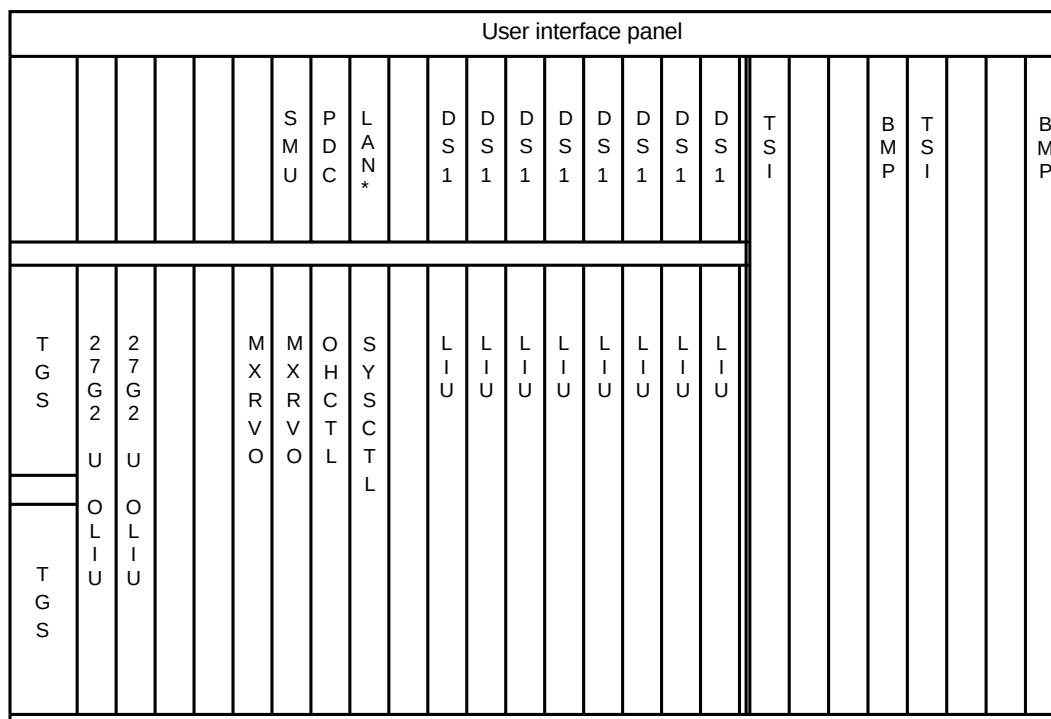


**NOTE:**

If the number of Servers needed for the two OC-1 FiberReach rings exceeds 28, then you must use an additional collocated WBS for one of the rings.

Because it requires the use of DSX-1 metallic CO interface feeders, the application is typically used when the HDT is collocated with the LDS.

See Chapter 3 “System Configurations and Applications” for more information on this configuration. For details on the DDM-2000 FiberReach multiplexer, see Document 363-206-300, *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*.



\* Optional at the RT/HDT

arm27g.eps

**Figure 8-19. ARM Shelf Configured to Multiplex DSX-1 Signals onto an OC-1 Ring 27G2-U OLIUs in the MAIN Slots — DSX-1 Metallic Feeders Only**

### **Configuration for Multiplexing DSX-1 Signals onto an OC-1 Optical Ring Using Function Group C — J1C265AA-1, L4 ARM Shelf**

Figure 8-20 shows the configuraton for multiplexing DSX-1 signals from the Servers in the MDS assembly onto an OC-1 ring. This configuration requires the following equipment and software:

- J1C265AA-1, L4 ARM shelf
- SLC-2000 Software Release R4.4 or later
- 26G2-U OLIUs in the two Function Group C slots
- DS1 low-speed circuit packs in the DS1 low-speed section of the ARM shelf (the number of DS1 low-speed packs is dependent on the number of servers supported — each pack can support up to four servers)
- SONET subsystem Software Release R13 or later.

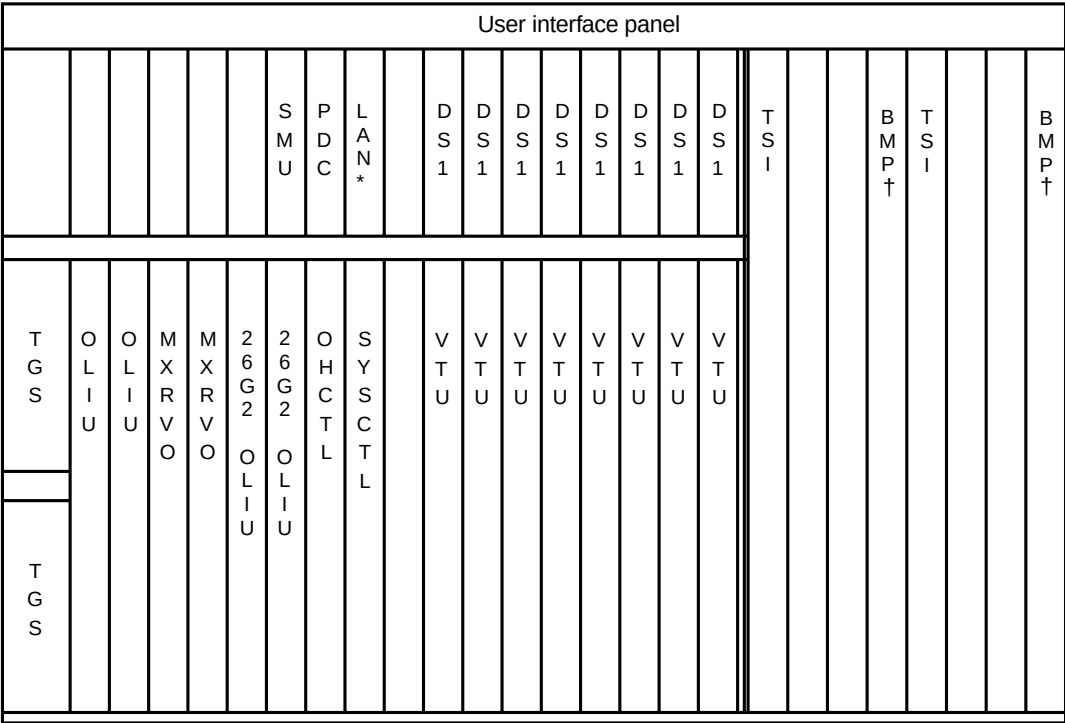
This configuration allows you to eliminate the collocated DDM-2000 FiberReach WBS when the HDT is hosting a NBS through an OC-1 ring. It also allows the ARM shelf to serve as a host for the DDM-2000 FiberReach WBSs in one OC-1 ring.



**NOTE:**

Figure 8-20 shows a ARM shelf using a SONET feeder (OLIUs in the MAIN slots) and the maximum 28 DS1 serving the DLC subsystem (7 VTUs and a protection VTU).

See Chapter 3 “System Configurations and Applications” for more information on this configuration. For details on the DDM-2000 FiberReach multiplexer, see Document 363-206-300, *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*.



\* Optional at the RT/HDT

† Release 4.0 or later (RT/HDT only)

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**Figure 8-20. ARM Shelf Configured to Multiplex DSX-1 Signals onto an OC-1 Ring with 26G2-U OLIUs in Function Group C — J1C265AA-1, L4 ARM Shelf**

## **Equipment Configurations — MDS Assembly — Metallic Distribution**

---

### **Minimum Metallic Configuration**

Figure 8-21 shows the minimum metallic configuration for the MDS assembly. It supports up to 96 lines for DS0 services. The components required for the MDS assembly minimum configuration for TR-08 applications are the following:

- MDS assembly (RT: J1C265AB-1 or COT: J1C265AE-1)
- Two metallic distribution controllers (MDCs - *BDJ*®240 circuit pack)
- Two TR-08 processing units (T8Us - *BDJ* 205 circuit pack) (not required for TR-303)
- Two power and test units (PTUs - *BDJ* 200 circuit pack)
- One to 24 channel units (installed as needed; see Chapter 11 for channel unit codes).

The PTU, MDC, and T8U circuit packs are not protected; however, failure of a unit is alarmed and reported to the system. If one of these cards fails, the failure group (maximum number of lines affected) is 48 lines.

In a TR-303 system, no T8U circuit packs are required. In a TR-08 system, the T8U circuit packs *are* required. In a mixed configuration, the T8U circuit pack may be required as follows:

- The T8U circuit packs are optional in MDS shelf assemblies that are DS0 cross-connected to the TR-303 VRT as long as no TR-08 lines are checkerboarded into the TR-303 VRT.
- If a channel unit in an MDS assembly is checkerboarded to a TR-08 VRT, the data link function of the T8U is provided in the MDS assembly to which the channel unit is checkerboarded. See Chapter 3 for details on mixed configurations and checkerboarding.

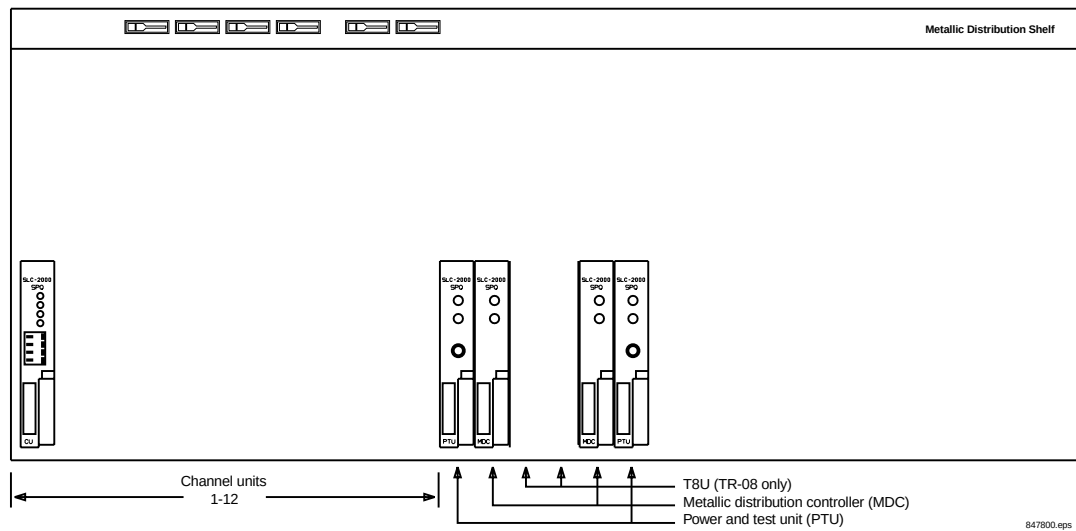


**Figure 8-21. MDS Assembly (Minimum Configuration for DS0 Services in TR-303 Applications)**



## Maximum Configuration

Figure 8-22 shows a fully equipped MDS assembly for metallic distribution, which supports up to 192 lines. This configuration requires four of each common unit (four MDCs and PTUs) and 1 to 48 channel units. The T8Us are required if the MDS assembly is supporting the TR-08 interface.

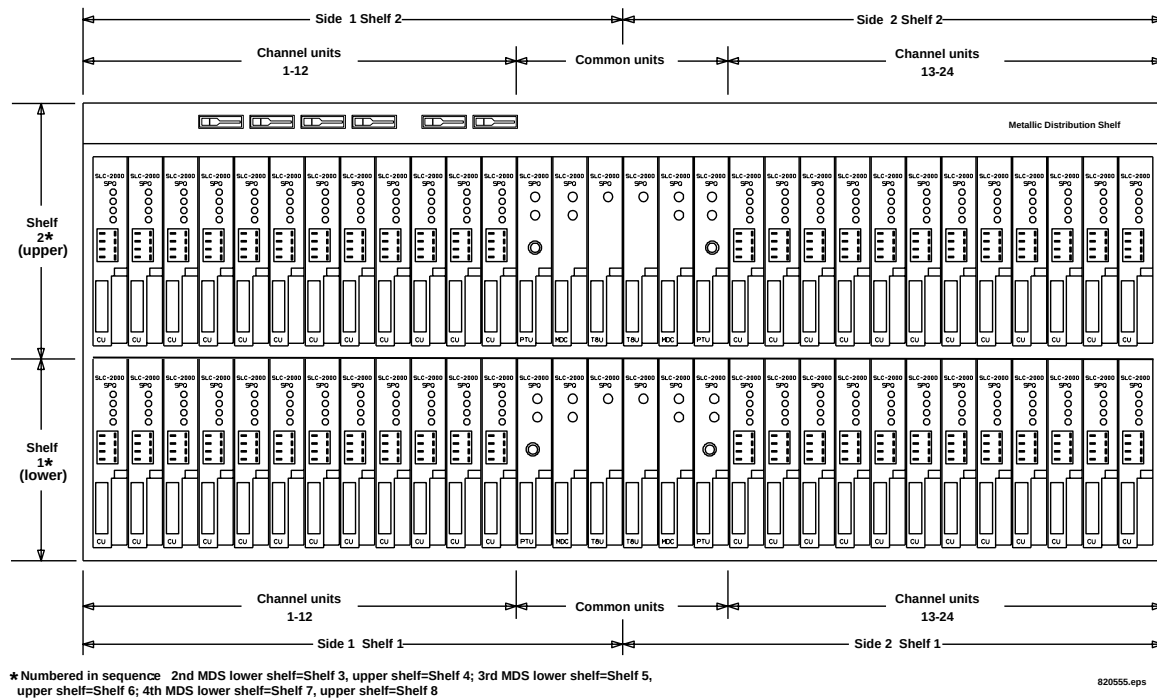


**Figure 8-22. MDS Assembly (Fully Equipped for TR-303 Applications)**

## Equipment Configurations — MDS Assembly — Fiber Distribution

The MDS assembly is equipped with common units and appropriate MSDT or DT Servers (*SPQ808*, *SPQ809*, *SPQ810*, or *SPQ811* units) for FITL configurations. Table 8-9 shows which MSDT or DT Server is compatible with the features offered by the specific software release when hosting either an MSDT or an NBS.

**Table 8-9. MSDT or DT Server Selection for Compatibility with Features of Specific Software Releases**

| <b>SLC<sup>®</sup>-2000<br/>Software<br/>Release</b> | <b>ONU Type</b>           |               |                                             |                                             |
|------------------------------------------------------|---------------------------|---------------|---------------------------------------------|---------------------------------------------|
|                                                      | <b>SPQ<sup>®</sup>808</b> | <b>SPQ809</b> | <b>SPQ810</b>                               | <b>SPQ811</b>                               |
| R3.1                                                 | MSDT                      | MSDT          | N/A                                         | N/A                                         |
| R3.2                                                 | MSDT                      | MSDT          | N/A                                         | N/A                                         |
| R4.0                                                 | —                         | MSDT          | N/A                                         | N/A                                         |
| R4.1                                                 | —                         | MSDT          | N/A                                         | N/A                                         |
| R4.2                                                 | —                         | MSDT          | N/A                                         | N/A                                         |
| R4.3                                                 | —                         | MSDT<br>NBS   | N/A                                         | N/A                                         |
| R4.4                                                 | —                         | MSDT          | NBS (Quad Mode)<br>NBS (Octet Mode)         | NBS (Quad Mode)<br>NBS (Octet Mode)         |
| R4.5                                                 | —                         | MSDT          | MSDT<br>NBS (Quad Mode)<br>NBS (Octet Mode) | MSDT<br>NBS (Quad Mode)<br>NBS (Octet Mode) |
| R4.6                                                 | —                         | —             | —                                           | MSDT<br>NBS (Quad Mode)<br>NBS (Octet Mode) |

Each Server supports 12 or 24 subscriber loops for DS0 services. Fiber distributed services can use one of the following ONUs depending on the software release:

- **Release 2.0 and later** — *SLC-2000* MSDT
- **Release 4.3 and later** — *SLC-2000* MSDT and/or *DDM-2000* FiberReach Narrowband Shelf.

In addition to the MSDT or DT Server, the FITL configuration requires the J1C265AC-1, L3 high-density optics shelf (HDOS) with optically hosting a *SLC-2000* MSDT.

For more information, refer to the following documents:

- 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service, and Ordering Guide.*
- 363-206-300, *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide.*

## Minimum FITL Configuration

Figure 8-23 shows the minimum FITL configuration in the MDS assembly. The components required for the MDS assembly minimum configuration for FITL in TR-303 applications are the following:

- MDS assembly (J1C265AB-1)
- Two metallic distribution controllers (MDCs - *BDJ 240* circuit pack)

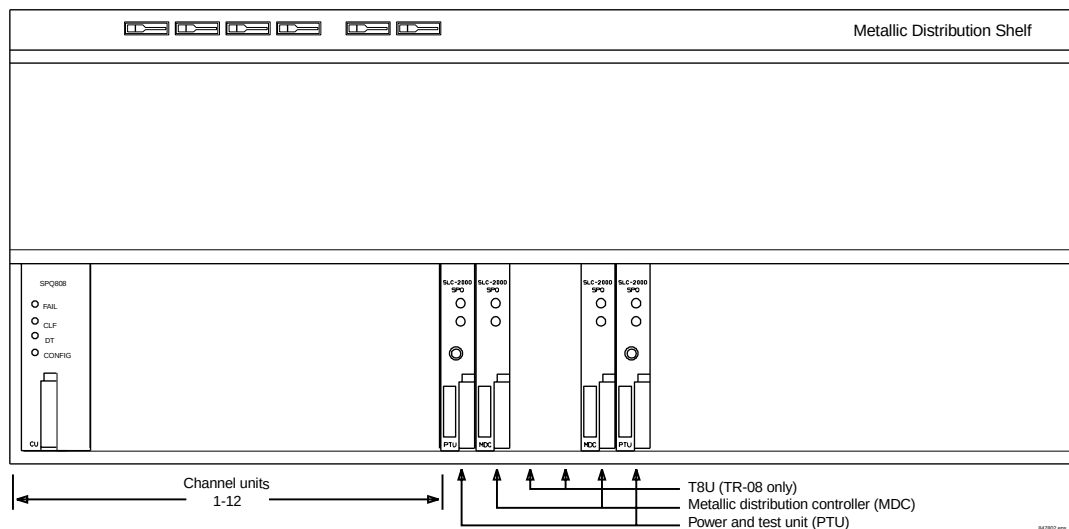


**Figure 8-23. MDS Assembly (Minimum Configuration for FITL Distribution in TR-303 Applications)**

- Two power and test units (PTUs - *BDJ 200* circuit pack)
- One MSDT or DT Server (*SPQ808*, *SPQ809*, or *SPQ810* unit), provisioned for 12 or 24 lines.

The T8Us (not shown) are required if the MDS assembly is supporting the TR-08 interface.

The Server and common circuit packs are not protected; however, failure of a unit is alarmed and reported to the system. If one of these cards fails, the failure group (maximum number of lines affected) is 24 lines.

## Maximum FITL Configuration (Release 4.4 or Earlier)

Figure 8-24 shows the maximum FITL configuration in the MDS assembly for Software Release 4.4 or earlier. This configuration is similar to the minimum configuration except for the following:

- Four MDCs
- Four T8Us (for TR-08 applications)
- Four PTUs
- Eight or 16 *SPQ808*, *SPQ809*, or *SPQ810* MSDT or DT Servers, depending on how the server is provisioned (12 or 24 lines).

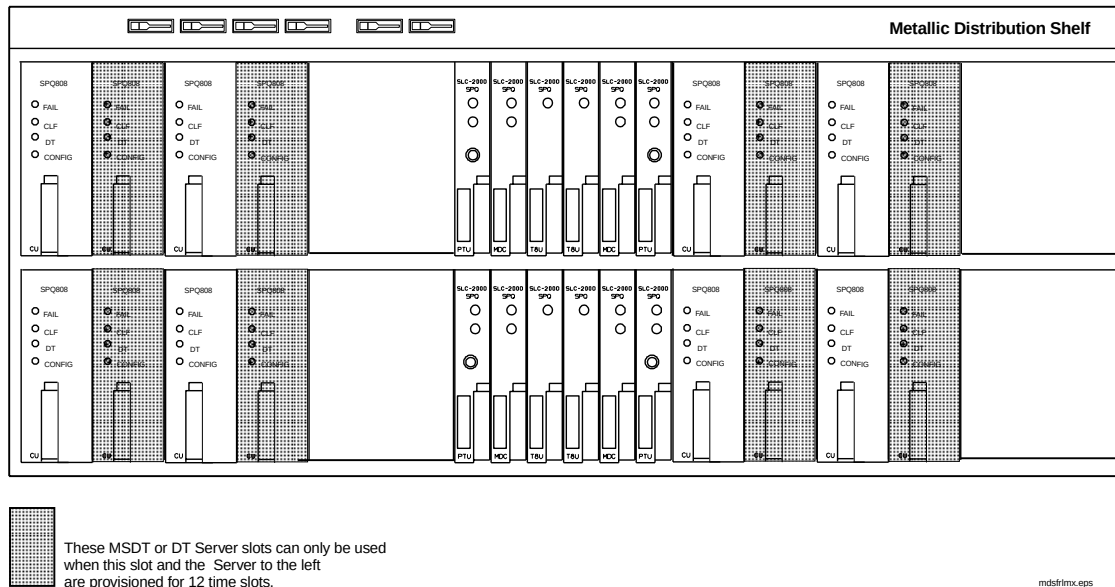


**Figure 8-24. MDS Assembly Fully Equipped for FITL Distribution (Release 4.4 or Earlier)**

The Server and common circuit packs are not protected; however, failure of a unit is alarmed and reported to the system. If one of these cards fails, the failure group (maximum number of lines affected) is 48 lines.

### **Maximum FITL Configuration (Release 4.5 or Later)**

Figure 8-25 shows the maximum FITL configuration in the MDS assembly for Software Release 4.5 or later. This configuration is similar to the minimum configuration except for the following:

- Four MDCs
- Four T8Us (for TR-08 applications)
- Four PTUs
- Eight or 16 *SPQ809*, *SPQ810*, or *SPQ811* DT Servers, depending on how the server is provisioned (12 or 24 lines)
- Additional DT Servers as follows depending on the software release and server type:
  - **Software Release R4.5:** *SPQ810* only — Two additional 12 - or 24-line DT Servers in slots 9 and 21 of each shelf in the MDS assembly.
  - **Software Release R4.6 or later:** *SPQ810* Server — Two additional 12 - or 24-line DT Servers in slots 9 and 21 of each shelf in the MDS assembly. *SPQ811* Server — Two additional 24-line DT Servers in slots 9 and 21 of each shelf in the MDS assembly. Four additional 12-line DT Servers in slots 9,11,21, and 23 of each shelf in the MDS assembly.

The Server and common circuit packs are not protected; however, failure of a unit is alarmed and reported to the system. If one of these cards fails, the failure group size (maximum number of lines affected) is 72 lines.



**Note:** 12-line Servers are allowed in slots 11 and 23 only with Software Release R4.6 and only if using an SPQ811 Server.

fitl46.eps

## **Equipment Configurations for Loop Testing**

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The *SLC-2000* Access System provides test access to its subscriber circuits both externally and internally, through interfaces to external remote testing [remote measurement unit (RMU) or bypass pair], external local testing, and to internal test capabilities, ranging from PGTC terminations to a full-scale internal test capability. The configurations that support testing include the following:

- POTS circuits configured in a metallic application
- POTS circuits configured in a fiber application (MSDT/V-MSDT/V-DT)
- Special service circuits configured in a metallic application.

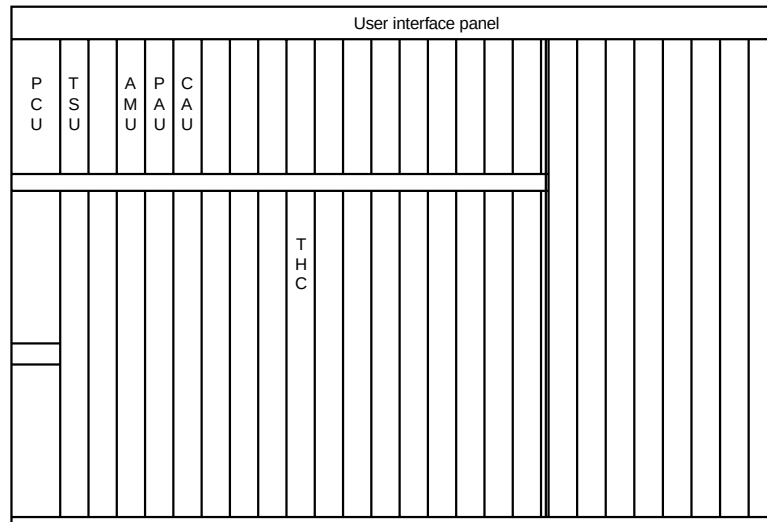
### **ARM Shelf — Integral Test Head (ITH)**

The ITH subsystem is an optional part of the *SLC-2000* Access System that provides a range of test features for TR-08 systems and can be configured by the customer according to local testing needs. Features provided by the ITH in TR-08 systems include:

1. Drop test capability, eliminating the need for a bypass pair. This feature is intended to test the 2-wire drops of locally switched lines with PGTC-like testing of the channel units as provided by the PTU in the *SLC-2000* Access System MDS assembly.
2. Local test access to *SLC-2000* Access System subscriber circuits comparable to that provided by the *SLC* Series 5 system craft interface unit (CIU). Using an ASCII terminal and test equipment comparable to that used with the *SLC* Series 5 CIU, a technician can access and test both locally switched and nonlocally switched subscriber circuits and can provision nonlocally switched special services circuits. Features and access are comparable to those provided by the CIU.

The ITH circuit packs are installed in the ARM shelf (Figure 8-26).

The ITH circuit packs are not service affecting and are not protected. The ITH is equipped with different circuit packs depending on the application as listed in Table 8-10.



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**Figure 8-26. ARM Shelf Assembly with the ITH Option****Table 8-10. Required ITH Circuit Packs by Application (TR-08 Systems Only)**

| ITH Circuit Pack                                                              | MLT-2 | Local Test Access |
|-------------------------------------------------------------------------------|-------|-------------------|
| Test head controller (THC - BBG220) (contains software for the ITH subsystem) | X     | X                 |
| Power converter unit (PCU - BBF220)                                           | X     | X                 |
| Analog measurement unit (AMU - BBF221)                                        | X     |                   |
| Power amplifier unit (PAU - BBF222)                                           | X     |                   |
| Transmission signaling unit (TSU - BBF223)                                    | X     |                   |
| Craft access unit (CAU - BBF225)*                                             |       | X                 |

\* If the ITH is equipped for local test access (with the CAU), external remote test unit access will be blocked. However, installing dummy bantam plugs (Chapter 11) in the UIP jacks T/R - CHAN and DROP, T1/R1 - CHAN and DROP, and E/M - CHAN (five plugs total) will enable external remote testing. When local test access is needed, the plugs may be removed temporarily to use the jacks but must be replaced as soon as local testing is completed to restore external remote test access.



## External Test Equipment Configurations

The *SLC-2000* Access System has the capabilities required by TR-08 and TR-465\* of DLC systems for channel and drop testing performed by remote measurement units (RMUs). Specifically, the *SLC-2000* Access System works with the Teradyne *4TEL*† RMU supporting a single *SLC-2000* Access System or multiple *SLC-2000* Access Systems using the line test fanout (LTF) unit. The LTF allows a single RMU to provide routine drop and channel testing services for up to eight RTs. Figure 8-27 shows a system configuration using an external test head.

The external test equipment and supporting hardware (LTF and the mediation device) require –48 V power. This is provided by an optional auxiliary fuse panel, which may be ordered from Reliance Com-Tech as follows:

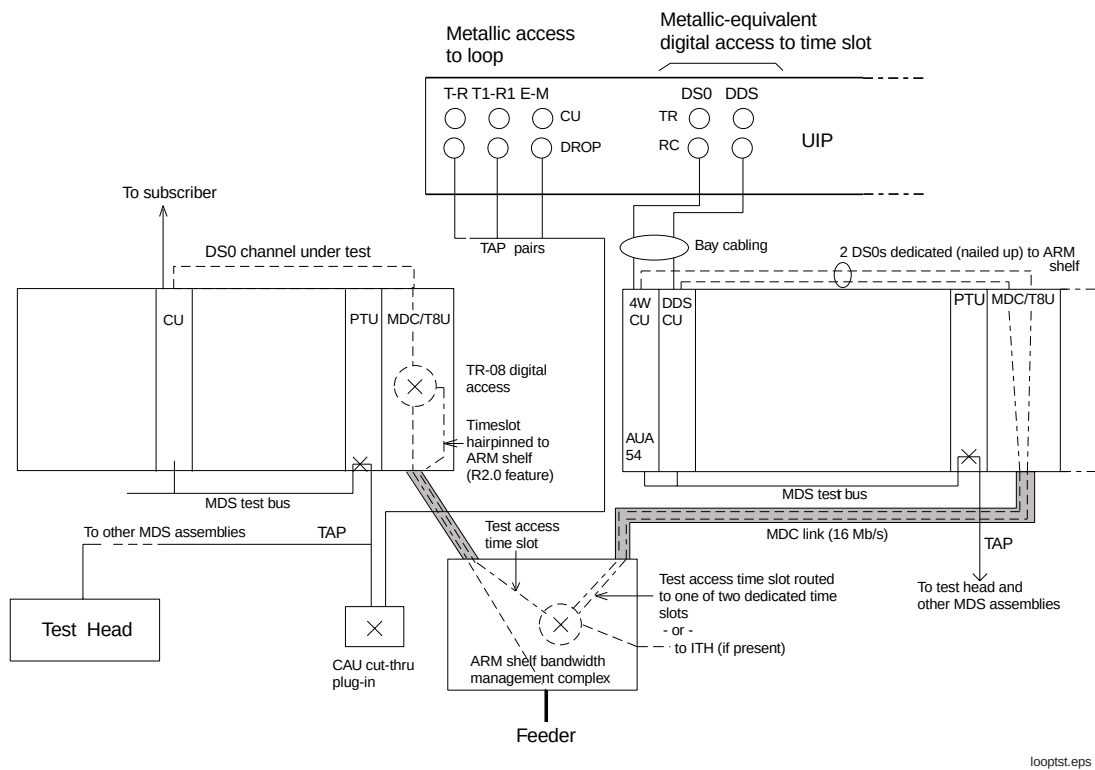
Transmission Systems Division of Rel-Tec  
P.O. Box 919  
Bedford, TX 76095  
(817) 540-8278

Part# 41-108-96

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\* Bellcore Technical Reference TR-TSY-000465, Issue 2, April, 1987, *Interface Between Loop carrier Systems and Loop Testing Systems*.

† Registered trademark of Teradyne, Inc.



looptst.eps

**Figure 8-27. Local Access with External Test Head**

## 4TEL RMU Configuration

The cabling/equipment needed to support these testing configurations for an RT bay is listed in Table 8-11 and Table 8-12. Figure 8-28 and Figure 8-29 show the connections for these configurations:

**Table 8-11. Cabling/Equipment for Test Configuration with a 4TEL RMU Supporting One SLC-2000 Access System**

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**Equipment:**

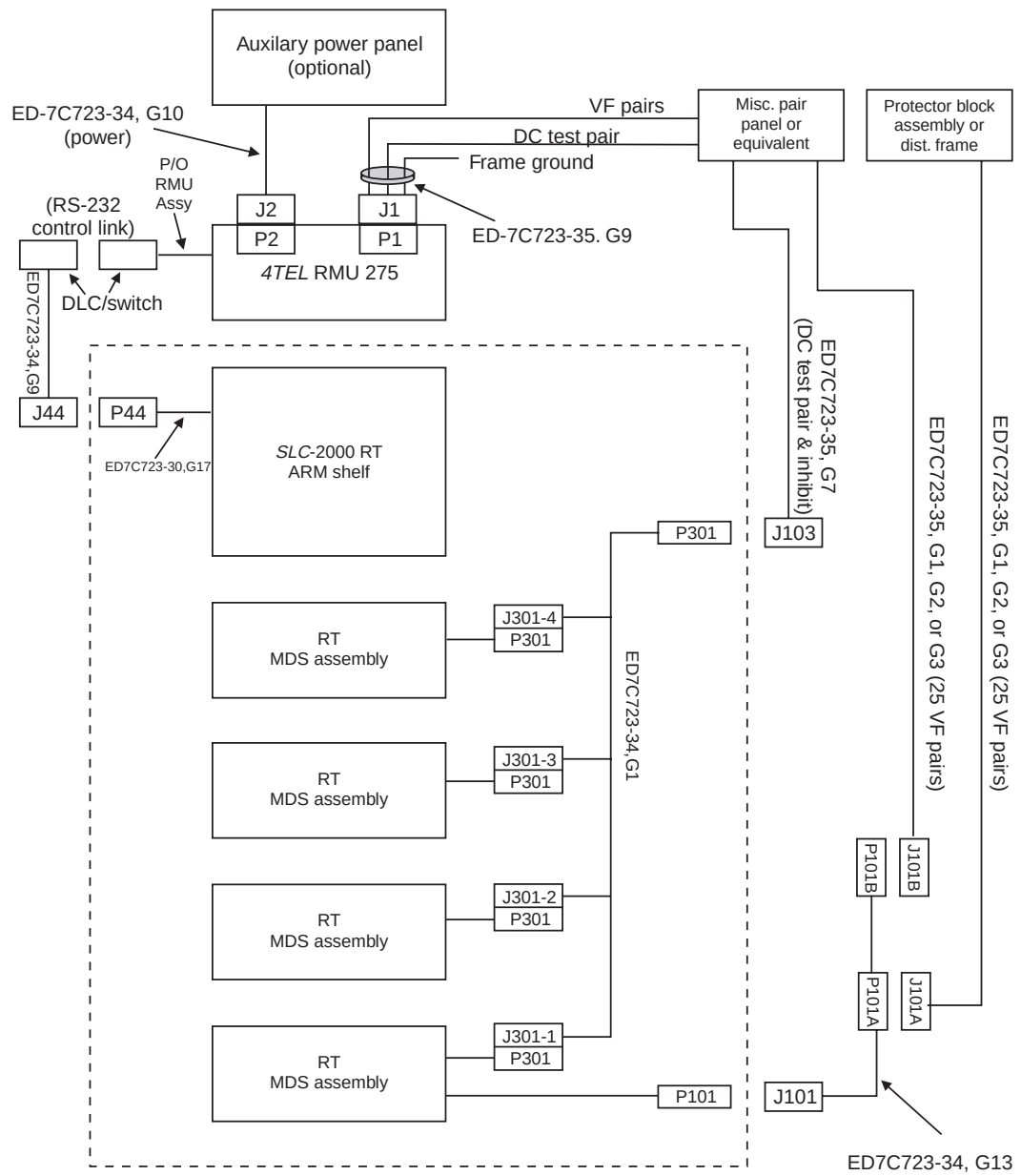
- 4TEL RMU 275
- Reliance Fuse Panel (Optional) (Part# 41-108-96)

---

**Cabling:**

| ED Number   | Group       | Description                                                                                                                                                        |
|-------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ED-7C723-30 | G17         | One per ARM shelf. Provides EIA-232 control link ARM shelf dangler.                                                                                                |
| ED-7C723-34 | G9          | One per 4TEL RMU.<br>Provides EIA-232 control link cable between RMU and ARM shelf.                                                                                |
| ED-7C723-34 | G10         | One per 4TEL RMU.<br>Used only with Reliance Fuse Panel to provide power to RMU.                                                                                   |
| ED-7C723-35 | G7          | One per SLC-2000 system.<br>Connects DC test pair and inhibit from RT bay to cross-connect point.                                                                  |
| ED-7C723-35 | G9          | One per 4TEL RMU.<br>Connects communications and DC test pair from RMU to cross-connect points.                                                                    |
| ED-7C723-35 | G1, 2, or 3 | Optional. One per SLC-2000 system.<br>Connects 25 VF pairs from MDS #1 to cross-connect to points for RMU communications pairs.                                    |
| ED-7C723-34 | G13         | Optional: One per system. Allows the MDS #1 25-pair VF leads to be connected to the protector block or distribution panel and to a miscellaneous pair panel (MPP). |

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4telrum.eps

Figure 8-28. 4TEL RMU Connections to the SLC-2000 Access System

**Table 8-12. Cabling/Equipment for Test Configuration with a 4TEL RMU Supporting Multiple SLC-2000 Access Systems**

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**Equipment:**

- 4TEL RMU 275
- Reliance Fuse Panel (Optional) (Part# 41-108-96)
- Lucent Technologies Line Test Fanout (LTF)

---

**Cabling:**

| ED Number      | Group       | Description                                                                                                                                                                                                                                                                                                                        |
|----------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ED-7C723-30    | G17         | One per ARM shelf. Provides EIA-232 control link ARM shelf dangler.                                                                                                                                                                                                                                                                |
| Cable Assembly | —           | Already provided — EIA-232 control link cable between RMU and LTF. (Comcode 846823763)                                                                                                                                                                                                                                             |
| ED-7C723-34    | G10         | One per 4TEL RMU.<br>Used only with Reliance Fuse Panel to provide power to the RMU.                                                                                                                                                                                                                                               |
| ED-7C723-34    | G11         | One per LTF.<br>Used only with Reliance Fuse Panel to provide power to the LTF.                                                                                                                                                                                                                                                    |
| ED-7C723-35    | G7          | One per SLC-2000 system.<br>Connects DC test pair and inhibit from RT bay to cross-connect point.                                                                                                                                                                                                                                  |
| ED-7C723-35    | G9          | One per 4TEL RMU.<br>Connects communications and DC test pair from RMU to cross-connect points.                                                                                                                                                                                                                                    |
| ED-7C723-35    | G1, 2, or 3 | Optional. One per SLC-2000 system.<br>Connects 25 VF pairs from MDS #1 to cross-connect to RMU communications pairs.                                                                                                                                                                                                               |
| VA-02706-XX    | —           | One per SLC-2000 system up to eight per LTF.<br>EIA-232 control link cable between each SLC-2000 system and the LTF.<br>"XX" is the length (in feet) to be specified by the engineer/customer.<br>This cable may be ordered from:<br>Freedom Electronics, Inc.<br>268 Cliffwood Ave.<br>Cliffwood, NJ 07721-1599<br>1-800-221-1377 |
| ED-7C723-34    | G13         | Optional: One per system.<br>Future cable for added flexibility; allows the MDS #1 25-pair VF leads to be connected to the protector block or distribution panel and to an MPP.                                                                                                                                                    |
| ED-7C723-34    | G14         | One per SLC-2000 system as required.<br>Multiples adjacent SLC-2000 system TAP buses.                                                                                                                                                                                                                                              |

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## Internal Test Access Paths (TAPs)

The test access path (TAP) is a 12-conductor metallic test bus in the *SLC-2000* RT/HDT that allows full-split access by the RMU to most subscriber drops terminated on channel units installed in MDS assemblies in the system. There are two TAPs in the RT/HDT, TAP-A and TAP-B, and both can be connected to any channel unit slot within the system. TAPs of collocated *SLC-2000* Access Systems can be connected together (multiplied) to increase the metallic access span of an RMU to multiple systems.

Software Release 4.2 and later supports *multihosting* configurations. In these configurations, you may need to provide test access from two LDSs that are not co-located. In this situation, you must share test access paths (TAPs) using one of the following methods:

- If two sets of *bypass repeaters* are used, connect the two LDSs with a single test access path using two separate bypass pairs.
- Connect each LDS with a separate test access path ( for example, TAP-A connected to LDS #1, TAP-B connected to LDS #2).



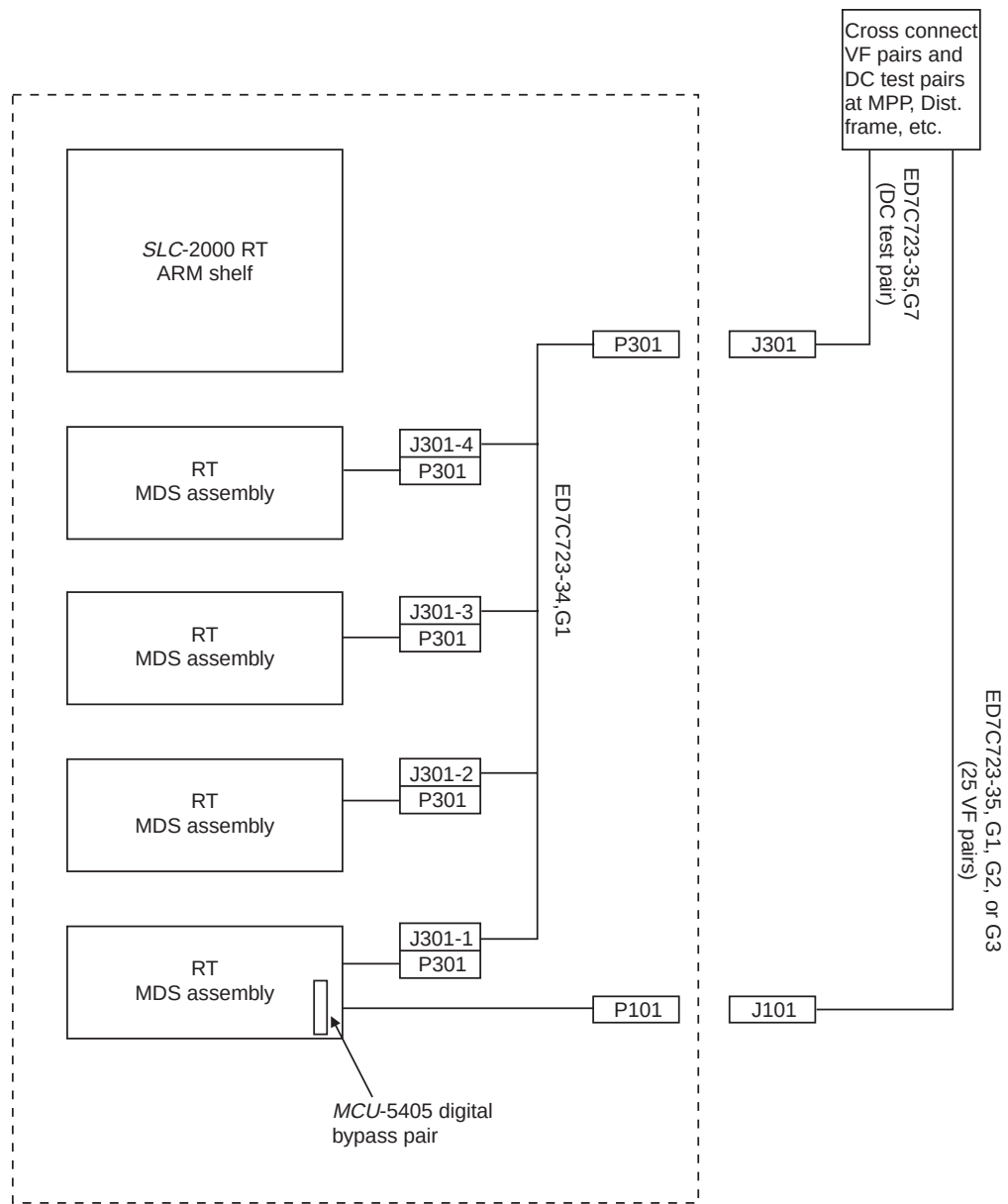
**NOTE:**

The second method requires that the LDSs have the capability to choose the test access path that it is going to use. ***Not all LDSs have this capability.***

## Drop Testing with the Tollgrade MCU5405 Channel Unit

The digital bypass pair channel units manufactured by Tollgrade allow testing of metallic POTS and other locally switched circuits. The *MCU5405* channel unit is equipped in the RT and the *SLC-2000* COT, or a corresponding *MCU4496/4496ER* channel unit equipped in a *SLC-96* COT or D4 channel bank. The *MCU5405* uses two DS0 time slots that must be handled as nonswitched special service circuits between the two channel units. The *MCU5405* is not supported in the MSDT.

Figure 8-30 shows the test connections using the *MCU5405* digital bypass pair.



5405tst.eps

**Figure 8-30. Test Connections Using the MCU5405 Digital Bypass Pair**



## Lucent/Tautron ngRTH Test Head

The cabling/equipment needed to support the Tautron *ngRTH*\* test head for a testing configuration in an RT (Software Release R3.2 and R4.5 or later) or COT (Software Release R3.3.1 or later) is listed in Table 8-13 (90A cabinet) and Table 8-14 (bay mount). To connect the *ngRTH* test head to the *SLC-2000* system, you must select a cable from the tables for your specific configuration for each of the following connections:

- Power and Ringing connections
- Analog connections
- Digital connections
- MTAU connections.

The following tables and figures show the connections for the 90A cabinet configuration and the bay mount configuration :

- **90A Cabinet Mount:** Table 8-13 and Figure 8-31
- **Bay Mount:** Table 8-14 and Figure 8-32.

**Table 8-13. Cables for Connecting the *ngRTH* Test Head to the *SLC-2000* System — 90A Cabinet**

| Tautron Part Number (Note) | Description                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 955-7000123*               | (COMCODE 407764893) Power and ringing cable that connects J12 and J15 of the <i>ngRTH</i> † test head (power and ringing) to J302-C of the <i>SLC-2000</i> system. (4 ft.)                                                                                                                                                                                                                                          |
| 955-7000124*               | (COMCODE 407764901) Connects from <i>ngRTH</i> test head analog connector J14 to the <i>SLC-2000</i> TAP connection P301 and provides access for 2 VF lines through two RJ11 jacks: one for MLT control and one for monitor/talk. (6 ft.)                                                                                                                                                                           |
| 955-7000xxx126             | The system requires two of these "VF Cables." Each cable has an RJ11 plug at one end and a twisted pair jumper wire on the other end. One cable connects from the voice frequency MLT connector of the <i>ngRTH</i> cable to the Miscellaneous Distribution Frame (MDF). The other cable connects from the voice frequency Talk/Monitor connector of the <i>ngRTH</i> cable to the MDF. (Customer specifies length) |
| 955-7000107*               | (COMCODE 407764877) Digital cable that connects to J13 of the <i>ngRTH</i> test head and provides separate connectors for MTAU control, TL1 input, and alarms. (4 ft.)                                                                                                                                                                                                                                              |
| 955-7000003108*            | (COMCODE 407764885) Connects from the MTAU connector on the digital cable (955-7000107) to J44 on the <i>SLC-2000</i> system (3 ft.)                                                                                                                                                                                                                                                                                |

**Note:** When ordering cable from Tautron Inc., substitute desired length in feet for "xxx" in the part number.

\* This cable can be ordered from Lucent Technologies using the comcode number shown.

† Trademark of Tautron, Inc.

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\* Trademark of Tautron Inc.

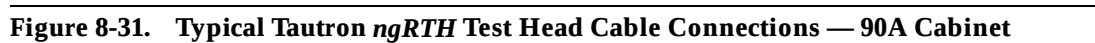


**Table 8-14. Cables for Connecting the *ngRTH* Test Head to the *SLC-2000* System — Bay Mounted**

| <b>Tautron Part Number (Note)</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 955-7000xxx037                    | Brings out -48VDC, battery return, frame ground, and measurement ground connections from J12 of the <i>ngRTH</i> * test head to the power source. (Customer specifies length — raw-ended.)                                                                                                                                                                                                                                                                                                     |
| 955-7000xxx038                    | Brings out + and - ringing and ringing return connections from J15 of the <i>ngRTH</i> test head to the ringing source. (Customer specifies length — raw-ended.)                                                                                                                                                                                                                                                                                                                               |
| 955-7000079                       | Connects from <i>ngRTH</i> test head analog connector J14 to the <i>SLC-2000</i> TAP connection P301 and provides access for 2 VF lines through two RJ11 jacks: one for MLT control and one for monitor/talk. (10 ft.)                                                                                                                                                                                                                                                                         |
| 955-7000051                       | Connects from <i>ngRTH</i> test head analog connector J14 to the <i>SLC-2000</i> TAP connection P301 and provides access for 2 VF lines through two RJ11 jacks: one for MLT control and one for monitor/talk. (20 ft. — used in place of the 955-7000079 when a longer cable is needed)                                                                                                                                                                                                        |
| 955-7000xxx126                    | The system requires two of these "VF Cables." Each cable has an RJ11 plug at one end and a twisted pair jumper wire on the other end. One cable connects from the voice frequency MLT connector of the <i>ngRTH</i> cable to the MDF. The other cable connects from the voice frequency Talk/Monitor connector of the <i>ngRTH</i> cable to the MDF. (Customer specifies length)                                                                                                               |
| 955-7000107†                      | (COMCODE 407764877) Digital cable that connects to J13 of the <i>ngRTH</i> test head and provides separate connectors for MTAU control, TL1 input, and alarms. (4 ft.)                                                                                                                                                                                                                                                                                                                         |
| 955-7000010108                    | Connects from the MTAU connector on the digital cable (955-7000107) to J44 on <i>SLC-2000</i> RT/COT systems or to cable ED-7C723-37, G30 on <i>SLC-2000</i> COT ARM shelves used for daisy-chaining the DS1/SONET timing source with other COT ARM shelves ( 10 ft.)                                                                                                                                                                                                                          |
| 955-7000003046                    | Brings out all analog signals from J14 on the <i>ngRTH</i> test head to an intermediate connector. 3 ft. [Optional — used to extend the J14 connector to the front of the bay for easy access during installation. If this cable is <i>not</i> used, J14 connects either directly to the 955-7000079 or 955-7000051 cable. If this cable <i>is</i> used, J14 connects to one end of this cable (955-7000003046) with the other end connecting to either the 955-7000051 or 955-7000079 cable.] |

**Note:** When ordering cable from Tautron Inc., substitute desired length in feet for "xxx" in the part number.

\* Trademark of Tautron, Inc.

† This cable can be ordered from Lucent Technologies using the comcode number shown.

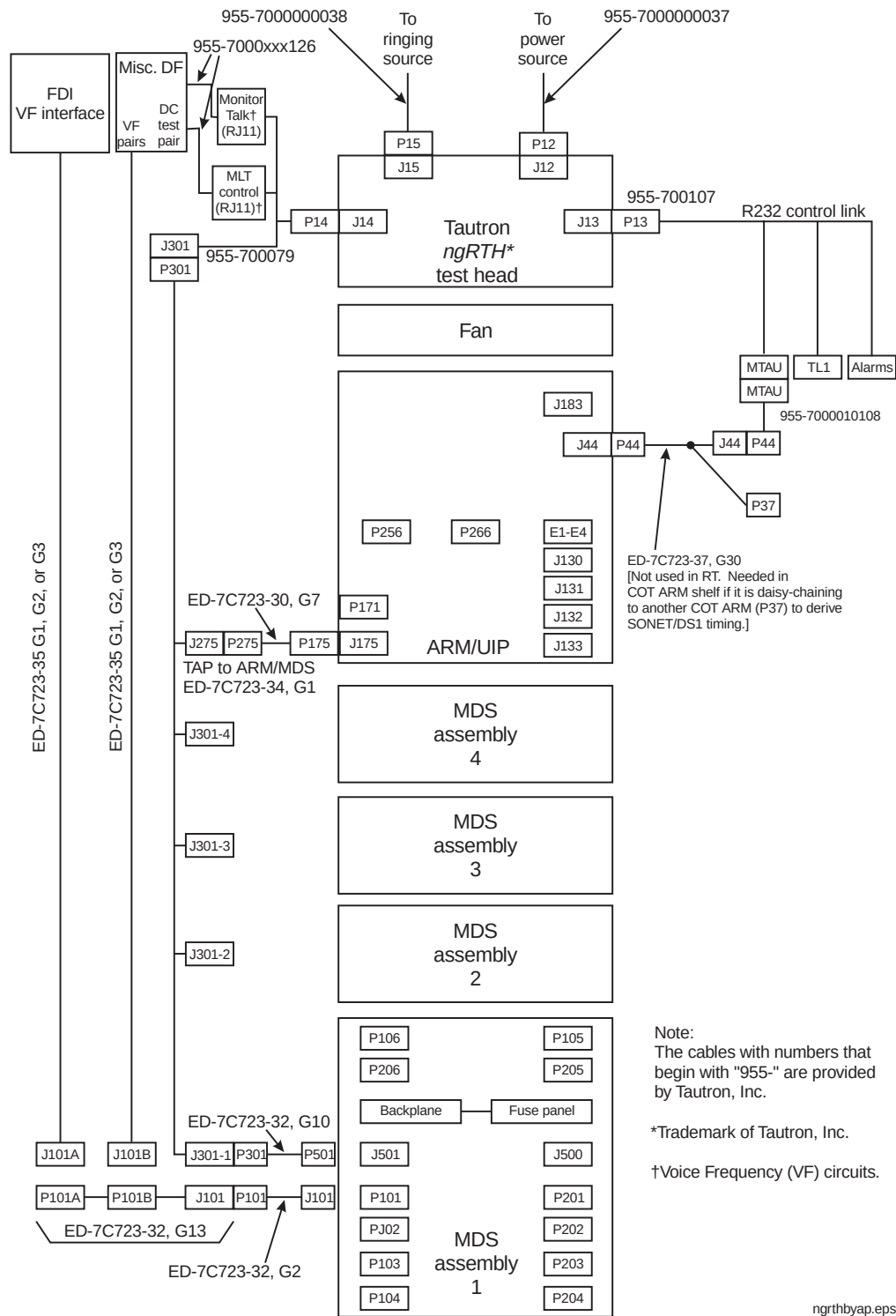


Figure 8-32. Typical Tautron *ngRTH* Test Head Cable Connections — Bay Mounted

## System Optioning

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The *SLC-2000* Access System should be properly equipped and wired. The outside plant engineer should make sure that system options are chosen correctly. Some of the common units have options that must be set correctly for the system to operate. Some channel units require prescription setting of option switches or provisioning of options.

The engineer provides information to installation personnel for options required on the common units selected for the specific application. The following decisions on the *SLC-2000* Access System application must be reflected in the common unit selection and further option selection on those plug-ins.

## Design Options

The engineer, when designing the facility and its support, makes common unit option decisions that must be specified on the work order. These include network and site ID, looped timing synchronization, OLIU transmitter power setting, line coding and framing format, and equalization.

Additional options are set during turn-up from instructions in 363-208-001, *SLC-2000 Access System User/Service Manual*, task-oriented practices (TOP) procedures.

**SONET Subsystem Option Settings.** The *SLC-2000* RT SONET subsystem has a limited subset of optionable features used by the DDM-2000 multiplexer. The *SLC-2000* system only supports looped timing synchronization (*no sync in* or *sync out* TGS options are used). TBOS cabling connections and rear access craft interface terminal (CIT) connections are not supported. It must be set for shelf 1. Front access CIT baud rate should be set to 9600 unless another baud rate will be used to download software. Most options must be set in a specific way. The only options that need to be predetermined are the *Network Element number* on the OHCTL, the *Site Identification number*, the *TBOS Display number*, and how a *Power Minor Alarm* should be reported.

The *Network Element number* option on the OHCTL and the *Site Identification number* option on the SYSCTL are used to identify SONET nodes in the network. Each node in a SONET network should have the same *Network Element number* but a different *Site Identification number*. When two or more SONET terminals are at the same location, the *Site Identification number* is the same but different *Network Element numbers* are used. A unique network number and site number must be assigned to each terminal in a SONET network. The SONET terminal in the serving CO should be set to site "7." The site assignment of other terminals in the same network only requires different numbers at each site (node).

The *TBOS Display number* option follows the same rules as assigning *Site Identification numbers*. That is, there can be eight SONET terminals served by one TBOS link. But these terminals can be in different networks (for example, one TBOS link can support four point-to-point SONET networks).

A more detailed description of the site, network, and TBOS display setting can be found in 824-102-148, *2000 Family of Products, Operations Systems Engineering Guide*.

## Identifiers

The identifiers (IDs) used for the shelf, site, network element (NE), and target are as follows:

- **Shelf ID:** The shelf ID is a switch-settable parameter with values from 1 to 8. Shelf ID should be set to 1 for the *SLC-2000* Access System.
- **Site ID:** The site ID is a switch-settable parameter with values of from 1 to 8. The site ID is displayed on the seven-segment display on the SYCTL circuit pack to indicate to which site the UIP alarm LEDs apply. The same site ID should be assigned to all shelves in the same bay or cabinet. The site ID should be assigned consecutively starting at the central office (CO) site unless parallel telemetry is used. If parallel telemetry is used, the CO site should be assigned as site "7," and the remote sites should be assigned numbers 1 through 6.
- **Network Element ID:** The network element ID is a switch settable parameter with values of from 1 to 5. Network elements at a specific site that belong to the same subnetwork must be assigned a unique network element ID. The network element ID is combined with the site ID to form a default value for the TID. In an OC-3 or OC-12 only network, there is one shelf per subnetwork at each site. Therefore, all the shelves in the subnetwork could be assigned a network element ID of 1. In a mixed network, there may be up to five network elements per site that are part of the same subnetwork. In this configuration, each network element at the same site must be assigned a unique network element ID.
- **TID:** The target identifier (TID) is a 20-character parameter that is set through the CIT using the **set -ne** command. The TID is used in the **rlgn** command to identify an NE to establish a remote login session. The TID is also used by OSs such as the *NMA*\* OS to identify NEs using the TL1 message-based communications protocol.

After the **init-sys:all** or **init-sys:sysctl** command is entered from the SONET subsystem, the system sets the TID to a default value obtained by combining the site ID with the NE ID. The TID must be unique among all NEs served by a common *NMA* OS. Therefore, the default TID must be changed using the **set -ne** command to a user-assigned value recognized by the *NMA* OS.

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\* Trademark of Bellcore.

### Switch-Selectable Parameters (Options)

The following tables list the parameters (options provisioned through hardware switches):

- **Table 8-15** — SONET Software Release 7.X and earlier
- **Table 8-16** — SONET Software Release 9.0 and later.

**Table 8-15. Parameters Provisionable Through Hardware Switches (SONET Software Release 7.X and Earlier)**

| Parameter                        | Range                                   | Pack       | Command (Note)        |
|----------------------------------|-----------------------------------------|------------|-----------------------|
| Site # (par. telem., 7 seg. LED) | 1-8                                     | SYSCTL     | rtrv-ne               |
| Shelf # in bay                   | 1-8                                     | SYSCTL     | rtrv-ne               |
| Network Element #                | 1-5                                     | OHCTL      | rtrv-ne               |
| C/R (Command/Response DCC bits)  | user,network                            | OHCTL      | rtrv-ne               |
| CO/RT select                     | RT, CO                                  | SYSCTL     | rtrv-ne               |
| TBOS display number              | 1-8                                     | SYSCTL     | rtrv-ne               |
| TBOS backup function             | primary, secondary, normal, no TBOS     | SYSCTL     | rtrv-ne               |
| TBOS termination                 | last, not last                          | SYSCTL     |                       |
| Remote TBOS reporting            | enabled, disabled                       | SYSCTL     | rtrv-ne               |
| Front CIT data rate              | 300, 1200, 2400, 4800, 9600, 19200 baud | SYSCTL     | rtrv-ne               |
| Rear CIT (modem) data rate       | 300, 1200, 2400, 4800, 9600, 19200 baud | SYSCTL     | rtrv-ne               |
| Power minor office alarm         | minor, major                            | SYSCTL     | rtrv-ne               |
| Optical transmitter power        | high, low                               | 21G OLIU   | rtrv-oc3              |
| DS1 reference format*            | SF, ESF                                 | TGS        | rtrv-sync             |
| DS1 reference line coding*       | AMI, B8ZS                               | TGS        | rtrv-sync             |
| Timing mode                      | free run, external DS1, loop timed      | TGS        | rtrv-sync             |
| SYNC Output LBO †                | 5 settings (cable dependent)            | TGS(BBF2B) |                       |
| DS1 Output                       | MULT/SYNC OUT                           | TGS(BBF2B) | rtrv-sync             |
| DS1 line coding‡                 | AMI, B8ZS                               | DS1        | rtrv-t1               |
| DS1 LBO§                         | 5 settings (cable dependent)            | DS1        |                       |
| STS1E LBO§                       | 2 settings (cable dependent)            | STS1E      |                       |
| STS1E pack type                  | high-speed, low-speed                   | STS1E      | rtrv-eqpt<br>rtrv-ec1 |

**Note:** Current switch settings except DS1 LBO, SYNC Output LBO, STS1E LBO, and TBOS termination can be reported using CIT.

\* For both DS1 in and out.

† Operational only in the SYNC OUT mode.

‡ CIT can override switch settings. (Factory default is *noOverride*.) Parameter can be set for each port.

§ Parameter can be set for each circuit pack.



**Table 8-16. Parameters Provisionable Through Hardware Switches (SONET Software Release 9.0 and Later)**

| <b>Parameter</b>           | <b>Range</b>                           | <b>Pack</b>       | <b>Command (Note)</b>               |
|----------------------------|----------------------------------------|-------------------|-------------------------------------|
| Product ID (S1)            | "Product Type"                         | SYSCTL            | <b>rtrv-ne</b>                      |
| TBOS termination (S2)      | last, not last                         | SYSCTL            | –                                   |
| Optical transmitter power  | high,low                               | 21G/21G-U<br>OLIU | <b>rtrv-oc3</b>                     |
| DS1 reference format*      | SF,ESF                                 | TGS               | <b>rtrv-sync</b>                    |
| DS1 reference line coding* | AMI,B8ZS                               | TGS               | <b>rtrv-sync</b>                    |
| Shelf timing mode          | free-running, external DS1, line timed | TGS               | <b>rtrv-sync</b>                    |
| SYNC Output LBO†           | 5 settings (cable dependent)           | TGS               |                                     |
| DS1 Output                 | MULT/SYNC OUT                          | TGS               | <b>rtrv-sync</b>                    |
| DS1 line coding‡           | AMI,B8ZS                               | DS1               | <b>rtrv-t1</b>                      |
| DS1 LBO§                   | 5 settings (cable dependent)           | DS1               |                                     |
| DS3 LBO§                   | 2 settings (cable dependent)           | DS3               | –                                   |
| STS1E LBO§                 | 2 settings (cable dependent)           | STS1E             | –                                   |
| STS1E pack type            | high-speed, low-speed                  | STS1E             | <b>rtrv-eqpt</b><br><b>rtrv-ec1</b> |

**Note:** Current switch settings except DS1 LBO, SYNC Output LBO, DS3 LBO, STS1E LBE, and TBOS termination can be reported using CIT.

\* For both DS1 in and out.

† Operational only when in SYNC OUT mode.

‡ CIT can override switch settings. (Factory default is *noOverride*.) Parameter can be set for each port.

§ Parameter can be set for each circuit pack

**CIT Provisionable Parameters**

Table 8-17 lists the parameters for the SONET subsystem that can be provisioned with the CIT.

**Table 8-17. SONET Subsystem Parameters Provisioned Using the CIT**

| Parameter                            | Range                                 | Default<br>(Note 1) | Command<br>(Note 2) |
|--------------------------------------|---------------------------------------|---------------------|---------------------|
| Date                                 | current value                         | 70-01-01            | set-date            |
| Time                                 | current value                         | 00:00:00            | set-date            |
| Target ID (system name)              | 20 characters                         | Site#NE#*           | set-ne              |
| Gateway network element <sup>†</sup> | yes, no                               | no ‡                | set-ne              |
| Cross-connect mode                   | default, manual                       | default             | set-ne              |
| Site number <sup>§</sup>             | 1-32                                  | 32                  | set-ne              |
| Network element <sup>§</sup> #       | 1-5                                   | 5                   | set-ne              |
| Shelf number <sup>§</sup>            | 1-8                                   | 1                   | set-ne              |
| CO/RT select <sup>§</sup>            | CO,RT                                 | RT                  | set-ne              |
| TBOS address <sup>§</sup>            | 1-8                                   | 1                   | set-ne              |
| TBOS link <sup>§</sup>               | primary,secondary,<br>normal, no TBOS | no TBOS             | set-ne              |
| TBOS remote <sup>§</sup>             | enabled, disabled                     | disabled            | set-ne              |
| DSNE <sup>‡§</sup>                   | yes, no                               | no                  | set-ne              |
| AGNE <sup>§</sup>                    | yes, no                               | no                  | set-ne              |
| Alarm group number <sup>§</sup>      | 1-255                                 | 255                 | set-ne              |
| STS Uneqpd./AIS insert <sup>§</sup>  | Uneqpd., AIS                          | AIS                 | set-ne              |
| VT Uneqpd./AIS insert <sup>§</sup>   | Uneqpd., AIS                          | AIS                 | set-ne              |

\* The # is the value set by the switches on the SYSCTL and OHCTL in SONET Subsystem Software Release 7 and earlier.

† SONET Subsystem Software Release 7 and earlier.

‡ One and only one shelf in a subnetwork must be set to "yes" for proper DCC communications.

§ SONET Subsystem Software Release 9.0 and later.

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*Continued on next page*

**Table 8-17. SONET Subsystem Parameters Provisioned Using the CIT (Continued)**

| Parameter                                         | Range                                                                          | Default (Note 1) | Command (Note 2)          |
|---------------------------------------------------|--------------------------------------------------------------------------------|------------------|---------------------------|
| System Location*                                  | 36 characters                                                                  | null             | set-sid                   |
| CIT page length                                   | 0 (pager off), 3-150 rows                                                      | 24               | set-link                  |
| PM thresholds                                     | See Table 8-19                                                                 | -                | set-pmthres               |
| Alarm holdoff delay                               | 0-30 sec                                                                       | 2                | set-attr-alm              |
| Alarm clear delay                                 | 0-30 sec                                                                       | 15               | set-attr-alm              |
| Power minor alarm level <sup>†</sup>              | MN, MJ                                                                         | MN               | set-attr-alm              |
| OC-3 degrade threshold                            | $10^{-5}$ — $10^{-9}$                                                          | $10^{-6}$        | set-oc3                   |
| Kbyte Messages (sync messaging)*                  | enable,disable                                                                 | enable           | set-oc3                   |
| Sync Messaging <sup>†</sup>                       | K byte, S byte, disable                                                        | K byte           | set-oc3                   |
| Concatenation mode*                               | enable, disable                                                                | enable           | set-oc3                   |
| Concatenation mode (linear release 8)             | disable, sts3c                                                                 | disable          | set-oc3                   |
| AIS alarm level of NSA OC-3 Line AIS <sup>†</sup> | CR,MJ,MN,NA                                                                    | NA               | set-oc3                   |
| DS1 line coding                                   | AMI,B8ZS,noOverride <sup>‡</sup>                                               | noOverride       | set-t1 <sup>§</sup>       |
| DS1 alarm level                                   | MJ, MN, NA                                                                     | NA               | set-t1 <sup>§</sup>       |
| DS1 AIS insertion                                 | yes, no                                                                        | yes              | set-t1 <sup>§</sup>       |
| DS1 failure threshold                             | $10^{-3}$ , $10^{-6}$ , $10^{-7}$ <sup>†</sup> ,<br>$10^{-8}$ <sup>†</sup> BER | $10^{-3}$        | set-t1 <sup>§</sup>       |
| DS1 BPV to LOS                                    | yes,no                                                                         | no               | set-t1 <sup>§</sup>       |
| DS1 port state*                                   | not monitored, AUTO <sup>¶</sup>                                               | AUTO             | set-state-t1 <sup>§</sup> |
| DS1 PM Mode                                       | off*, sf*, esf*, esfn*<br>off <sup>†</sup> , on <sup>†</sup>                   | off              | set-tl                    |
| DS1 PM Format <sup>§†</sup>                       | sf, esf, esfn                                                                  | esf              | set-tl                    |
| DS1 primary port state <sup>§†</sup>              | NMON, AUTO <sup>¶</sup>                                                        | AUTO             | set-state-t1 <sup>§</sup> |

\* SONET Subsystem Software Release 7 and earlier.

<sup>†</sup> SONET Subsystem Software Release 9.0 and later.<sup>‡</sup> noOverride means read and use switch settings on circuit pack.<sup>§</sup> Parameter can be set for each port<sup>¶</sup> AUTO means the port is ready to be automatically provisioned via signal detection.*Continued on next page*

**Table 8-17. SONET Subsystem Parameters Provisioned Using the CIT (Continued)**

| Parameter                              | Range                     | Default<br>(Note 1)          | Command<br>(Note 2) |
|----------------------------------------|---------------------------|------------------------------|---------------------|
| Environmental alarm level              | CR, MJ, MN, none          | MN                           | set-attr-env        |
| Environmental alarm type               | 10 characters             |                              | set-attr-env        |
| Environmental alarm description        | 26 characters             |                              | set-attr-env        |
| Control point description              | 26 characters             |                              | set-attr-cont       |
| OC-12 degrade threshold*               | $10^{-5}$ to $10^{-9}$    | $10^{-6}$                    | set-oc12            |
| Sync Messaging*                        | K byte, S byte, Disabled  | K byte                       | set-oc12            |
| AIS alarm level of NSA OC-12 Line AIS* | CR,MJ,MN,NA               | NA                           | set-oc12            |
| STS-1 path signal degrade threshold†   | $10^{-5}$ to $10^{-9}$    | 0 (disabled)                 | set-sts1            |
| NSA STS-1 path AIS alarm level         | MN, NR                    | MN                           | set-sts1            |
| SA STS-1 path AIS alarm level          | CR, MN, NA, NR            | MN                           | set-sts1            |
| STS-1 channel state‡                   | NMON, AUTO§               | AUTO                         | set-state-sts1      |
| OC-1 line state (ring releases)        | NMON, IS                  | IS                           | set-state-oc1       |
| VT1.5 path signal degrade threshold††  | $10^{-5}$ to $10^{-9}$    | 0 (disabled)                 | set-vt1             |
| NSA VT path AIS                        | MN, NR                    | MN                           | set-vt1             |
| SA VT path AIS                         | MJ, MN, NA, NR            | MJ for ring<br>MN for linear | set-vt1             |
| VT channel state‡                      | NMON, AUTO§               | AUTO                         | set-state-vt1       |
| DS3 VMR mode¶                          | VMR, VM, clear channel    | VMR                          | set-t3              |
| Clear channel DS3 AIS insertion¶       | yes, no                   | no                           | set-t3              |
| DS3 sig failure alm. level¶            | CR, MJ, MN, NA            | CR                           | set-t3              |
| DS3 failure threshold¶                 | $10^{-3}$ , $10^{-6}$ BER | $10^{-3}$                    | set-t3              |
| DS3 PM mode¶                           | off,on                    | on                           | set-t3              |
| DS3 PM frame¶                          | m13,cbit                  | m13                          | set-t3              |
| DS3 PM format¶                         | pbit, fmbit, cpbit        | pbit                         | set-t3              |
| DS3 port state¶                        | NMON, AUTO§               | AUTO                         | set-state-t3        |

\* SONET Subsystem Software Release 11 or later with 24G-U OLIUs in the MAIN slots.

† Ring Releases. Requires 22D-U/22F2-U/22G-U/22G2-U OLIUs.

‡ Parameters can be set for each channel.

§ AUTO means the port or channel is ready to be automatically provisioned via signal detection.

¶ Parameters can be set for each port.

*Continued on next page*

**Table 8-17. SONET Subsystem Parameters Provisioned Using the CIT (Continued)**

| Parameter                                | Range                                      | Default<br>(Note 1) | Command<br>(Note 2)    |
|------------------------------------------|--------------------------------------------|---------------------|------------------------|
| Far end communication *                  | disabled, enabled                          | enabled             | set-fecom <sup>†</sup> |
| DCC identity for OSI ntwks. <sup>‡</sup> | userside, networkside                      | see 363-208-003     | set-fecom <sup>†</sup> |
| Set security <sup>†</sup>                | enabled, disabled,<br>lockout <sup>‡</sup> | disabled            | set-secu               |
| CIT security <sup>†</sup>                | enable, disable, lockout <sup>‡</sup>      | disable             | set-secu               |
| CIT timeout (minutes) <sup>†</sup>       | 0-120                                      | 15                  | set-secu               |
| DCC security <sup>†</sup>                | enable, disable, lockout <sup>‡</sup>      | disable             | set-secu               |
| DCC timeout (minutes) <sup>†</sup>       | 0-120                                      | 15                  | set-secu               |
| Sync Timing Source <sup>§¶</sup>         | main, fn-c,                                | main                | set-sync               |
| Sync Output Mode <sup>§**</sup>          | track, lock1, lock2                        | track               | set-sync               |
| Sync Timing Source <sup>¶ ††</sup>       | main-1, main-2                             | main-1              | set-sync               |
| SYNC mode switching                      | revertive, nonrevertive                    | revertive           | set-sync               |
| AIS Threshold                            | level 5, level 4, level 3,<br>level 2      | level 5             | set-sync               |
| Auto. sync. reconfig. <sup>‡</sup>       | enabled, disabled                          | disabled            | set-sync               |
| EC-1 alarm level <sup>‡‡</sup>           | CR, MJ, MN, NA                             | CR                  | set-ec1                |
| EC-1 degrade threshold*                  | 10 <sup>-5</sup> to 10 <sup>-9</sup> BER   | 10 <sup>-6</sup>    | set-ec1                |
| EC-1 port state <sup>§§</sup>            | NMON, AUTO <sup>¶¶</sup>                   | AUTO                | set-stats-ec1          |

\* The # is the value set by the switches on the SYSCTL and OHCTL in SONET Subsystem Release 7 and earlier.

† This command is available to privileged users only.

‡ SONET Subsystem Software Release 9.0 and later.

§ Release 3.2 and later linear releases.

¶ Setting this parameter also affects DS1 output source and DS1 sync output mode.

\*\* Track means the source for timing will be selected from the active received OC-3 line specified.

†† Release 5.1 (rings).

‡‡ One and only one shelf in a subnetwork must be set to "yes" for proper DCC communications.

§§ Parameter can be set for each port.

¶¶ AUTO means the port is ready to be automatically provisioned via signal detection.

*Continued on next page*

**Table 8-17. SONET Subsystem Parameters Provisioned Using the CIT (Continued)**

| Parameter                                        | Range                                | Default (Note 1)                             | Command (Note 2) |
|--------------------------------------------------|--------------------------------------|----------------------------------------------|------------------|
| Feature Packaging*<br>VT PM, DS1 PM, or STS3c    | enable, disable                      | disable                                      | set-feat         |
| X.25 packet size†                                | 128,256                              | 256                                          | set-x25          |
| NSAP†                                            |                                      |                                              |                  |
| OrganizationID (OperatorID)†                     | 6 hex digits                         | 000000                                       | ent-ulsdcc       |
| Reserved (reserved†)                             | 4 hex digits                         | 0000                                         | ent-ulsdcc       |
| Routing Data (Domain/Area†)                      | 8 hex digits                         | 00000000                                     | ent-ulsdcc       |
| VC ckt. type X.25 attach.<br>SNPA: LCN for PVCs† | PVC, SVC<br>LCN, DTE                 | PVC<br>LCN1(PVC)<br>LCN2 (PVC)<br>LCN3 (PVC) | ent-osacmap      |
| or DTE address for SVC†                          | see 363-208-003                      |                                              | ent-osacmap      |
| OS type (ACID)†                                  | see 363-208-003                      |                                              | ent-osacmap      |
| ACID (OS type or funct.)†                        | see 363-208-003                      |                                              | ent-tl1msgmap    |
| TL1 message type†                                | see 363-208-003                      |                                              | ent-tl1msgmap    |
| Action to assoc. message type to OS†             | enabled, disabled                    | enabled                                      | ent-tl1msgmap    |
| Cross-connection type†                           | twoway, dc                           | twoway                                       | ent-crs-sts1     |
| Ring ID for drop&continue†                       | m1,m2                                | see 363-208-003                              | ent-crs-sts1     |
| Cross-connection type†                           | twoway, dc, locked                   | twoway                                       | ent-crs-vt1      |
| Outgoing STS-1 path trace message†               | 62 characters                        | see 363-208-003                              | set-trace-sts1   |
| Expected STS-1 path trace message†               | 62 characters                        | see 363-208-003                              | set-trace-sts1   |
| OC-1 degrade threshold                           | 10 <sup>-5</sup> to 10 <sup>-9</sup> | 10 <sup>-6</sup>                             | set-oc1          |
| AIS almn, level of NSA OC-1 line AIS             | CR, MJ, MN, NA                       | NA                                           | set-oc1          |
| OC-12 degrade threshold‡                         | 10 <sup>-5</sup> to 10 <sup>-9</sup> | 10 <sup>-6</sup>                             | set-oc12         |
| Sync Messageing†                                 | K byte, S byte, disabled             | K byte                                       | set-oc12         |
| AIS alm. level of NSA OC-12 Line AIS‡            | CR, MJ, MN, NA                       | NA                                           | set-oc12         |

**Notes:**

1. Default means factory default (the CIT prompts display current provisioned values).
2. To view the current values, precede these commands with **rtrv-** instead of **set-**.

\* This command is available to privileged users only.

† SONET Subsystem Software Release 9.0 and later

‡ With 24G-U OLIU in the main slots.

Table 8-18 lists the parameters for the DLC subsystem that can be provisioned with the CIT.

**Table 8-18. DLC Subsystem Parameters Provisioned Using the CIT**

| Parameter                            | Range                                                                                                      | Default (Note)        | Command                             |
|--------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------|
| Type of DT<br>Lines<br>DT Mode (dtm) | msdt <sup>*†</sup> , nbs <sup>*</sup><br>0, 12 <sup>‡</sup> , 24<br>quad <sup>*</sup> , octet <sup>*</sup> | current<br>quad       | ED-DT                               |
| Feeder type                          | VTU (SONET), LIU (DSX-1)                                                                                   | current value         | ED-FDR                              |
| INA framing format                   | SF,ESF                                                                                                     | SF                    | ED-INA                              |
| TR-08 mode <sup>§</sup>              | (mode)1,(mode)2                                                                                            | current value         | ED-MODE-TR8                         |
| T8U mode <sup>¶</sup>                | Y(enabled),N(disabled)                                                                                     | current value         | ED-MODE-T8U                         |
| Terminal loc.                        | COT,RT                                                                                                     | current value         | ED-NE                               |
| SMU state                            | enabled,disabled                                                                                           | current value         | ED-STATE-SMU                        |
| Distribution mode                    | MET(metallic), FITL(fiber)                                                                                 | current value         | ED-DISTN                            |
| DS1 equalization <sup>**</sup>       | 0-665                                                                                                      | 0                     | ED-T1                               |
| DS1 line coding <sup>**</sup>        | AMI                                                                                                        | AMI (R3.1, R3.2)      | ED-T1                               |
| DS1 line coding <sup>**</sup>        | B8ZS                                                                                                       | B8ZS (R4.0 and later) | ED-T1                               |
| DS1 port primary state <sup>**</sup> | No Change, OOS-MT-AUTO                                                                                     | No Change             | ED-T1                               |
| Channel unit provisioning            | see Table 8-20                                                                                             | see Table 8-20        | ENT-T0<br>ED-T0<br>DLT-T0<br>CPY-T0 |
| CIT page length                      | 0 (pager off), 3-150 rows                                                                                  | 24                    | SET-LINK                            |
| CORE synchronization mode            | SONET,COMPCLK (VTU config.)<br>LPD,FRNG,COMPCLK (LIU config.)                                              | SONET <sup>††</sup>   | SET-SYNCN                           |
| Primary DS1 loop timing ref.         | a-{1-7}-{1-4}                                                                                              | a-1-1                 | SET-SYNCN                           |
| Secondary DS1 loop timing ref.       | a-{1-7}-{1-4}                                                                                              | a-1-3                 | SET-SYNCN                           |
| Composite clock protection           | Y (yes) or N (no)                                                                                          | Y                     | SET-SYNCN                           |

**Note:** Default means factory default (the CIT prompts display current values).

\* For Software Release 4.4, you must enter these parameters in lowercase.

† When the type of DT is "msdt," the only valid DT mode is "quad."

‡ The "line" parameter of "12" is not valid when the type of DT is set to "nbs" and the DT mode is set to "octet."

§ For a pair of TR-08 VRTs.

¶ For a single or range of shelves.

\*\* Can be set on each feeder DS1 port.

†† When the feeder configuration (**ED-FDR**) or terminal location (**ED-NE**) is changed, the system automatically reprovisions the synchronization mode. See the **SET-SYNCN** command page for details.

Table 8-19 describes SONET the performance-monitoring parameters provisionable using the CIT.

**Table 8-19. SONET Performance-Monitoring Parameters Provisionable via the CIT**

| Parameter Definition       |                                              | Threshold Range [Default] |                   | Command          |
|----------------------------|----------------------------------------------|---------------------------|-------------------|------------------|
| Facility                   | Measure                                      | Current Quarter Hour      | Current Day       |                  |
| OC-3 Optics                | Optical Transmit Power* (21G/21G-U)          | -1 dB, -2 dB              | -1 dB, -2 dB      | set-pmthres-sect |
|                            | Laser Bias Current* (21G/21G-U)              | enable/disable            | enable/disable    | set-pmthres-sect |
| OC-3 Section               | SE Frame Seconds (SEFS)                      | 1-63[10]                  | 1-4095[30]        | set-pmthres-sect |
| OC-12 Section <sup>†</sup> | SE Frame Seconds (SEFS)                      | 1-63[10]                  | 1-4095[30]        | set-pmthres-sect |
| OC-1 Section               | SE Frame Seconds (SEFS)                      | 1-63[10]                  | 1-4095[30]        | set-pmthres-sect |
| OC-12 Line <sup>†</sup>    | B2 Coding Violations (CV)                    | 1-55365[5537]             | 1-5315040[531504] | set-pmthres-line |
|                            | B2 Errored Seconds (ES)                      | 1-900[40]                 | (1-65535)[900]    | set-pmthres-line |
|                            | B2 Errored Seconds Type A (ESA)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Errored Seconds Type B (ESB)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Severely Errored Seconds (SES)            | 1-63[20]                  | (1-4095)[60]      | set-pmthres-line |
|                            | B2 Unavailable Seconds (UAS)                 | 1-63[30]                  | (1-4095)[90]      | set-pmthres-line |
|                            | STS Pointer Justification (PJC)              | 1-65535[60]               | 1-9999999         | set-pmthres-line |
| OC-3 Line                  | B2 Coding Violations (CV)                    | 1-13841[1384]             | 1-1328736[132874] | set-pmthres-line |
|                            | B2 Errored Seconds (ES)                      | 1-900[40]                 | (1-65535)[900]    | set-pmthres-line |
|                            | B2 Errored Seconds Type A (ESA)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Errored Seconds Type B (ESB)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Severely Errored Seconds (SES)            | 1-63[20]                  | (1-4095)[60]      | set-pmthres-line |
|                            | B2 Unavailable Seconds (UAS)                 | 1-63[30]                  | (1-4095)[90]      | set-pmthres-line |
|                            | Line Protection Switch Counts (PSC-L)        | 1-63[2]                   | (1-255)[4]        | set-pmthres-line |
|                            | STS Pointer Justification (PJC) <sup>‡</sup> | 1-65535[60]               | 1-9999999[5760]   | set-pmthres-line |
| OC-1 Line                  | B2 Coding Violations (CV)                    | 1-4613[641]               | 1-442848[44285]   | set-pmthres-line |
|                            | B2 Errored Seconds (ES)                      | 1-900[40]                 | (1-65535)[900]    | set-pmthres-line |
|                            | B2 Errored Seconds Type A (ESA)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Errored Seconds Type B (ESB)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Severely Errored Seconds (SES)            | 1-63[20]                  | (1-4095)[60]      | set-pmthres-line |
|                            | B2 Unavailable Seconds (UAS)                 | 1-63[30]                  | (1-4095)[90]      | set-pmthres-line |
|                            | STS Pointer Justification (PJC) <sup>‡</sup> | 1-65535[60]               | 1-9999999[5760]   | set-pmthres-line |
| EC-1 Line <sup>§</sup>     | B2 Coding Violations (CV) EC-1               | 1-4613[461]               | 1-442848 [44285]  | set-pmthres-line |
|                            | B2 Errored Seconds (ES)                      | 1-900[40]                 | (1-65535)[900]    | set-pmthres-line |
|                            | B2 Errored Seconds Type A (ESA)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Errored Seconds Type B (ESB)              | 1-900[30]                 | (1-65535)[90]     | set-pmthres-line |
|                            | B2 Severely Errored Seconds (SES)            | 1-63[20]                  | (1-4095)[60]      | set-pmthres-line |
|                            | B2 Unavailable Seconds (UAS)                 | 1-63[30]                  | (1-4095)[90]      | set-pmthres-line |
|                            | STS Pointer Justification (PJC) <sup>‡</sup> | 1-65535[60]               | 1-9999999[5760]   | set-pmthres-line |

\* Threshold is set once for both current quarter hour and current day.

† SONET Subsystem Release R11 or later with 24G-U OLIUs.

‡ SONET Subsystem Release R11 or later.

§ Release 5.1 and later ring releases and Release 6.0 and later linear releases.

*Continued on next page*



**Table 8-19. SONET Performance-Monitoring Parameters Provisionable via the CIT (Continued)**

| Parameter Definition                                       |                                        | Threshold Range [Default] |                   | Command           |
|------------------------------------------------------------|----------------------------------------|---------------------------|-------------------|-------------------|
| Facility                                                   | Measure                                | Current Quarter Hour      | Current Day       |                   |
| DS3 Path*                                                  | P-Bit Error Counts                     | 1-4026[403]               | 1-386500[38650]   | set-pmthres-t3    |
|                                                            | SE Frame Seconds (SEFS)                | 1-63[10]                  | 1-4095[30]        | set-pmthres-t3    |
| DS3 Path for P-Bit, F&M Bit, and C-Bit from Fiber and DSX† | CV-P Coding Violations                 | 1-16383[40]               | 1-1048575[3820]   | set-pmthres-t3    |
|                                                            | ES-P Errored Seconds                   | 1-900[25]                 | 1-65535[250]      | set-pmthres-t3    |
|                                                            | SES-P Severely Errored Seconds         | 1-63[4]                   | 1-4095[40]        | set-pmthres-t3    |
|                                                            | UAS-P Unavailable Seconds              | 1-63[10]                  | 1-4095[10]        | set-pmthres-t3    |
|                                                            | SEFS                                   | 1-63[2]                   | 1-4095[8]         | set-pmthres-t3    |
| DS3 Line†                                                  | CV-L Coding Violations                 | 1-16383[40]               | 1-1048575[3865]   | set-pmthres-t3    |
|                                                            | Errored Seconds, Line (ES-L)           | 1-900[25]                 | 1-65535[250]      | set-pmthres-t3    |
|                                                            | Severely Errored Seconds, Line (SES-L) | 1-63[4]                   | 1-4095[40]        | set-pmthres-t3    |
| STS-1 Path‡                                                | B2 Coding Violations (CV) EC-1         | 1-4510[461]               | 1-432960 [43296]  | set-pmthres-sts-1 |
|                                                            | B2 Errored Seconds (ES)                | 1-900[40]                 | (1-65535)[900]    | set-pmthres-sts-1 |
|                                                            | B2 Errored Seconds Type A (ESA)        | 1-900[30]                 | (1-65535)[90]     | set-pmthres-sts-1 |
|                                                            | B2 Errored Seconds Type B (ESB)        | 1-900[30]                 | (1-65535)[90]     | set-pmthres-sts-1 |
|                                                            | B2 Severely Errored Seconds (SES)      | 1-63[20]                  | (1-4095)[60]      | set-pmthres-sts-1 |
|                                                            | B2 Unavailable Seconds (UAS)           | 1-63[30]                  | (1-4095)[90]      | set-pmthres-sts-1 |
| VT1.5 Path‡                                                | V5 Errored Seconds (ES)                | 1-900 [40]                | 1-65535 [900]     | set-pmthres-vtl   |
|                                                            | V5 Severely Errored Seconds (SES)      | 1-63[20]                  | 1-4095 [60]       | set-pmthres-vtl   |
|                                                            | V5 Unavailable Seconds (UAS)           | 1-63[30]                  | 1-4095 [90]       | set-pmthres-vtl   |
| DS-1 Path§¶                                                | ES-P Errored Seconds                   | 1-900[65]                 | 1-65535 [648]     | set-pmthres-tl    |
|                                                            | SES-P Severely Errored Seconds         | 1-63 [10]                 | 1-4095 [100]      | set-pmthres-tl    |
|                                                            | UAS-P Unavailable Seconds              | 1-63 [10]                 | 1-4095 [10]       | set-pmthres-tl    |
|                                                            | ES-PFE Errored Seconds                 | 1-900 [65]                | 1-65535 [648]     | set-pmthres-tl    |
|                                                            | SES-PFE Severely Errored Seconds       | 1-63 [10]                 | 1-4095 [100]      | set-pmthres-tl    |
|                                                            | UAS-PFE Unavailable Seconds            | 1-63 [10]                 | 1-4095 [10]       | set-pmthres-tl    |
|                                                            | CV-P (SF) Coding Violations*           | 1-16383 [72]              | 1-1048575[691]    | set-pmthres-tl    |
|                                                            | CV-P (ESF) CODing Violations*          | 1-16383 [13296]           | 1-1048575[132960] | set-pmthres-tl    |
|                                                            | CV-PFE Coding Violations*              | 1-16383 [13296]           | 1-1048575[132960] | set-pmthres-tl    |
| DS-1 Line†§                                                | ES-L Line Errored Seconds              | 1-900 [65]                | 1-65535[648]      | set-pmthres-tl    |

\* SONET Subsystem Software Release 7 or earlier.

† SONET Subsystem Software Release 9.0 and later.

‡ Release 6.0 and later linear releases and Release 7.0 and later ring releases (feature package option).

§ Release 5.1 and later ring releases and Release 6.0 and later linear releases (feature package option).

¶ Release 9.1 and later in OC-3 systems supports current quarter-hour thresholding and reporting of DS1 PM.

Table 8-20 contains the channel unit provisioning parameters that can be set using the CIT. Refer to Chapter 4 “Services” (Table 4-1 on page 4-4) to determine the valid locations for each channel unit. Valid locations include:

- Remote terminal (RT)
- Central office terminal (COT)
- Multi-Services Distant Terminal (MSDT)
- DDM-2000 FiberReach Narrowband Shelf (NBS).

Values in the **Range** column shown in “[ ]” brackets denote default values.

**Table 8-20. Channel Unit Options Provisioned Using the CIT**

| Channel Unit                                                                                                               | Option                | Range                                                                   | Comment                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| AUA34<br>DS0 dataport<br>channel unit<br>(AUA34 CLEI*<br>code = 5SCU38)                                                    | Functional CLEI code  | 5SCU38                                                                  |                                                                                                                                                   |
|                                                                                                                            | Function code         | [DS0A], DS0B                                                            | DS0A = 2.4, 4.8, 9.6 kb/s data rates<br>DS0B = 56 kb/s data rates                                                                                 |
|                                                                                                                            | Error Correction      | MVEC, SCEC, [NONE]                                                      | MVEC should not be used with 56 kb/s.                                                                                                             |
|                                                                                                                            | All-zero-code allowed | [NO] or YES                                                             |                                                                                                                                                   |
| AUA34B<br>DS0 dataport<br>channel unit<br>(AUA34B CLEI<br>code = 5SC133)                                                   | Functional CLEI code  | 5SC133                                                                  |                                                                                                                                                   |
|                                                                                                                            | Function code         | [DS0A], DS0B                                                            | DS0A = 2.4, 4.8, 9.6 kb/s data rates<br>DS0B = 19.2, 56, 64 kb/s data rates                                                                       |
|                                                                                                                            | Error Correction      | MVEC, SCEC, [NONE]                                                      | MVEC should not be used with 56 or 64 kb/s. On the AUA34B, selecting MVEC with 19.2 kb/s enables single time slot 19.2 error correction (19.2 EC) |
|                                                                                                                            | All-zero-code allowed | [NO] or YES                                                             | ZC should be set to YES if the data rate is 64 kb/s.                                                                                              |
| AUA41(B)<br>or AUA141<br>4-wire channel<br>unit (AUA41/<br>AUA141 CLEI<br>code = 5SCU7D)<br>(AUA41B CLEI<br>code = 5SC3HJ) | Functional CLEI code  | 5SC3HJ, 5SCU7D                                                          |                                                                                                                                                   |
|                                                                                                                            | Function code         | [FXS1], FXS2, FXS3, FXS5, FXT1, FXT2, FXT3, FXT5, DX4N, DX4R, TO4, ETO4 | Selects channel unit signalling function.                                                                                                         |
|                                                                                                                            | TRMT attenuator       | 0 to [16.5]                                                             |                                                                                                                                                   |
|                                                                                                                            | RCV attenuator        | 0 to [16.5]                                                             | FX, DX, and ETO4 functions only.                                                                                                                  |
|                                                                                                                            | Loaded or nonloaded   | L <sub>i</sub> [N]                                                      |                                                                                                                                                   |
|                                                                                                                            | Slope                 | [0] to 15                                                               |                                                                                                                                                   |
|                                                                                                                            | -7 dB TRMT            | WH, [BK]                                                                | TO4 function only.                                                                                                                                |
|                                                                                                                            | -7 dB RCV             | WH, [BK]                                                                |                                                                                                                                                   |
|                                                                                                                            | -7 dB (J3)            | WH, [BK]                                                                | ETO4 function only.                                                                                                                               |
|                                                                                                                            | Bandwidth             | [0] to 15                                                               | FX, DX, and ETO4 functions only.                                                                                                                  |
|                                                                                                                            | Height                | [0] to 15                                                               |                                                                                                                                                   |
|                                                                                                                            | TRMT & RCV impedance  | 150, [600], 1200                                                        |                                                                                                                                                   |
|                                                                                                                            | Sealing current       | [YES] or NO                                                             | Only AUA41B (ETO4/TO4 function).                                                                                                                  |
|                                                                                                                            | Redlined              | YES, [NO]                                                               |                                                                                                                                                   |

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**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                                                                                                                             | Option                           | Range                                                                                                          | Comment                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUA42(B),<br>AUA142, or<br>SPQ <sup>®</sup> 442<br>E SPOTS <sup>®</sup><br>channel unit<br>(AUA42/<br>AUA142 CLEI*<br>code = 5SCU69)<br>(AUA42B CLEI<br>code = 5SCU6E)<br>(SPQ442 CLEI<br>code = SAC1AH) | Functional CLEI code             | SAC1AH, 5SCU69,<br>5SCU6E                                                                                      | Selects channel unit signaling function.<br><br><br><br><br><br>FXO function only.<br>FXO function only.<br>FXO function only.                                                                                                  |
|                                                                                                                                                                                                          | Function code                    | [FXO], DPT, TO                                                                                                 |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Impedance                        | 600, [900]                                                                                                     |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Balance                          | 0 to 15, [3]                                                                                                   |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | XMT gain                         | [-1.0] to 6.75                                                                                                 |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | RCV gain                         | [-8.0] to 1.5                                                                                                  |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Slope                            | [0] to 7                                                                                                       |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Toll diversion                   | YES, [NO]                                                                                                      |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Signaling type                   | LS, [GS]                                                                                                       |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | On hook transmission<br>Redlined | YES, [NO]<br>YES, [NO]                                                                                         |                                                                                                                                                                                                                                 |
| AUA43(B)<br>or SPQ443<br>E SPOTS<br>channel unit<br>(AUA43 CLEI code<br>= 5SCU6A)<br>(AUA43B CLEI<br>code = 5SCU6F)<br>(SPQ443 CLEI<br>code = SAC1AE)                                                    | Functional CLEI code             | SAC1AE, 5SCU6A,<br>5SCU6F                                                                                      | Selects channel unit signaling function.<br><br><br><br><br><br>FXS function only.                                                                                                                                              |
|                                                                                                                                                                                                          | Function code                    | [FXS], DPO, TO                                                                                                 |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Impedance                        | [600], 900                                                                                                     |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Balance                          | 0 to 15, [3]                                                                                                   |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | XMT gain                         | [-1.0] to 6.75                                                                                                 |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | RCV gain                         | [-8.0] to 1.5                                                                                                  |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Slope                            | [0] to 7                                                                                                       |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | On hook transmission<br>Redlined | YES, [NO]<br>YES, [NO]                                                                                         |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
| AUA44<br>or SPQ444<br>4-wire channel unit<br>(AUA44 CLEI* code<br>= 5SCU7C)<br>(SPQ444 CLEI<br>code = SAC1BF)                                                                                            | Functional CLEI code             | SAC1BF                                                                                                         | Selects channel unit signaling function.<br>For TD0C function code, the only valid<br>options are "TRMT attenuator" and<br>"Redlined."<br><br><br>For TDOC: 0 - 11.6<br><br><br><br><br><br>For TDOC: "NO" is only valid entry. |
|                                                                                                                                                                                                          | Function code                    | [FX01], FX02<br>FX03, FX05<br>FXP1, FXP2<br>FXP3, FXP5<br>TD0A, TD0B<br>TD0C, TD0D<br>TDSA, TDSB<br>TDSC, TDSD |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          |                                  |                                                                                                                |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | TRMT attenuator                  | 0 - [16.5]                                                                                                     |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | RCV attenuator                   | 0 - [16.5]                                                                                                     |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Nonloaded/loaded                 | L - [N]                                                                                                        |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Slope                            | [0] to 15                                                                                                      |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Height                           | [0] to 15                                                                                                      |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Bandwidth                        | [0] to 15                                                                                                      |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | TRMT and RCV                     | 150, [600], or 1200                                                                                            |                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                          | Redlined                         | YES or [NO]                                                                                                    |                                                                                                                                                                                                                                 |

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**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                                                                                          | Option                      | Range                         | Comment                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| AUA52,<br>or AUA152<br>OCU dataport<br>(AUA52/<br>AUA152 <i>CLEI</i> *<br>code = 5SCU48)                                                                              | Functional <i>CLEI</i> code | 5SCU48                        |                                                                                                                                                     |
|                                                                                                                                                                       | Function code               | OCU                           |                                                                                                                                                     |
|                                                                                                                                                                       | Subscriber Data Rate        | 2.4, 4.8, 9.6, [56]           |                                                                                                                                                     |
|                                                                                                                                                                       | Error Correction            | MVEC, SCEC, [NONE]            | For rate=56 kb/s, MVEC is not allowed.                                                                                                              |
|                                                                                                                                                                       | All-zero-code allowed       | YES, [NO]                     |                                                                                                                                                     |
|                                                                                                                                                                       | Secondary channel used      | YES, [NO]                     |                                                                                                                                                     |
|                                                                                                                                                                       | Redlined                    | YES, [NO]                     |                                                                                                                                                     |
| AUA52B,<br>or AUA252( )<br>OCU dataport<br>(AUA52B <i>CLEI</i><br>code = 5SC143)<br>(AUA252 <i>CLEI</i><br>code = 5SCTFFE)<br>(AUA252B <i>CLEI</i><br>code = 5SCTFFF) | Functional <i>CLEI</i> code | 5SC143, 5SCTFF                |                                                                                                                                                     |
|                                                                                                                                                                       | Function code               | OCU                           |                                                                                                                                                     |
|                                                                                                                                                                       | Subscriber Data Rate        | 2.4, 4.8, 9.6, 19.2, [56], 64 |                                                                                                                                                     |
|                                                                                                                                                                       | Error Correction            | MVEC, SCEC, [NONE]            | For rate=56 or 64 kb/s, MVEC is not allowed. On the AUA52B, selecting MVEC with 19.2 kb/s enables single time slot 19.2 error correction (19.2 EC). |
|                                                                                                                                                                       | All-zero-code allowed       | YES, [NO]                     | For rate=64 kb/s, set to Yes.                                                                                                                       |
|                                                                                                                                                                       | Secondary channel used      | YES, [NO]                     |                                                                                                                                                     |
|                                                                                                                                                                       | Redlined                    | YES, [NO]                     |                                                                                                                                                     |

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**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                                  | Option                      | Range                                       | Comment                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SPQ</i> <sup>®</sup> 452*<br>( <i>CLEI</i> <sup>†</sup> =5SCTFFG)<br>When Function Code<br>OCU is selected | Functional <i>CLEI</i> code | 5SCTFF                                      |                                                                                                                                                                |
|                                                                                                               | Function Code*              | [OCU], SW56                                 | The OCU function code is for dataport services.                                                                                                                |
|                                                                                                               | Subscriber Data Rate        | 2.4, 4.8, 9.6, 19.2,<br>38.4, [56], 64 kb/s |                                                                                                                                                                |
|                                                                                                               | Error Correction            | [NONE], SCEC, MVEC                          | MVEC is not permitted for 38.4, 56, or 64 kb/s. On the <i>SPQ</i> 452, selecting MVEC with 19.2 kb/s enables single time slot 19.2 error correction (19.2 EC). |
|                                                                                                               | All Zero Code               | YES, [NO]                                   | This option is set to YES if the 64-kb/s data rate is selected                                                                                                 |
|                                                                                                               | Secondary Channel           | YES, [NO]                                   |                                                                                                                                                                |
|                                                                                                               | Quality Monitoring          | YES, [NO]                                   |                                                                                                                                                                |
| <i>SPQ</i> <sup>®</sup> 452*<br>( <i>CLEI</i> =5SCTFFG)<br>When Function Code<br>SW56 is selected.            | Redlined                    | YES, [NO]                                   |                                                                                                                                                                |
|                                                                                                               | Functional <i>CLEI</i> code | 5SCTFF                                      |                                                                                                                                                                |
|                                                                                                               | Function Code*              | [OCU], SW56                                 | The SW 56 function code is for Switched 56 services.                                                                                                           |
|                                                                                                               | Enhanced Switched 56*       | YES, [NO]                                   |                                                                                                                                                                |
|                                                                                                               | A/B Signaling*              | YES, [NO]                                   |                                                                                                                                                                |
|                                                                                                               | Quality Monitoring          | YES, [NO]                                   |                                                                                                                                                                |
|                                                                                                               | Redlined                    | YES, [NO]                                   |                                                                                                                                                                |

\* **Release 3.3 Channel Unit Information:** The system COT does not provide the following options for the *SPQ*452 channel unit: SW56, Enhanced SW56, and A/B Signaling.

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**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                                                                                     | Option                  | Range                          | Comment                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUA54 E&M<br>or SPQ454<br>channel unit<br>(AUA54 CLEI*<br>code = 5SCU7B)<br>(SPQ454 CLEI<br>code = SAC1BG)                                                       | Functional CLEI code    | SAC1BG                         |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Function code           | [EM4C], EM4H<br>PLR1, PLR2     |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | TRMT attenuator         | 0 to 25.5, [16.5]              |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | RCV attenuator          | 0 to 25.5, [16.5]              |                                                                                                                                                                                                                                                                                                                                    |
| SPQ456<br>(CLEI=SACPDC)                                                                                                                                          | Redlined                | YES or [NO]                    |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Functional CLEI code    | SACPDC                         |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Function Code           | [DFLT], RVT                    | Selects channel signaling function.                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                  | Transmission Loss       | 0, [2.5] dB                    | Provisionable loss.                                                                                                                                                                                                                                                                                                                |
| AUA92, AUA93, or<br>AUA293 ISDN<br>BRITE II<br>channel unit<br>(AUA92 CLEI<br>code = 5SC1JE)<br>(AUA93 CLEI<br>code = 5SC1HE)<br>(AUA293 CLEI<br>code = 5SC4PT0) | Redlined                | YES, [NO]                      |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Functional CLEI code    | 5SC1HE (RT) or<br>5SC1JE (COT) |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | ISDN channel<br>service | 2B+D, 1B+D, [D]                | Selects type of ISDN service<br>for the channel.                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                  |                         |                                |                                                                                                                                                                                                                                                                                                                                    |
| AUA94() or SPQ494<br>ISDN channel unit<br>(AUA94() CLEI<br>code = 5SC18E)<br>(SPQ494 CLEI<br>code = 5SC212)                                                      | Functional CLEI code    | 5SC18E, 5SC212                 |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Function Code           | ISDN                           |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  |                         |                                | These CUs can be provisioned from<br>the CIT when software release R4.5<br>or later is install on the RT/HDT. Even<br>though a single command acts upon<br>several objects, you must repeat the<br>command twice for the AUA94(), and<br>four times for the SPQ494 to provision<br>all ISDN lines provided by the channel<br>unit. |
| PGM†-2000‡<br>(CLEI=SAC1CS)                                                                                                                                      | Functional CLEI code    | SAC1CS                         |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Function Code           | [PG5], PG8, PG15,<br>PG20      |                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                  | Redlined                | YES, [NO]                      | Selects program channel bandwidth<br><i>in the system.</i>                                                                                                                                                                                                                                                                         |

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‡ **Release 3.3 Channel Unit Information:** The system COT does not prompt for the PGM-2000 channel unit's function code; rather, setting the program channel bandwidth is done automatically.

*Continued on next page*

**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                 | Option                                 | Range                                    | Comment                                                                                                                                                      |
|----------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SPQ</i> <sup>®</sup> 808 or <i>SPQ</i> 809<br>MSDT or DT Server                           | 12- and 24- line MSDT, V-MSDT, or V-DT | 0, 12, [24]                              | Use the CIT command <b>ed-dt</b> to set the number of lines feeding the MSDT, V-MSDT, or V-DT. Default is 24.                                                |
| <i>SPQ</i> 810 DT Server                                                                     | 12- and 24- line V-DT                  | 0, 12, [24]                              | Use the CIT command <b>ed-dt</b> to set the number of lines feeding the MSDT, V-MSDT, or V-DT. Default is 24.                                                |
|                                                                                              | DS1 Mode                               | Quad, Octet                              |                                                                                                                                                              |
| <i>SPQ</i> 334<br>( <i>CLEI</i> <sup>†</sup> =5SC324)<br>When Function Code SW56 is selected | Functional <i>CLEI</i> code            | 5SC324                                   |                                                                                                                                                              |
|                                                                                              | Function Code                          | [DS0A],DS0B,SW56                         |                                                                                                                                                              |
|                                                                                              | A/B Signaling                          | YES, [NO]                                |                                                                                                                                                              |
|                                                                                              | Error Correction <sup>†</sup>          | NONE                                     |                                                                                                                                                              |
|                                                                                              | Data Rate <sup>†</sup>                 | 56 kb/s                                  |                                                                                                                                                              |
|                                                                                              | All Zero Code <sup>†</sup>             | NO                                       |                                                                                                                                                              |
|                                                                                              | Redlined <sup>†</sup>                  | YES, [NO]                                |                                                                                                                                                              |
| <i>SPQ</i> 334<br>( <i>CLEI</i> =5SC324)<br>When Function Code DS0A or DS0B is selected      | Functional <i>CLEI</i> code            | 5SC324                                   |                                                                                                                                                              |
|                                                                                              | Function Code                          | [DS0A],DS0B,SW56                         |                                                                                                                                                              |
|                                                                                              | Data Rate                              | 2.4, 4.8, 9.6, 19.2, 38.4, [56], 64 kbps |                                                                                                                                                              |
|                                                                                              | Error Correction                       | [NONE], SCEC, MVEC                       | MVEC is not permitted for 38.4, 56, or 64 kb/s. On the <i>SPQ</i> 334, selecting MVEC with 19.2 kb/s enables single time slot 19.2 error correction(19.2 EC) |
|                                                                                              | All Zero Code                          | YES, [NO]                                | This option is set to YES if the 64-kb/s data rate is selected.                                                                                              |
|                                                                                              | Redlined                               | YES,[NO]                                 |                                                                                                                                                              |

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† For the *SPQ*334 channel unit, when Function Code SW56 is selected, only the range value shown is valid for the following options: Data Rate, All Zero Code, and Error Correction.

*Continued on next page*



**Table 8-20. Channel Unit Options Provisioned Using the CIT (Continued)**

| Channel Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Option                                    | Range                                                                                                                             | Comment                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUA25, AUA25B, AUA27,<br>AUA45, AUA45B, AUA51,<br>AUA53, AUA56, AUA56B,<br>AUA57, AUA58, AUA58B,<br>AUA58C, AUA59, AUA75,<br>AUA150, AUA150C, AUA151,<br>AUA158, AUA158B, AUA158C,<br>AUA159, AUA159B, AUA159C,<br>AUA178, AUA179, MCU5205,<br>MCU5405, SPQ400, SPQ400B,<br>XSPQ400, SPQ401, SPQ401B,<br>SPQ419, SPQ429, SPQ440,<br>SPQ440B, SPQ440C, SPQ450,<br>SPQ453, SPQ478, and SPQ909<br>(CLEI* codes: 5SCURP7,<br>5SCURP8, 5SC1DD1, 5SCUU05,<br>5SCUUJ5, 5SCU150, 5SCU261,<br>5SCU9E0, 5SCU9Y0, 5SCUT04,<br>5SCU1H0, 5SCU1H8, 5SC1P00,<br>5SCU1L0, 5SC1FF2, 5SCU1LV,<br>5SC3PV0, 5SC1XXO,<br>5SC1WW8, 5SC1WW0,<br>5SC1WK0, 5SC1WW9,<br>5SC1W09, 5SC1WK9,<br>5SC1WX0, 5SC1HW9, 5SC26TV,<br>5SC26T0, SAC1AAA,<br>SAC1AUA, SAC1EW0,<br>SAC1EWU, SAC1ARM,<br>SAC1AK0, SAC1AAE,<br>SAC1AAG, SAC1AC0,<br>SAC1AAD, 5SC3EEC,<br>SAC1AAK, SAC1A00) | Functional CLEI code<br><br>Function code | [OTHER]<br><br>See Table 8-21 on<br>page 8-117 for the<br>function codes<br>available with the<br>functional CLEI code<br>"OTHER" | The DFLT<br>function code is<br>used for POTS-<br>type units and<br>switch-optioned<br>units so the<br>system can<br>provision the slot<br>for the equipped<br>channel units. |

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**Table 8-21. Function Codes for the Functional CLEI Code “OTHER”**

| <b>Function Code</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AC                   | Manual ringdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DATA                 | Digital data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| DFLT                 | Defaults (for TR-08 VRTs) to equipped function (circuit function determined by installed channel unit). The function code for certain CUs can be derived from the equipment in addition to being explicitly specified. This includes POTS, multiparty (MP), coin, frequency selective ringing (FSR), direct inward dial (DID), manual ringdown, private line automatic ring (PLAR), and DC bypass pair or alarm channel units<br><br>Default for TR-303 VRTs is 2-wire loop start (LS). You must explicitly provision other functions using the appropriate function code. |
| EBS                  | Enhanced Business Service (EBS) (P-Phone)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| GO                   | 2-wire ground start (current sink)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| GS                   | 2-wire ground start (current feed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| LO                   | 2-wire loop start (current sink)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| LR                   | Private line automatic ringdown (PLAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| LS                   | 2-wire loop start (current feed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| NO                   | 2-wire transmission only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| RVT                  | 2-wire loop reverse battery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Operations Channel (EOC)

The EOC provisionable parameters are listed in Table 8-22. The DS1 and ATT ISDN framed path termination parameters referred to in this table are listed separately in Table 8-23 and Table 8-24, respectively.

**Table 8-22. EOC Provisionable Parameters (TR-303 VRT)**

| Object                       | Attribute                                            | Range                                                               | Default (Note)                                         |
|------------------------------|------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|
| Equipment                    | Location Name                                        | 36 characters                                                       | set by set-sid                                         |
| Network Element              | System Clock                                         | YYYYMMDDhhmmss.s                                                    | 19700101000000.0                                       |
| IDLC Data Link Profile       | Maximum I Frames                                     | 1-7                                                                 | 7                                                      |
|                              | N200                                                 | 1-10                                                                | 3                                                      |
|                              | T200                                                 | 100-1000 ms., increments of 50                                      | 150 ms.                                                |
|                              | T203                                                 | 10-300 sec., increments of 10                                       | 30 sec.                                                |
| IDLC Call Processing Profile | T303                                                 | 700-4700 ms., inc. by 500                                           | 700 ms.                                                |
|                              | T308                                                 | 2-5 sec.                                                            | 4 sec.                                                 |
|                              | T396                                                 | 700-14700 ms., inc. by 1000                                         | 14700 ms.                                              |
|                              | T397                                                 | 60-180 sec.                                                         | 120 sec.                                               |
| ds1 Line Termination         | DS1 line coding<br>Line Build Out                    | AMIZCS,B8ZS*<br>0-655                                               | B8ZS                                                   |
| ds1 Framed Path Termination  | DS1 Frame Format                                     | ESF                                                                 | ESF                                                    |
| Event Report Control         | Discriminator State                                  | True (active), False (inactive)                                     | True                                                   |
| Cross Connection             | From Termination ID<br>To Termination ID<br>Redlined | Local Distinguished Name<br>Local Distinguished Name<br>True, False |                                                        |
| PM Interval Profile (DS1)    | Interval Value                                       | 15, 60 for minute<br>1 for day                                      | 15<br>1                                                |
| ATT PM Freeze Sched. (DS1)   | Schedule State<br>Interval<br>PM Start Time          | True (Active), False (Inactive)<br>15, 60<br>0-23                   | True<br>Must match PM Interval Profile<br>0 (Midnight) |
| DS1 Framed Path Termination  | See Table 8-23                                       |                                                                     |                                                        |
| PM Interval Profile (DSL)    | Interval Value                                       | 1,2,3,4,6,8,12,24 for interval<br>1 for hourly/daily                | 1<br>1                                                 |
| ATT PM Freeze Schedule (DSL) | Schedule State<br>Interval<br>PM Start Time          | True (Active), False (Inactive)<br>1,2,3,4,6,8,12,24<br>0-23        | True<br>1<br>0 (Midnight)                              |
| ISDN Per System Profile      | DSL SES Definition                                   | 1-255                                                               | 3                                                      |
| ATT ISDN Framed Path Term.   | See Table 8-24                                       |                                                                     |                                                        |

**Note:** Default means value established by the system on turn-up.

\* DS1 #1 and DS1 #2 must be set to B8ZS.

**Table 8-23. DS1 Framed Path Termination Parameters (EOC Provisionable)**

| Object                      | Attribute          | Range   | Default |
|-----------------------------|--------------------|---------|---------|
| DS1 Framed Path Termination | CV Day Current     | 0*      |         |
|                             | CV Day Previous    | 0*      |         |
|                             | CV Min Current     | 0*      |         |
|                             | CV Min Previous    | 0*      |         |
|                             | ES Day Threshold   | 1-86400 | 648     |
|                             | ES Min Threshold   | 1-3600  | 65/259  |
|                             | ES Day Current     | 0*      |         |
|                             | ES Day Previous    | 0*      |         |
|                             | ES Min Current     | 10      |         |
|                             | ES Min Previous    | 0*      |         |
|                             | ES Min History     | 0*      |         |
|                             | SES Day Threshold  | 1-86400 | 100     |
|                             | SES Min Threshold  | 1-3600  | 10/40   |
|                             | SES Day Current    | 0*      |         |
|                             | SES Day Previous   | 0*      |         |
|                             | SES Min Current    | 0*      |         |
|                             | SES Min Previous   | 0*      |         |
|                             | SES Min History    | 0*      |         |
|                             | SEFS Day Threshold | 1-86400 | 17      |
|                             | SEFS Min Threshold | 1-3600  | 2/7     |
|                             | SEFS Day Current   | 0*      |         |
|                             | SEFS Day Previous  | 0*      |         |
|                             | SEFS Min Current   | 0*      |         |
|                             | SEFS Min Previous  | 0*      |         |
|                             | SEFS Min History   | 0*      |         |
|                             | DM Day Threshold   | 1-1440  | 4       |
|                             | DM Min Threshold   | 1-60    | 4/15    |
|                             | DM Day Current     | 0*      |         |
|                             | DM Day Previous    | 0*      |         |
|                             | DM Min Current     | 0*      |         |
|                             | DM Min Previous    | 0*      |         |
|                             | DM Min History     | 0*      |         |

\* Partial Accumulate 0 is the only valid value.

*Continued on next page*

**Table 8-23. DS1 Framed Path Termination Parameters (EOC Provisionable)  
(Continued)**

| Object                                        | Attribute         | Range   | Default |
|-----------------------------------------------|-------------------|---------|---------|
| DS1 Framed Path<br>Termination<br>(Continued) | UAS Day Threshold | 1-86400 | 10      |
|                                               | UAS Min Threshold | 1-3600  | 3/10    |
|                                               | UAS Day Current   | 0*      |         |
|                                               | UAS Day Previous  | 0*      |         |
|                                               | UAS Min Current   | 0*      |         |
|                                               | UAS Min Previous  | 0*      |         |
|                                               | UAS Min History   | 0*      |         |
|                                               | CSS Day Threshold | 1-86400 | 4       |
|                                               | CSS Min Threshold | 1-3600  | 1/2     |
|                                               | CSS Day Current   | 0*      |         |
|                                               | CSS Day Previous  | 0*      |         |
|                                               | CSS Min Current   | 0*      |         |
|                                               | CSS Min Previous  | 0*      |         |
|                                               | CSS Min History   | 0*      |         |
|                                               | APS BER Threshold | 6†      |         |

---

\* Partial Accumulate 0 is the only valid value.

† Value is fixed and is always 6.

---

**Table 8-24. ISDN Framed Path Termination Parameters (EOC Provisionable)**

| Object                                 | Attribute           | Value       | Default     |
|----------------------------------------|---------------------|-------------|-------------|
| ATT ISDN<br>Framed Path<br>Termination | CV Fe Hr Current    | 0/Corrupted | 0/Corrupted |
|                                        | SES Fe Hr Current   | 0/Corrupted | 0/Corrupted |
|                                        | ES Fe Hr Current    | 0/Corrupted | 0/Corrupted |
|                                        | CV Hr Current       | 0/Corrupted | 0/Corrupted |
|                                        | SES Hr Current      | 0/Corrupted | 0/Corrupted |
|                                        | ES Hr Current       | 0/Corrupted | 0/Corrupted |
|                                        | CV Fe Hr Previous   | 0/Corrupted | 0/Corrupted |
|                                        | SES Fe Hr Previous  | 0/Corrupted | 0/Corrupted |
|                                        | ES Fe Hr Previous   | 0/Corrupted | 0/Corrupted |
|                                        | CV Hr Previous      | 0/Corrupted | 0/Corrupted |
|                                        | SES Hr Previous     | 0/Corrupted | 0/Corrupted |
|                                        | ES Hr Previous      | 0/Corrupted | 0/Corrupted |
|                                        | ES Fe Hr History    | empty SET   | empty SET   |
|                                        | ES Hr History       | empty SET   | empty SET   |
|                                        | SES Fe Day Current  | 0/Corrupted | 0/Corrupted |
|                                        | ES Fe Day Current   | 0/Corrupted | 0/Corrupted |
|                                        | SES Day Current     | 0/Corrupted | 0/Corrupted |
|                                        | ES Day Current      | 0/Corrupted | 0/Corrupted |
|                                        | SES Fe Day Previous | 0/Corrupted | 0/Corrupted |
|                                        | ES Fe Day Previous  | 0/Corrupted | 0/Corrupted |
|                                        | SES Day Previous    | 0/Corrupted | 0/Corrupted |
|                                        | ES Day Previous     | 0/Corrupted | 0/Corrupted |
|                                        | SES Hr Threshold    | 1-3601      | 10          |
|                                        | ES Hr Threshold     | 1-3601      | 40          |
|                                        | SES Day Threshold   | 1-86401     | 25          |
|                                        | ES Day Threshold    | 1-86401     | 100         |

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*Continued on next page*

**Table 8-24. ISDN Framed Path Termination Parameters (EOC Provisionable)  
(Continued)**

| <b>Object</b>                                      | <b>Attribute</b>         | <b>Value</b> | <b>Default</b> |
|----------------------------------------------------|--------------------------|--------------|----------------|
| ATT ISDN Framed<br>Path Termination<br>(Continued) | CV Fe Int Current        | 0/Corrupted  | 0/Corrupted    |
|                                                    | SES Fe Int Current       | 0/Corrupted  | 0/Corrupted    |
|                                                    | ES Fe Int Current        | 0/Corrupted  | 0/Corrupted    |
|                                                    | CV Int Current           | 0/Corrupted  | 0/Corrupted    |
|                                                    | SES Int Current          | 0/Corrupted  | 0/Corrupted    |
|                                                    | ES Int Current           | 0/Corrupted  | 0/Corrupted    |
|                                                    | CV Fe Int Previous       | 0/Corrupted  | 0/Corrupted    |
|                                                    | SES Fe Int Previous      | 0/Corrupted  | 0/Corrupted    |
|                                                    | ES Fe Int Previous       | 0/Corrupted  | 0/Corrupted    |
|                                                    | CV Int Previous          | 0/Corrupted  | 0/Corrupted    |
|                                                    | SES Int Previous         | 0/Corrupted  | 0/Corrupted    |
|                                                    | ES Int Previous          | 0/Corrupted  | 0/Corrupted    |
|                                                    | ES Fe Int History        | empty SET    | empty SET      |
|                                                    | ES Int History           | empty SET    | empty SET      |
|                                                    | SES Int Report Threshold | 1-86401      | 5              |
|                                                    | ES Int Report Threshold  | 1-86401      | 20             |
|                                                    | SES Day Report Threshold | 1-86401      | 15             |
|                                                    | ES Day Report Threshold  | 1-86401      | 50             |

## **Provisionable System Defaults**

All installation and service parameters have preset defaults defined with the software installation. These preset defaults can be tailored to the company's individual needs. The following parameters can be set for common units (this list does not include all settable parameters).

- Parameters for SONET feeder such as OC-3 and DCC provisioning, and protection switching and performance monitoring
- Bandwidth management parameters — STS-1 and/or VT1.5 cross-connect provisioning
- Parameters for maintenance and alarm reporting
- DS1 pipe provisioning.

## **Remote Alarm Planning**

Several alarm configurations are supported. The *SLC-2000* Access System RT/HDT can report miscellaneous/environmental alarms (14 with the SYSCTL or 6 with LIUs) plus the PMN and an external (cabinet) minor alarm to the office and remote alarm systems. Chapter 7 explains the alarm configurations in more detail.

The *SLC-2000* RT/HDT reports a power minor alarm (PMN) when AC power is lost and the system switches to battery backup. If the central office alarm display is equipped to show the PMN status, the *SLC-2000* COT or DDM-2000 multiplexer should be optioned to transmit PMN by itself to the office alarm system. Otherwise, PMN can be grouped with the central office MN alarm.

With the SYSCTL, the alarm level (critical, major, or minor) can be provisioned with the CIT. See Chapter 7 for details.



## Facility Engineering

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### Fiber Facility

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#### OC-3 Fiber Interface

Optical line interface units (OLIUs) used in the *SLC-2000* system for OC-3 interface include the 21D, 21G, 22F, 22D-U, and 22G-U OLIUs. Chapter 5 describes the application and operation of these units.

#### OC-12 Fiber Interface

The OLIU used in the *SLC-2000* system for OC-12 interface is the 24G-U OLIU. Chapter 3 and Chapter 5 describe the application and operation of this unit.

#### OC-1 Fiber Interface

Function group C of the SONET subsystem can host an OC-1 ring configuration when used with a DDM-2000 FiberReach wideband shelf (WBS). When used for this configuration, function group C contains 27G-U OLIUs.

Function group C can also multiplex DSX-1s from the DT Servers onto an OC-1 ring when it contains 26G2-U OLIUs. This configuration requires an J1C26AA-1, L4 ARM shelf and SONET subsystem software release R13 or later. Also, any WBSs in the ring must contain FiberReach software release R3.0 or later.

Chapter 3 and Chapter 5 describe the applications and operations of this units.

### Loss Budgets

The span length, loss budget, and other link parameters for the OLIUs are given in the following tables:

- **21G/21G-U and 21D/21D-U/22D-U OLIUs:** Table 8-25 on page 8-125
- **22F, 22G-U, and 22G2-U OLIUs:** Table 8-26 on page 8-127
- **24G-U OC-12 OLIU:** Table 8-27 on page 8-128
- **26G2-U and 27G2-U OC-1 OLIUs:** Table 8-28 on page 8-129
- **OC-3 OLIU Link Budget — Multimode Operation:** Table 8-29 on page 8-130
- **26G2-U and 27G2-U OC-1 OLIU Multimode Operation:** Table 8-30 on page 8-131.

**Table 8-25. 21G/21G-U and 21D/21D-U/22D-U OLIU Link Budgets (Note 1)**

| Parameter                                 | 21G/21G-U           |               | 21D/21D-U/22D-U  |
|-------------------------------------------|---------------------|---------------|------------------|
|                                           | Tx High<br>(Note 2) | Tx Low        |                  |
| Minimum Wavelength ( $\lambda_{Tmin}$ )   | 1282/1280* nm       | 1282/1280* nm | 1270/1260* nm    |
| Maximum Wavelength ( $\lambda_{Tmax}$ )   | 1325/1335* nm       | 1325/1335* nm | 1380 nm          |
| Spectral Width ( $\delta\lambda_{rms}$ )  | 4.0 nm              | 4.0 nm        | 170 nm ¶¶        |
| Maximum Transmitter Power† ( $P_{Tmax}$ ) | -2.5 dBm            | -7.5 dBm      | -14.0 dBm        |
| Minimum Transmitter Power ( $P_{Tmin}$ )  | -5.0 dBm            | -11.4 dBm     | -18.8/-21.8 dBm  |
| Maximum Received Power ( $P_{Rmax}$ )     | -7.0 dBm            | -7.0 dBm      | -14.0 dBm        |
| Receiver Sensitivity ( $P_{Rmin}$ )       | -34.0 dBm           | -34.0 dBm     | -33.8/-31.8* dBm |
| Minimum System Gain (S-R)‡                | 29.0 dB             | 22.6 dB       | 15/10.0* dB      |
| Optical Path Penalty ( $P_O$ )§           | 1.0 dB              | 1.0 dB        | 1.6 dB           |
| Connector Loss¶                           | 1.5 dB              | 1.5 dB        | 1.5 dB           |
| Unallocated Margin**                      | 1.5 dB              | 1.5 dB        | 2.0 dB           |
| Minimum Loss Budget                       | 4.5 dB††            | 0.0 dB        | 0.0 dB           |
| Maximum Loss Budget‡‡                     | 25.0 dB             | 18.6 dB       | 9.9/4.9* dB      |
| Maximum Span Length§§                     | 55 km               | 41 km         | (Note 3)         |

**Notes:**

1. All terminology is consistent with TR-TSY-000253 (TR-253). All specifications for the 21G/21G-U OLIU meet or exceed long reach (LR) values described in TR-253.
2. The High/Low transmitted power switch on the 21G/21G-U OLIU circuit pack allows for loopbacks or small outside plant (OSP) budgets without external attenuators.  
Multimode only. See Table 8-29.

\* When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions.

† Transmit and receive powers are referenced to points S and R as shown in Figure 8-33.

‡ The minimum system gain for the SONET OC-3 interface takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power.

**Table 8-25. 21G/21G-U and 21D/21D-U/22D-U OLIU Link Budgets (Continued)**

§ Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path.

¶ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

\*\* Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

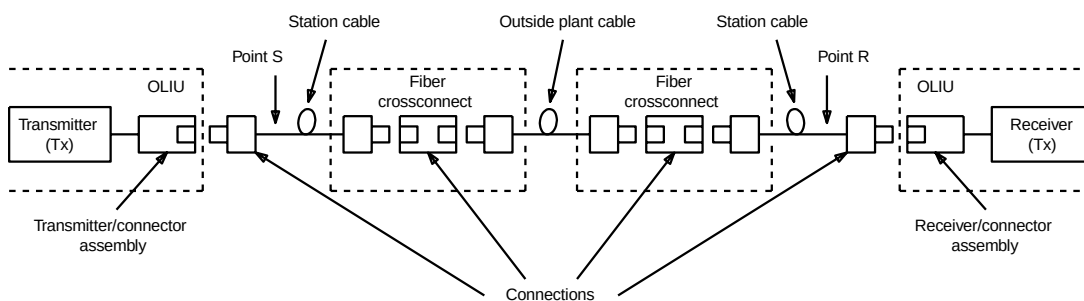
†† If the loss budget is less than 6.0 dB, use low power. Maximum loss budget includes a 1.5 dB safety margin.

‡‡ Budget available for both station and transmission cable and splices.

§§ Attenuation and dispersion can be the limiting factors in span length. For OC-3 single-mode fiber systems, dispersion is not a factor and all applications are attenuation-limited. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 splices total) associated with single-mode fiber.

Maximum span length can be calculated more precisely based on specific fiber and splice characteristics and local engineering rules.

¶¶ Full width at half maximum (FWHM) spectral width.



813696.eps

**Figure 8-33. Optical System Interfaces (Points S and R)**

**Table 8-26. 22F, 22G-U, and 22G2-U OLIU Link Budgets (Note 1)**

| Parameter                                 | 22F       | 22G-U     | 22G2-U    |
|-------------------------------------------|-----------|-----------|-----------|
| Minimum Wavelength ( $\lambda_{Tmin}$ )   | 1260 nm   | 1272 nm   | 1272 nm   |
| Maximum Wavelength ( $\lambda_{Tmcx}$ )   | 1360 nm   | 1350 nm   | 1350 nm   |
| Spectral Width ( $\delta \lambda_{rms}$ ) | 7.7 nm    | 3.0 nm    | 3.0 nm    |
| Maximum Transmitter Power† ( $P_{Tmcx}$ ) | −8.0 dBm  | 0.0 dBm   | 0.0 dBm   |
| Minimum Transmitter Power ( $P_{Tmin}$ )  | −15.0 dBm | −7.0 dBm  | −7.0 dBm  |
| Maximum Received Power ( $P_{Rmcx}$ )     | −7.0 dBm  | −7.0 dBm  | 0.0 dBm   |
| Receiver Sensitivity ( $P_{Rmin}$ )       | −34.0 dBm | −34.0 dBm | −34.0 dBm |
| Minimum System Gain (S-R)‡                | 19.0 dB   | 27.0 dB   | 27.0 dB   |
| Optical Path Penalty ( $P_O$ )§           | 1.0 dB    | 1.0 dB    | 1.0 dB    |
| Connector Loss¶                           | 1.5 dB    | 1.5 dB    | 1.5 dB    |
| Unallocated Margin**                      | 1.5 dB    | 1.5 dB    | 1.5 dB    |
| Minimum Loss Budget                       | 0.0 dB    | 7.0 dB    | 0.0 dB    |
| Maximum Loss Budget‡‡                     | 15.0 dB   | 23.0 dB   | 23.0 dB   |
| Maximum Span Length§§                     | 33 km     | 51 km     | 51 km     |

**Notes:**

1. All terminology is consistent with TR-253. All specifications for the 22F OLIU meet or exceed intermediate reach (IR) values described in TR-253.

† Transmit and receive powers are referenced to points S and R as shown in Figure 8-33.

‡ The minimum system gain for the SONET OC-3 interface takes into account aging temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power.

§ Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path.

¶ One connector (0.75 dB) on each end is assumed to connect station cable to Outside Plant.

\*\* Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

‡‡ Budget available for both station and transmission cable and splices.

§§ Attenuation and dispersion can be the limiting factors in span length. For OC-3 single-mode fiber systems, dispersion is not a factor and all applications are attenuation limited. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 splices total) associated with single-mode fiber. Maximum span length can be calculated more precisely based on specific fiber and splice characteristics and local engineering rules.

**Table 8-27. 24G-U OC-12 OLIU Link Budgets**

| Parameter                                             | 24G-U OLIU |
|-------------------------------------------------------|------------|
| Minimum Wavelength ( $\lambda_{Tmin}$ )               | 1280 nm    |
| Maximum Wavelength ( $\lambda_{Tmax}$ )               | 1335 nm    |
| Spectral Width ( $\Delta\lambda_{20}$ )               | 1.0 nm     |
| Maximum Transmitter Power ( $P_{Tmax}$ ) <sup>*</sup> | +1.9 dBm   |
| Minimum Transmitter Power ( $P_{Tmin}$ )              | -3.0 dBm   |
| Maximum Received Power ( $P_{Rmax}$ )                 | -8.0 dBm   |
| Maximum Received Power ( $P_{Rmin}$ )                 | -30.0 dBm  |
| Minimum system Gain (S-R) <sup>†</sup>                | 27.0 dB    |
| Optical Path Penalty ( $P_O$ ) <sup>‡</sup>           | 1.0 dB     |
| Connector Loss <sup>§</sup>                           | 1.5 dB     |
| Unallocated Margin <sup>¶</sup>                       | 1.5 dB     |
| Minimum Loss Budget <sup>**</sup>                     | 8.0 dB     |
| Maximum Loss Budget <sup>††</sup>                     | 23.0 dB    |
| Maximum Span Length <sup>‡‡</sup>                     | 51 km      |

**Notes:**

1. All terminology is consistent with TR-253, Issue 2. All values are worst-case end of life.
2. All specifications for the 24G-U meet or exceed long reach (LR) values described in TR-253, Issue 2.

\* Transmit and receive powers are referenced to points S and R as shown in Figure 8-33 on page 8-126.

† The minimum system gain for the SONET subsystem of the SLC<sup>®</sup>-2000 system already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The SONET subsystem gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system is determined.

‡ Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The 24G-U has 4.0 dB of total margin. Optical path penalty is normally 1.0 dB.

§ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

¶ Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

\*\* The 24G-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 10 dB.

†† Budget available for both station and transmission cable and splices.

‡‡ Attenuation can be the limiting factors in span length. A rough rule of thumb for attenuation-limited systems operating in the 1310-nm wavelength range is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber in the 1310-nm range.

For the 24G-U, the maximum distance is not dispersion limited because single longitudinal mode laser is used. Given the attenuation assumption, the maximum span length for the 24G-U is 51 km.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

**Table 8-28. 26G2-U and 27G2-U OLIU Link Budgets**

| <b>Parameter</b>                                      | <b>26G2-U and<br/>27G2-U OLIU</b> |
|-------------------------------------------------------|-----------------------------------|
| Minimum Wavelength ( $\lambda_{Tmin}$ )               | 1272 nm                           |
| Maximum Wavelength ( $\lambda_{Tmax}$ )               | 1350 nm                           |
| Spectral Width ( $\Delta\lambda_{20}$ )               | 3.0 nm                            |
| Maximum Transmitter Power ( $P_{Tmax}$ ) <sup>*</sup> | -0.0 dBm                          |
| Minimum Transmitter Power ( $P_{Tmin}$ ) <sup>*</sup> | -7.0 dBm                          |
| Maximum Received Power ( $P_{Rmax}$ )                 | -13.8 dBm                         |
| Minimum Input Power ( $P_{Rmin}$ )                    | -30.8 dBm                         |
| Minimum System Gain (S-R) <sup>†</sup>                | 23.8 dB                           |
| Optical Path Penalty ( $P_O$ ) <sup>‡</sup>           | 1.0 dB                            |
| Connector Loss <sup>†</sup>                           | 1.5 dB                            |
| Unallocated Margin                                    | 1.5 dB                            |
| Minimum Loss Budget                                   | 13.8 dB                           |
| Maximum Loss Budget                                   | 19.8 dB                           |
| Maximum Span Length <sup>§</sup>                      | 44 km                             |

**Note:** All values are for both controlled and uncontrolled environmental conditions.

\* Transmit and receive powers are referenced to points S and R as shown in Figure 8-33 on page 8-126.

† One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

‡ Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path.

§ The 26G2-U/27G2-U OLIUs are dispersion limited at 44 km, due to the wider wavelength range. Assuming fiber with zero dispersion wavelength between 1300 and 1320 nm, the worst case dispersion over the transmitter wavelength range of 1272 to 1350 nm is 4.88 psec/nm km. This implies a 44 km span would have a total dispersion of about 214 psec/nm.

**Table 8-29. OC-3 OLIU Link Budget — Multimode Operation**

| <b>Fiber Bandwidth</b> | <b>Maximum Span Length (km)</b> |                     |                                 |
|------------------------|---------------------------------|---------------------|---------------------------------|
|                        | <b>21G/21G-U (Note 1)</b>       | <b>22F (Note 2)</b> | <b>21D/21D-U/22D-U (Note 3)</b> |
| 1000 MHz-km            | 6.5                             | 6.5                 | 3.6/3.4                         |
| 800 MHz-km             | 5.1                             | 5.1                 | 3.4/3.3                         |
| 500 MHz-km             | 3.1                             | 3.1                 | 2.7                             |
| 300 MHz-km             | 1.8                             | 1.8                 | 1.9                             |

**Notes:**

1. Maximum 21G/21G-U MM Link Budget (dB) for multimode operation is 22.0 dB for high power and 15.6 dB for low power.
2. Maximum 22F MM Link Budget (dB) for multimode operation is 12.0 dB.
3. When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions.

The system is dispersion limited for all the fiber bandwidths listed in this table.

Multimode fiber operation on the SONET OC-3 interface requires a minimum exit bandwidth of 120 MHz to ensure that dispersion loss is kept below acceptable levels. If the fiber is already installed and the exit bandwidth is measured at 120 MHz or greater, then the maximum link budget values (see Notes 1 and 2) can be used to determine if the loss budget is enough for that fiber.

If planning a new fiber installation, the values at the end of the table, given for a number of commercially available fiber bandwidth-distance products, can be used. Fiber distances are calculated using the 120 MHz exit bandwidth limit; however, actual exit bandwidths may be higher for these distances because of splices. This may permit longer span lengths (for the given fiber bandwidths) than those specified in the table. However, the span length can only be increased to the point where the system is loss limited as specified by the maximum multimode link budget given in the table (1 dB/km cable is assumed).

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**Table 8-30. 26G2-U and 27G2-U OLIU (OC-1) Link Budget — Multimode Operation (Note)**

| <b>Fiber Bandwidth</b> | <b>Maximum Span Length (km)</b> |
|------------------------|---------------------------------|
| 1000 MHz-km            | 19.8                            |
| 800 MHz-km             | 19.8                            |
| 500 MHz-km             | 19.8                            |
| 300 MHz-km             | 13.6                            |

**Note:**

The maximum Link Budget loss is 19.8 dB.

Multimode fiber operation requires a minimum exit bandwidth of 44 MHz to ensure that dispersion loss is kept below acceptable levels. If the fiber is already installed and the exit bandwidth is measured to be 44 MHz or greater, then the maximum link budget values can be used to determine if the loss budget is sufficient for that fiber.

If planning a new fiber installation, the values given in the table (given for a number of commercially available fiber bandwidth-distance products) can be used. Fiber distances are calculated using the 44-MHz exit bandwidth limit; however, actual exit bandwidths may be higher for these distances due to the existence of splices. This may permit longer span lengths to be achieved for the given fiber bandwidths than those specified in the table. In this case, however, the span length can only be increased to the point where the system is loss limited as specified by the maximum multimode link budget given in the table (1 dB/km cable is assumed).



## **SONET Performance Monitoring Parameters**

The alarm thresholding parameters that are monitored at the SONET interface are described in Chapter 7 and listed in Table 7-14 on page 7-77. See Table 8-19 for provisionable performance monitoring parameters.

## **Metallic Facility Engineering**

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### **T1 Digital Line Design**

Refer to 915-710-115, *SLC Series 5 Carrier System, Application Engineering, Facility Design Systems*.

### **Digital Line Powering Design**

Refer to 915-710-115, *SLC Series 5 Carrier System, Application Engineering, Facility Design Systems*.

## **Remote Terminal Engineering**

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The SLC-2000 Access System RT equipment arrangement consists of various combinations of MDS assemblies, ARM shelf assemblies, and fan units mounted in a cabinet or frame. This equipment may be supplied with bulk power and ringing using a centralized power source and battery supply and a common ringing supply. The RT frame arrangement provides a power interface unit (ED-7C734-30, G1) for connecting the power and ringing source to the bay and cabling it to the equipment.

Table 8-31 summarizes the *SLC-2000* Access System capacity for various RT enclosures. The frame may be mounted on customer premises, in a custom designed building, or in standard enclosures.

The standard enclosures for the RT frame are provided with precabled bays, protectors, and cable entrance facilities for terminating feeder and distribution facilities. Ordering information for RT enclosures is provided in Chapter 11, "Ordering."

Existing unfilled enclosures may be considered for transition from *SLC* Series 5 Carrier System to the *SLC-2000* Access System. The principal problem in this transition is the increased cabling, protection, and splicing space required. If all the bays in the enclosure are precabled, it is probably easier to remove the wiring for a given bay than try to reuse it for the *SLC-2000* Access System.

**Table 8-31. *SLC-2000* Access System RT Enclosure Capacities with Bulk Power**

| <b>Type of Enclosure</b> | <b>With SONET Feeder</b>    |                   |                    |                   |
|--------------------------|-----------------------------|-------------------|--------------------|-------------------|
|                          | <b>ARM Shelf Assemblies</b> | <b>TR-08 VRTs</b> | <b>TR-303 VRTs</b> | <b>Lines/DS1s</b> |
| 80A-BP/HX cabinet        | 1                           | 8                 | up to 1* or 2†     | 768‡/28           |
| 80D-BP/HX cabinet        | 2                           | 16                | up to 2* or 4†     | 1536‡/56          |
| 80G-BP/HX cabinet        | 3                           | 24                | up to 3* or 6†     | 2304/84           |
| 90A Cabinet              | 1                           | 8                 | up to 1* or 2†     | 768/28            |

\* Software Releases 4.0 and 4.1.

† Software Release 4.2 and later.

‡ Software Release 4.5 or later configured entirely for FITL distribution: 80A-BP/HX — 1152 lines  
80D-BP/HX — 2304 lines.

The derived pair wiring for the *SLC* Series 5 Carrier System and *SLC-2000* Access System is the same. However, the alarm pair wiring, power and ringing connections, and fusing requirements are different. Therefore, the *SLC* Series 5 Carrier System and the *SLC-2000* Access System should not be mixed in a bay.

If bay splicing space is a problem, a different splicing and protection arrangement must be provided that fits in the existing space. This may be solved by using a high-density protector, such as the 307-C2-100, with connectorization to the outside plant cables and to the bay.

The capacity of existing power supply and/or AC circuit breakers in the enclosure may have to be expanded depending on the quantity of systems being added.

### **RT/HDT Power and Ringing Architecture**

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The *SLC-2000* system requires nominal -48 V DC inputs and  $\pm 20$  Hz ringing inputs. The *SLC-2000* system does not contain integrated power and ringing sources and, thus, separate shelves/plants are needed to provide the bulk power and ringing sources. Ringing power is not required only if the *SLC-2000* system is configured for fiber distribution. Powering can be provided by the bulk power plants designed for the 80-type cabinets. Some power plant designs also have ringing capabilities. Separate ringing plants are also available, J1C182BC-1, if bulk power plants are specified that do not have ringing features.

The requirement for power input is -48 V DC nominal (-41.75 V DC to -60.0 V DC). The requirements for ringing input are *negative* ringing voltage at -20 Hz and positive ringing at +20 Hz. Ringing voltages consist of approximately 100 V AC with a superimposed nominal -48 V DC component. The DC voltage provides ring trip capability.

### **Power Termination/Distribution in Cabinets and RT Frames**

Powering termination and distribution for *SLC-2000* systems in 80-type cabinets is provided in the pre-equipped cabinets with a prewired cable harness. In remote terminal frames, power and ringing sources (feeders) are terminated to a power interface unit assembly, ED-7C723-30, G2. The PIU contains a cable harness for distribution of power and ringing to the *SLC-2000* equipment shelves. The PIU complies with the requirements of the National Electric Code (NEC) and *UL*<sup>\*</sup>-1459 for field wiring terminal connections, allowing deployment in restricted-access customer premises locations.

### **Fusing Protection**

There is no bay-level fusing of the incoming power or ringing feeders. Therefore, appropriate breaker/fusing protection is required at the source end. Circuit breaker and fusing recommendations are listed in the *SLC-2000 Remote Terminal Application Schematic*, SD-7C174-01. Fusing is provided on each shelf and is detailed in the following section.

### **System Powering/Distribution**

The *SLC-2000* system requires two -48 V DC feeders. The feeders terminate on a power interface unit assembly mounted on the side of the ARM shelf. The PIU

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\* Registered trademark of Underwriters Laboratories Inc.

contains a cable harness equipped with connectors for distributing and connecting the *SLC-2000* equipment shelves to the power cable dangles. The PIU assembly supports a metallic configuration consisting of one ARM shelf, up to four MDS assemblies, and one 4-type fan unit. In a FITL configuration, an additional bay power cable (ED-7C723-34, Group 5) is required with the PIU to power up to two HDOS shelves and another one 4-type fan unit.

Both power feeders are distributed to the ARM shelf, where one is a primary active feeder and the other is active but is intended for power redundancy. Each feeder powers two MDS assemblies; two assemblies are wired in parallel on one feeder and the remaining pair of MDS assemblies is wired on the other feeder. Lastly, the 4-type fan unit is powered by one feeder in parallel with the ARM shelf and two MDS assemblies. In a FITL configuration, each feeder is distributed to the ARM shelf, two MDS assemblies, one HDOS, and one 4-type fan unit.

### Component Powering

**PIU.** The power interface unit assembly is a metal enclosure mounted on the right side of the ARM shelf. It contains a UL-approved pressure-type field wiring terminal block and a connectorized cable harness for power distribution and connection to the *SLC-2000* equipment power cable dangles. The terminal block contains 20 screw-down terminals in two columns of ten rows each. One side of the unit is equipped with a factory prewired/connectorized cable harness. The other side of the terminal block is used to terminate the incoming power and ringing feeders.

**ARM shelf.** On the ARM shelf, power is distributed to the circuit packs where on-board modular power converters provide the voltages needed by the circuits. Power modules are located on the TGS, OLIU, MXRVO, OHCTL, SYSCTL, PDC, SMU, VTU/LIU, and TSI/BMP (CORE) circuit packs. The power converter on the MXRVO circuit pack in each **FUNCTION C** slot also provides power (using the backplane) to the DS1 circuit packs located in the DS1 low-speed interface section. The ITH subsystem has a power converter unit (PCU) that converts the -48 V input from the ARM shelf backplane to the power levels required by the other ITH units.

The ARM shelf power feeders are fused at 10 amps per feeder (on the UIP). If the -48 V power feeder input fails, a selector circuit on the circuit pack switches automatically to the alternate power feeder. The DS1 circuit pack also has a selector circuit to switch to the alternate MXRVO if the power feeder from the MXRVO fails. If a power module on a circuit pack fails, the circuit pack **FAULT** indicator will light.

**MDS assembly.** The metallic distribution shelf has one power feeder (fused at 5 A) cabled to the assembly. Fuses on the front panel of the assembly divide the power feeder into four power buses, one to each side of each shelf (Figure 5-19 on page 5-50). If a power bus fails, the power and test unit (PTU) in the adjacent side provides a fault indication that is reported on the UIP (**RETRIEVE-FAULTS** command and MAJOR indicator).

The power bus feeds the PTU; removing a PTU will interrupt power to the side. The PTU contains a power converter to provide the proper voltages for the common and channel units in the side. If a PTU power converter fails, the FAULT indicator will light *on the PTU in the adjacent side*.

**HDOS.** The high density optics shelf has one power feeder (single- or dual-fed) cabled to the assembly. The power feeder is divided through the fuses (located on the front panel of the assembly) into eight power buses (one bus for each PCU). The power bus feeds the PCU. The PCU contains a power converter to supply the proper voltages to the AYB1C optical units (OUs).

## Ringling

Ringling is distributed from the power interface unit using dangler cables to each MDS assembly. The power interface unit provides connections for two ringling feeders. Each ringling feeder (consisting of negative and positive ringling) serves up to 384 lines (two MDS assemblies). The ringling feeder is separated into negative and positive ringling with separate fuses on the MDS assembly front panel (see previous section on fusing).

The PTU in each side monitors ringling for the side; removing the PTU will drop service on a group of 12 channel units. Negative ringling is monitored all the time for the MDS assembly; however, positive ringling is monitored only when a multiparty channel unit (which uses positive ringling) is installed in the side. Loss of ringling is reported on the UIP (**RETRIEVE-FAULTS** command, normally with MAJOR indicator).

From the power interface unit, a single ringling feeder (consisting of negative and positive ringling) is connected to the ARM shelf. This ringling input is *not* fused and is routed only to the transmission/signaling unit (TSU) in the ITH for channel testing. Ringling is fused on the TSU. Loss of ringling is monitored by the ITH.

The system external alarm MJ alarm input is used to detect ringling generator failures.

## Cabling Considerations

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The RT bay cables are listed in the tables in Chapter 11. Cabling diagrams are provided at the end of the product description in 363-208-001, *SLC-2000 Access System, User/Service Manual*, and in 363-208-010, *RT Bay Customer Assembly Manual*.

## Central Office Terminal (COT) Bay Engineering

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The COT bay power and ringing architecture is the same as the RT bay. The only physical difference is that the power interface unit (PIU) assembly is mounted on the ARM backplane cover instead of the sideplate.

### Office Clock

---

Central office composite clock (8/64 kHz) is required for the TSI circuit packs (R3.1 and later) and for digital services such as ISDN and DDS terminating in the COT. The composite clock is fed to the COT bay using a TS1 connector block on the bay. (See 363-208-011, *COT Bay Customer Assembly Manual*, for details.) This connection may be multiplexed to several bays. P-Phone services also require composite clock.



**NOTE:**

The composite clock input must be properly terminated for the TSI circuit packs to operate properly. This requires 133-ohm terminating resistors (or equivalent) connected at the TS1 block on the COT bay.

### COT Cabling Considerations

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The cables for the COT are listed in the tables in Chapter 11. Connection details are given in 363-208-011, *COT Bay Customer Assembly Manual*.

## Floor Plan Data Sheets

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### 7-Foot COT Bay Floor Plan

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COT bay floor plan data (FPD) sheets can be used to plan for space needed, cabling, current draw, and heat release for bays configured for metallic distribution. Two arrangements are available: flush-mount J1C265B-1 (FPD in Figure 8-34) and extended-mount (typical in GTE applications) J1C265C-1 (FPD in Figure 8-35).

|                                                                                                                                                                                       |          |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------|--------------------------------|---------------------|------|-------------------------------------|----------------|
| ISSUE                                                                                                                                                                                 | 1        | FLOOR PLAN DATA                                                                                                                                                                                                                        |            |                 |                                |                     |      | SABAC 1                             |                |
| DATE                                                                                                                                                                                  | 05-09-94 |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
| EQUIPMENT IDENTIFICATION                                                                                                                                                              |          | PHYSICAL DATA                                                                                                                                                                                                                          |            | CABLING DATE    |                                | HEAT RELEASE, WATTS |      |                                     |                |
| MFR'S NAME:<br>MFR'S CODE: J1C265B-1<br>RATING: GENERAL AVAIL.<br>FRAME FUNCTION CODE: SABAC<br>SUFFIX: 1<br>ACRONYMS: SLC-2000                                                       |          | NEBS COMPATIBLE: CONDITIONAL (2)<br>HEIGHT: 7-0<br>DEPTH: 1-1 (2)<br>EFFECT. WIDTH: 2-2<br>WEIGHT LBS. 500<br>FRWK TYPE: UNEQUAL FLNG<br>MIN FRONT AISLE: 2-6<br>MIN REAR AISLE: 2-0<br>FRAMES/FUNCTION: 1 (3)<br>UNITS/FRAME: 768 (3) |            | SHIELD OR CLASS | EFFECTIVE CABLE AREA (SQ. IN.) | MAX                 | BUSY | IDLE                                | PLANNING VALUE |
|                                                                                                                                                                                       |          |                                                                                                                                                                                                                                        |            | 3               | 12.25                          | MIN                 | 1013 | 625                                 |                |
|                                                                                                                                                                                       |          |                                                                                                                                                                                                                                        |            | 4               | 0.5                            |                     | 754  | 625                                 | 754            |
| DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES.<br>* DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000. |          |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
| DC CURRENT DRAINS                                                                                                                                                                     |          |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
| VOLTAGE                                                                                                                                                                               | LIST NO. | BUS                                                                                                                                                                                                                                    | MAX AMPS   | MIN AMPS        |                                |                     |      |                                     |                |
| -48 (7)                                                                                                                                                                               | 1        | A                                                                                                                                                                                                                                      | 20         | 14              |                                |                     |      |                                     |                |
| -48 (7)                                                                                                                                                                               | 2        | B                                                                                                                                                                                                                                      | 28         | 20              |                                |                     |      |                                     |                |
| AC CURRENT DRAINS                                                                                                                                                                     |          |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
| VOLTAGE                                                                                                                                                                               | CATEGORY | RUNNING CURR. AMPS                                                                                                                                                                                                                     | INRUSH     |                 |                                |                     |      |                                     |                |
|                                                                                                                                                                                       |          |                                                                                                                                                                                                                                        | CURR. AMPS | DURATION SECS   |                                |                     |      |                                     |                |
|                                                                                                                                                                                       |          |                                                                                                                                                                                                                                        |            |                 |                                |                     |      |                                     |                |
|                                                                                                                                                                                       |          | SLC-2000<br>CENTRAL OFFICE TERMINAL FRAME<br>7' - 0" FRAME FOR FLUSH MOUNTING<br>E/W 1 ARM, 4MDS, AND 1 1A ATU                                                                                                                         |            |                 |                                |                     |      | FPD 801-450-110-001<br>SHEET 1 OF 2 |                |

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Figure 8-34. Floor Plan Data for 7-Foot COT Frame for Flush Mounting (Sheet 1 of 2)

| ISSUE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1            | FLOOR PLAN DATA                                                                                                 | SABAC                               | 1                  |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
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| DATE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 05-09-94     |                                                                                                                 |                                     |                    |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| <p>NOTES:</p> <p>1. APPLICATION SCHEMATIC, WIRING AND COT ASSEMBLY INFORMATION ARE AVAILABLE IN DOCUMENTS SD7C180-01, 77C180-30, AND DOCUMENT 363-208-011 RESPECTIVELY.</p> <p>2. NEBS COMPATIBILITY -- CONDITIONAL. THE SLC-2000 ACCESS SYSTEM HAS A 13" EQUIPMENT DEPTH. THE ADDITIONAL INCH EXTENDS INTO THE WIRING "REAR" AISLE.</p> <p>3. INDICATES THE NUMBER OF VF CIRCUITS FOR UNITS/FRAME.</p> <p>4. FIBER OPTIC CABLE DUCTING TO BE SIZED FOR APPROXIMATELY 20 FIBER CABLES. THE FIBER CABLES CAN BE ROUTED ON EITHER LEFT OR RIGHT SIDE OF THE FRAMEWORK BUT IT IS RECOMMENDED ON THE LEFT SIDE.</p> <p>5. THE HEAT AND DC CURRENT DRAINS OF SLC-2000 CENTRAL OFFICE TERMINAL SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), AND THE ASSOCIATED ACTIVITY RATE. SUBSEQUENT NOTES IN THIS FLOOR PLAN DATA SHEET PROVIDE DETAILED INFORMATION WHICH CAN BE USED TO ENGINEER OFFICE POWER PLANTS, AIR DIFFUSERS, AND CABLING FOR THE VARIABLE CONDITIONS.</p> <p>6. HEAT RELEASE VALUES ARE BASED ON 50% MIX OF CURRENT FEED AND CURRENT SINK QUAD SPOTS CHANNEL UNITS:</p> <table><tr><td>MAX: BUSY - 18 CCS</td><td>IDLE - 0 CCS</td></tr><tr><td>MIN: BUSY - 6 CCS</td><td>IDLE - 0 CCS</td></tr></table> <p>7. EACH FRAME IS SERVED BY TWO FEEDER CABLES. THE CURRENT DRAIN FOR THE ARM SHELF IS INCLUDED IN BOTH THE (A) AND (B) FEEDERS BECAUSE IT WILL DERIVE POWER FROM THE ACTIVE FEEDER IF ONE IS OUT OF SERVICE. THE PRIMARY SOURCE OF POWER FOR THE ARM SHELF IS THE (A) FEEDER. THE DC CURRENT DRAIN FOR THE ARM SHELF IS 5 AMPS MIN. - 7 AMPS MAX. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table><tr><th>BUS</th><th>VOLTS</th><th>LIST</th><th>MAX. AMPS (NOTE 8)</th><th>MIN. AMPS (NOTE 8)</th></tr><tr><td rowspan="2">A</td><td>52</td><td>1</td><td>12</td><td>9</td></tr><tr><td>42.5</td><td>2</td><td>16</td><td>12</td></tr><tr><td rowspan="2">B</td><td>52</td><td>1</td><td>12</td><td>9</td></tr><tr><td>42.5</td><td>2</td><td>16</td><td>12</td></tr></table> <p>8. A MAXIMUM AND MINIMUM AMPS ARE BASED ON A 50% MIX OF CURRENT FEED AND CURRENT SINK QUAD SPOTS CHANNEL UNITS.</p> <p>MAX. - LIST 1 DC DRAIN AT 18 CCS<br/>- LIST 2 DC DRAIN AT 36 CCS</p> <p>MIN. - LIST 1 DC DRAIN AT 6 CCS<br/>- LIST 2 DC DRAIN AT 12 CCS</p> <p>9. REFER TO ED 8C502-50 AND ED 8C502-52 FOR VARIOUS END GUARD OR SHIELD OPTIONS.</p> <p>10. DUE TO 13" EQUIPMENT DEPTH, A 1" GUARD RAIL ADAPTER IS AVAILABLE AS ED 8C506-50, G32 TO BE SECURED ON THE OPEN SIDE (REAR) OF THE FRAMEWORK.</p> |              |                                                                                                                 |                                     |                    | MAX: BUSY - 18 CCS | IDLE - 0 CCS | MIN: BUSY - 6 CCS | IDLE - 0 CCS | BUS | VOLTS | LIST | MAX. AMPS (NOTE 8) | MIN. AMPS (NOTE 8) | A | 52 | 1 | 12 | 9 | 42.5 | 2 | 16 | 12 | B | 52 | 1 | 12 | 9 | 42.5 | 2 | 16 | 12 |
| MAX: BUSY - 18 CCS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | IDLE - 0 CCS |                                                                                                                 |                                     |                    |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| MIN: BUSY - 6 CCS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IDLE - 0 CCS |                                                                                                                 |                                     |                    |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| BUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | VOLTS        | LIST                                                                                                            | MAX. AMPS (NOTE 8)                  | MIN. AMPS (NOTE 8) |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 52           | 1                                                                                                               | 12                                  | 9                  |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 42.5         | 2                                                                                                               | 16                                  | 12                 |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 52           | 1                                                                                                               | 12                                  | 9                  |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 42.5         | 2                                                                                                               | 16                                  | 12                 |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              | SLC-2000<br>CENTRAL OFFICE TERMINAL FRAME<br>7' - 0" FRAME FOR FLUSH MOUNTING<br>E/W 1 ARM., 4MDS, AND 1 1A ATU | FPD 801-450-110-001<br>SHEET 2 OF 2 |                    |                    |              |                   |              |     |       |      |                    |                    |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |

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**Figure 8-34. Floor Plan Data for 7-Foot COT Frame for Flush Mounting (Sheet 2 of 2)**



Figure 8-35 shows the COT 7-foot frame floor plan data sheet for extended mounting.

|                              |          |                                                                                                                  |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|------------------------------|----------|------------------------------------------------------------------------------------------------------------------|------------|-----------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----------------|
| ISSUE                        | 1        | FLOOR PLAN DATA                                                                                                  |            |                 |                                | SABAE 1                                                                                                                                                                               |      |      |                |
| DATE                         | 05-09-94 |                                                                                                                  |            |                 |                                |                                                                                                                                                                                       |      |      |                |
| EQUIPMENT IDENTIFICATION     |          | PHYSICAL DATA                                                                                                    |            | CABLING DATA    |                                | HEAT RELEASE, WATTS                                                                                                                                                                   |      |      |                |
| MFR'S NAME:                  |          | NEBS COMPATIBLE: CONDITIONAL (2)                                                                                 |            | SHIELD OR CLASS | EFFECTIVE CABLE AREA (SQ. IN.) | BUSY                                                                                                                                                                                  |      | IDLE | PLANNING VALUE |
| MFR'S CODE: J1C265C-1,L1 (1) |          | HEIGHT: 7-0                                                                                                      |            |                 |                                | MAX                                                                                                                                                                                   | 1013 | 625  |                |
| RATING: GENERAL AVAIL.       |          | DEPTH: 1-1 (2)                                                                                                   |            | 3               | 12.25                          | MIN                                                                                                                                                                                   | 754  | 625  | 754            |
| FRAME FUNCTION CODE: SABAE   |          | EFFECT WIDTH: 2-2                                                                                                |            |                 |                                |                                                                                                                                                                                       |      |      |                |
| SUFFIX: 1                    |          | WEIGHT LBS. 500                                                                                                  |            | 4               | 0.5                            | DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES.<br>* DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000. |      |      |                |
| ACRONYMS: SLC-2000           |          | FRWK TYPE: UNEQUAL FLNG                                                                                          |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          | MIN FRONT AISLE: 2-6                                                                                             |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          | MIN REAR AISLE: 2-0                                                                                              |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          | FRAMES/FUNCTION: 1 (3)                                                                                           |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          | UNITS/FRAME: 768 (3)                                                                                             |            |                 |                                |                                                                                                                                                                                       |      |      |                |
| DC CURRENT DRAINS            |          |                                                                                                                  |            |                 |                                |                                                                                                                                                                                       |      |      |                |
| VOLTAGE                      | LIST NO. | BUS                                                                                                              | MAX AMPS   | MIN AMPS        |                                |                                                                                                                                                                                       |      |      |                |
| -48 (7)                      | 1        | A                                                                                                                | 20         | 14              |                                |                                                                                                                                                                                       |      |      |                |
| -48 (7)                      | 2        | B                                                                                                                | 28         | 20              |                                |                                                                                                                                                                                       |      |      |                |
| AC CURRENT DRAINS            |          |                                                                                                                  |            |                 |                                |                                                                                                                                                                                       |      |      |                |
| VOLTAGE                      | CATEGORY | RUNNING CURR. AMPS                                                                                               | INRUSH     |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          |                                                                                                                  | CURR. AMPS | DURATION SECS   |                                |                                                                                                                                                                                       |      |      |                |
|                              |          |                                                                                                                  |            |                 |                                |                                                                                                                                                                                       |      |      |                |
|                              |          | SLC-2000<br>CENTRAL OFFICE TERMINAL FRAME<br>7' - 0" FRAME FOR EXTENDED MOUNTING<br>EW 1 ARM, 4MDS, AND 1 1A ATU |            |                 |                                | FPD 801-450-110-002<br>SHEET 1 OF 2                                                                                                                                                   |      |      |                |

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Figure 8-35. Floor Plan Data for 7-Foot COT Frame for Extended Mounting (Sheet 1 of 2)

| ISSUE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1            | FLOOR PLAN DATA                                                                                                    | SABAE                               | 1                     |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
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| DATE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 05-13-94     |                                                                                                                    |                                     |                       |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| <p>NOTES:</p> <p>1. APPLICATION SCHEMATIC, WIRING AND COT ASSEMBLY INFORMATION ARE AVAILABLE IN DOCUMENTS SD7C180-01, T7C180-30, AND DOCUMENT 363-208-011 RESPECTIVELY.</p> <p>2. NEBS COMPATIBILITY -- CONDITIONAL. THE SLC-2000 ACCESS SYSTEM HAS A 13" EQUIPMENT DEPTH. THE ADDITIONAL INCH EXTENDS INTO THE WIRING "REAR" AISLE.</p> <p>3. INDICATES THE NUMBER OF VF CIRCUITS FOR UNITS/FRAME.</p> <p>4. FIBER OPTIC CABLE DUCTING TO BE SIZED FOR APPROXIMATELY 20 FIBER CABLES. THE FIBER CABLES CAN BE ROUTED ON EITHER LEFT OR RIGHT SIDE OF THE FRAMEWORK BUT IT IS RECOMMENDED ON THE LEFT SIDE.</p> <p>5. THE HEAT AND DC CURRENT DRAINS OF SLC-2000 CENTRAL OFFICE TERMINAL SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), AND THE ASSOCIATED ACTIVITY RATE. SUBSEQUENT NOTES IN THIS FLOOR PLAN DATA SHEET PROVIDE DETAILED INFORMATION WHICH CAN BE USED TO ENGINEER OFFICE POWER PLANTS, AIR DIFFUSERS, AND CABLING FOR THE VARIABLE CONDITIONS.</p> <p>6. HEAT RELEASE VALUES ARE BASED ON 50% MIX OF CURRENT FEED AND CURRENT SINK QUAD SPOTS CHANNEL UNITS:</p> <table><tr><td>MAX: BUSY - 18 CCS</td><td>IDLE - 0 CCS</td></tr><tr><td>MIN: BUSY - 6 CCS</td><td>IDLE - 0 CCS</td></tr></table> <p>7. EACH FRAME IS SERVED BY TWO FEEDER CABLES. THE CURRENT DRAIN FOR THE ARM SHELF IS INCLUDED IN BOTH THE (A) AND (B) FEEDERS BECAUSE IT WILL DERIVE POWER FROM THE ACTIVE FEEDER IF ONE IS OUT OF SERVICE. THE PRIMARY SOURCE OF POWER FOR THE ARM SHELF IS THE (A) FEEDER. THE DC CURRENT DRAIN FOR THE ARM SHELF IS 5 AMPS MIN.. 7 AMPS MAX. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table><tr><th>BUS</th><th>VOLTS</th><th>LIST</th><th>MAX. AMPS<br/>(NOTE 8)</th><th>MIN. AMPS<br/>(NOTE 8)</th></tr><tr><td rowspan="2">A</td><td>52</td><td>1</td><td>12</td><td>9</td></tr><tr><td>42.5</td><td>2</td><td>16</td><td>12</td></tr><tr><td rowspan="2">B</td><td>52</td><td>1</td><td>12</td><td>9</td></tr><tr><td>42.5</td><td>2</td><td>16</td><td>12</td></tr></table> <p>8. A MAXIMUM AND MINIMUM AMPS ARE BASED ON A 50% MIX OF CURRENT FEED AND CURRENT SINK QUAD SPOTS CHANNEL UNITS.</p> <p>MAX. - LIST 1 DC DRAIN AT 18 CCS<br/>- LIST 2 DC DRAIN AT 36 CCS</p> <p>MIN. - LIST 1 DC DRAIN AT 6 CCS<br/>- LIST 2 DC DRAIN AT 12 CCS</p> <p>9. REFER TO ED 8C502-50 AND ED 8C502-52 FOR VARIOUS END GUARD OR SHIELD OPTIONS.</p> <p>10. THIS ASSEMBLY IS NOT EQUIPPED WITH A GUARD RAIL ON THE OPEN SIDE (REAR) OF THE FRAMEWORK. IF A GUARD IS REQUIRED ENGINEER TO ORDER A 2' GUARD RAIL, 845107002, WITH A 1" GUARD RAIL ADAPTER, 845540301. FOR ADDITIONAL INFORMATION, REFER TO DRAWINGS ED6C506-50 AND ED6C502-50..</p> |              |                                                                                                                    |                                     |                       | MAX: BUSY - 18 CCS | IDLE - 0 CCS | MIN: BUSY - 6 CCS | IDLE - 0 CCS | BUS | VOLTS | LIST | MAX. AMPS<br>(NOTE 8) | MIN. AMPS<br>(NOTE 8) | A | 52 | 1 | 12 | 9 | 42.5 | 2 | 16 | 12 | B | 52 | 1 | 12 | 9 | 42.5 | 2 | 16 | 12 |
| MAX: BUSY - 18 CCS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IDLE - 0 CCS |                                                                                                                    |                                     |                       |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| MIN: BUSY - 6 CCS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | IDLE - 0 CCS |                                                                                                                    |                                     |                       |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| BUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | VOLTS        | LIST                                                                                                               | MAX. AMPS<br>(NOTE 8)               | MIN. AMPS<br>(NOTE 8) |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 52           | 1                                                                                                                  | 12                                  | 9                     |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 42.5         | 2                                                                                                                  | 16                                  | 12                    |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 52           | 1                                                                                                                  | 12                                  | 9                     |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 42.5         | 2                                                                                                                  | 16                                  | 12                    |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              | SLC-2000<br>CENTRAL OFFICE TERMINAL FRAME<br>7' - 0" FRAME FOR EXTENDED MOUNTING<br>E/W 1 ARM., 4MDS, AND 1 1A ATU | FPD 801-450-110-002<br>SHEET 2 OF 2 |                       |                    |              |                   |              |     |       |      |                       |                       |   |    |   |    |   |      |   |    |    |   |    |   |    |   |      |   |    |    |

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**Figure 8-35. Floor Plan Data for 7-Foot COT Frame for Extended Mounting (Sheet 2 of 2)**

## 7-Foot RT Bay Floor Plan

RT bay floor plan data sheets can be used to plan for space needed, cable arrangements, current draw, and heat release for bays configured for metallic distribution and FITL distribution. Figure 8-36 shows the RT 7-foot frame floor plan data sheet for metallic distribution.

|                                                                                                                                             |          |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| ISSUE                                                                                                                                       | 1        |                                                                                | FLOOR PLAN DATA                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   | 5SBC 15                                                                                                                                                                               |  |
| DATE                                                                                                                                        | 10-9-92  |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| EQUIPMENT IDENTIFICATION                                                                                                                    |          |                                                                                | PHYSICAL DATA                                                                                                                                                                                                                    |               | CABLING DATE                                                                                                                                         |                                   | HEAT RELEASE, WATTS                                                                                                                                                                   |  |
| MFR'S NAME:<br>MFR'S CODE: Note 1<br>RATING: GENERAL AVAIL..<br>FLOOR PLAN DESIGNATION: 5SBC<br>MEGS SUFFIX: 15<br>CATEGORY: COMMON SYSTEMS |          |                                                                                | NEBS COMPATIBLE: CONDITIONAL(8)<br>HEIGHT: 7-0<br>DEPTH: 1-1<br>EFFECT WIDTH: 2-2<br>WEIGHT LBS: 450<br>FRWK TYPE: UNEQUAL FLNG<br>MIN FRONT AISLE: 2-6<br>MIN REAR AISLE: 0-1<br>FRAMES/FUNCTION: 1 (2)<br>UNITS/FRAME: 768 (2) |               | SHIELD OR CLASS<br>1<br>2<br>3                                                                                                                       |                                   | EFFECTIVE CABLE AREA (SQ. IN.)<br>6<br>6<br>4                                                                                                                                         |  |
|                                                                                                                                             |          |                                                                                |                                                                                                                                                                                                                                  |               | MAX<br>MIN                                                                                                                                           |                                   | BUSY<br>IDLE<br>PLANNING VALUE<br>1000                                                                                                                                                |  |
|                                                                                                                                             |          |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   | DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES.<br>* DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000. |  |
| DC CURRENT DRAINS                                                                                                                           |          |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| VOLTAGE                                                                                                                                     | LIST NO. | BUS                                                                            | MAX AMPS                                                                                                                                                                                                                         | MIN AMPS      |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| -48 (5)                                                                                                                                     | 1        |                                                                                | 28                                                                                                                                                                                                                               | 20            |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| -48 (5)                                                                                                                                     | 2        |                                                                                | 39                                                                                                                                                                                                                               | 25            |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| AC CURRENT DRAINS                                                                                                                           |          |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
| VOLTAGE                                                                                                                                     | CATEGORY | RUNNING CURR. AMPS                                                             | INRUSH                                                                                                                                                                                                                           |               | NOTES:<br>1. SEE APPLICATION SCHEMATIC SD-7C174-01, FIGURE BD-1 FOR PHYSICAL INFORMATION.<br>2. INDICATES THE NUMBER OF VF CIRCUITS FOR UNITS/FRAME. |                                   |                                                                                                                                                                                       |  |
|                                                                                                                                             |          |                                                                                | CURR. AMPS                                                                                                                                                                                                                       | DURATION SECS |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
|                                                                                                                                             |          |                                                                                |                                                                                                                                                                                                                                  |               |                                                                                                                                                      |                                   |                                                                                                                                                                                       |  |
|                                                                                                                                             |          | SLC-2000<br>REMOTE TERMINAL FRAME<br>7' 0" FRAME<br>WITH 1 ARM AND 4 MDS BANKS |                                                                                                                                                                                                                                  |               |                                                                                                                                                      | FPD 801-450-108-1<br>SHEET 1 OF 2 |                                                                                                                                                                                       |  |

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**Figure 8-36. 7-Foot RT Frame Floor Plan Data Sheet for Metallic Distribution (Sheet 1 of 2)**

|       |         |                        |             |           |
|-------|---------|------------------------|-------------|-----------|
| ISSUE | 1       | <b>FLOOR PLAN DATA</b> | <b>5SBC</b> | <b>15</b> |
| DATE  | 10-9-92 |                        |             |           |

NOTES CONTINUED:

3. THE HEAT AND DC CURRENT DRAINS OF SLC-2000 REMOTE TERMINAL SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), AND THE ASSOCIATED ACTIVITY RATE. SUBSEQUENT NOTES IN THIS FLOOR PLAN DATA SHEET PROVIDE DETAILED INFORMATION WHICH CAN BE USED TO ENGINEER OFFICE POWER PLANTS AND CABLING FOR THE VARIABLE CONDITIONS.

4. HEAT RELEASE VALUES ARE BASED ON THE FOLLOWING EQUIPMENT CONFIGURATIONS:

MAX ± ALL QUAD SPOTS CHANNEL UNITS  
       BUSY ± 18 CCS           IDLE ± 0 CCS

MIN ± ALL QUAD SPOTS CHANNEL UNITS  
       BUSY ± 6 CCS           IDLE ± 0 CCS

5. EACH FRAME IS SERVED BY TWO FEEDER CABLES. THE CURRENT DRAIN FOR THE ARM SHELF IS INCLUDED IN BOTH THE (A) AND (B) FEEDERS BECAUSE IT WILL DERIVE POWER FROM THE ACTIVE FEEDER IF ONE IS OUT OF SERVICE. THE PRIMARY SOURCE OF POWER FOR THE ARM SHELF IS THE (A) FEEDER. THE DC CURRENT DRAIN FOR THE ARM SHELF IS 5 AMPS MIN., 7 AMPS MAX. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.

| BUS | VOLTS | LIST | MAX (NOTE 6) | MIN (NOTE 7) |
|-----|-------|------|--------------|--------------|
| A   | 52    | 1    | 15 AMPS      | 11 AMPS      |
|     | 42.5  | 2    | 22 AMPS      | 14 AMPS      |
| B*  | 52    | 1    | 17 AMPS      | 13 AMPS      |
|     | 42.5  | 2    | 24 AMPS      | 16 AMPS      |

\*BUS B PROVIDES CURRENT FOR COOLING FAN

6. MAX AMPS ARE BASED ON QUAD SPOTS CHANNEL UNITS.  
    (A) LIST 1 DC DRAIN AT 18 CCS.  
    (B) LIST 2 DC DRAIN AT 36 CCS.

7. MIN AMPS ARE BASED ON QUAD SPOTS CHANNEL UNITS.  
    (A) LIST 1 DC DRAIN AT 6 CCS.  
    (B) LIST 2 DC DRAIN AT 12 CCS.

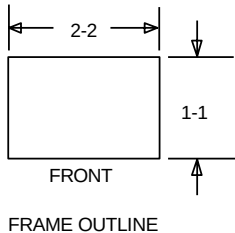
8. NEBS COMPATIBILITY - CONDITIONAL. THE SLC-2000 ACCESS SYSTEM HAS A 13" EQUIPMENT DEPTH. THE ADDITIONAL INCH EXTENDS INTO THE WIRING "REAR" AISLE.

|  |                                                                                |                                    |
|--|--------------------------------------------------------------------------------|------------------------------------|
|  | SLC-2000<br>REMOTE TERMINAL FRAME<br>7' 0" FRAME<br>WITH 1 ARM AND 4 MDS BANKS | FPD 801- 450-108-1<br>SHEET 2 OF 2 |
|--|--------------------------------------------------------------------------------|------------------------------------|

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**Figure 8-36. 7-Foot RT Frame Floor Plan Data Sheet for Metallic Distribution (Sheet 2 of 2)**

Figure 8-37 shows the RT 7-foot frame floor plan data sheet for FITL distribution.

|                                                                                                                                       |          |                                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
|---------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------|-------------------------------------|------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--|
| ISSUE                                                                                                                                 | 1        | FLOOR PLAN DATA                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  | 5SBC 16 |  |
| DATE                                                                                                                                  | 07-29-93 |                                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| EQUIPMENT IDENTIFICATION                                                                                                              |          | PHYSICAL DATA                                                                                                                                                                                                                    |            |               | CABLING DATE                                                                                                                                         |                                | HEAT RELEASE, WATTS |                                     |      |                |                                                                                                                                                                                  |         |  |
| MFR'S NAME:<br>MFR'S CODE: NOTE 1<br>RATING: GENERAL AVAIL.<br>FLOOR PLAN DESIGNATION: 5SBC<br>SUFFIX: 16<br>CATEGORY: COMMON SYSTEMS |          | NEBS COMPATIBLE: CONDITIONAL(5)<br>HEIGHT: 7-0<br>DEPTH: 1-1<br>EFFECT WIDTH: 2-2<br>WEIGHT LBS. 450<br>FRWK TYPE: UNEQUAL FLNG<br>MIN FRONT AISLE: 2-6<br>MIN REAR AISLE: 0-1<br>FRAMES/FUNCTION: 1 (2)<br>UNITS/FRAME: 768 (2) |            |               | SHIELD OR CLASS                                                                                                                                      | EFFECTIVE CABLE AREA (SQ. IN.) |                     | BUSY                                | IDLE | PLANNING VALUE |                                                                                                                                                                                  |         |  |
|                                                                                                                                       |          |                                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                | MAX                 | 715                                 | 715  | 700            |                                                                                                                                                                                  |         |  |
|                                                                                                                                       |          |                                                                                                                                                                                                                                  |            |               | 1                                                                                                                                                    | 6                              | MIN                 | 600                                 | 600  |                |                                                                                                                                                                                  |         |  |
| 2<br>6<br>3<br>4                                                                                                                      |          |                                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                |                     |                                     |      |                | DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES. DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000. |         |  |
| DC CURRENT DRAINS                                                                                                                     |          |                                                                                                                                                                                                                                  |            |               |                                                                    |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| VOLTAGE                                                                                                                               | LIST NO. | BUS                                                                                                                                                                                                                              | MAX AMPS   | MIN AMPS      |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| -48 (5)                                                                                                                               | 1        | A                                                                                                                                                                                                                                | 16         | 13            |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| -48 (5)                                                                                                                               | 2        | A                                                                                                                                                                                                                                | 23         | 18            |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| AC CURRENT DRAINS                                                                                                                     |          |                                                                                                                                                                                                                                  |            |               | NOTES:<br>1. SEE APPLICATION SCHEMATIC SD-7C174-01, FIGURE BD-1 FOR PHYSICAL INFORMATION.<br>2. INDICATES THE NUMBER OF VF CIRCUITS FOR UNITS/FRAME. |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
| VOLTAGE                                                                                                                               | CATEGORY | RUNNING CURR. AMPS                                                                                                                                                                                                               | INRUSH     |               |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
|                                                                                                                                       |          |                                                                                                                                                                                                                                  | CURR. AMPS | DURATION SECS |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
|                                                                                                                                       |          |                                                                                                                                                                                                                                  |            |               |                                                                                                                                                      |                                |                     |                                     |      |                |                                                                                                                                                                                  |         |  |
|                                                                                                                                       |          | SLC-2000<br>REMOTE TERMINAL FRAME<br>7'0" FRAME<br>WITH 1 ARM, 4 MDS BANKS, AND 2 HDOS                                                                                                                                           |            |               |                                                                                                                                                      |                                |                     | FPD 801-450-109-001<br>SHEET 1 OF 2 |      |                |                                                                                                                                                                                  |         |  |

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Figure 8-37. 7-Foot RT Frame Floor Plan Data Sheet for FITL Distribution (Sheet 1 of 2)

| ISSUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1       | FLOOR PLAN DATA                                                                         |          | 5SBC                                | 16 |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------|----------|-------------------------------------|----|-----|-------|------|----------|----------|---|----|---|---|---|------|---|----|---|----|----|---|----|---|------|---|----|----|
| DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7-29-93 |                                                                                         |          |                                     |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
| <p>NOTES CONTINUED:</p> <p>3. THERE IS NO BUSY OR IDLE POSITION IN THIS CONFIGURATION. THERE ARE NO POTS OR SPOTS CHANNEL UNITS AT THE REMOTE TERMINAL.</p> <p>4. EACH FRAME IS SERVED BY TWO FEEDER CABLES. THE CURRENT DRAIN FOR THE ARM SHELF IS INCLUDED IN BOTH THE (A) AND (B) FEEDERS BECAUSE IT WILL DERIVE POWER FROM THE ACTIVE FEEDER IF ONE IS OUT OF SERVICE. THE PRIMARY SOURCE OF POWER FOR THE ARM SHELF IS THE (A) FEEDER. THE DC CURRENT DRAIN FOR THE ARM SHELF IS 5 AMPS MIN., 7 AMPS MAX. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table border="1"><thead><tr><th>BUS</th><th>VOLTS</th><th>LIST</th><th>MAX AMPS</th><th>MIN AMPS</th></tr></thead><tbody><tr><td rowspan="2">A</td><td>52</td><td>1</td><td>9</td><td>7</td></tr><tr><td>42.5</td><td>2</td><td>13</td><td>9</td></tr><tr><td rowspan="2">B*</td><td>52</td><td>1</td><td>10</td><td>8</td></tr><tr><td>42.5</td><td>2</td><td>18</td><td>10</td></tr></tbody></table> <p>* BUS B PROVIDES CURRENT FOR COOLING FAN.</p> <p>5. NEBS COMPATIBILITY - CONDITIONAL THE SLC-2000 ACCESS SYSTEM HAS A 13" EQUIPMENT DEPTH. THE ADDITIONAL INCH EXTENDS INTO THE WIRING "REAR" AISLE.</p> |         |                                                                                         |          |                                     |    | BUS | VOLTS | LIST | MAX AMPS | MIN AMPS | A | 52 | 1 | 9 | 7 | 42.5 | 2 | 13 | 9 | B* | 52 | 1 | 10 | 8 | 42.5 | 2 | 18 | 10 |
| BUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | VOLTS   | LIST                                                                                    | MAX AMPS | MIN AMPS                            |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 52      | 1                                                                                       | 9        | 7                                   |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 42.5    | 2                                                                                       | 13       | 9                                   |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
| B*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 52      | 1                                                                                       | 10       | 8                                   |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 42.5    | 2                                                                                       | 18       | 10                                  |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         | SLC-2000<br>REMOTE TERMINAL FRAME<br>7' 0" FRAME<br>WITH 1 ARM, 4 MDS BANKS, AND 2 HDOS |          | FPD 801-450-109-001<br>SHEET 2 OF 2 |    |     |       |      |          |          |   |    |   |   |   |      |   |    |   |    |    |   |    |   |      |   |    |    |

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**Figure 8-37. 7-Foot RT Frame Floor Plan Data Sheet for FITL Distribution (Sheet 2 of 2)**

## **Distribution Engineering**

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### **Voice-Frequency (VF) Distribution Plant**

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The derived feeder facilities pair gain (PG) cable is labeled the same way as the Series 5 system. The field connecting arrangements are the same as those used for the Series 5 system and are terminated on the feeder distribution interface (FDI) to read 1-96 and 4DD.

The distribution facility used for the derived pairs between the *SLC-2000* Access System RT and the customer should be standard cable plant in good condition. The use of unshielded cables and open, multiple, or rural wire should be avoided because of the susceptibility of the cable to high trouble rates and AC inductive interference.

Tests should be made to determine the severity of the inductive interference in areas having a history of AC induction problems. Inductive interference on voice-frequency facilities should never exceed 50 V rms. The proper AC induction testing and mitigation methods are covered in the chapter on digital line acceptance testing in 915-710-115.

### **VF Design Limits**

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The VF design limits for the *SLC-2000* Access System and *SLC* Series 5 RT channel units vary by channel unit code and service provided. Design limits and loading guidelines for basic telephone services are given in 915-710-115 in the description of VF plant beyond the RT. Design guidelines for nonswitched special services are given in 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting*. See Chapter 4 for more detail on channel unit applications.

### **Carrier Serving Area (CSA) Summary**

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The carrier serving area (CSA) concept is to sectionalize an entire route into discrete geographical units or CSAs so that when digital subscriber carrier is deployed, every customer has access to a wide range of inexpensively provided analog and digital services (up to 64 kb/s). Using this planning approach, the entire route is segmented into CSAs. When relief is required in the route and it becomes economical to deploy digital loop carrier, pre-engineered RT sites can be employed.

The following list summarizes the CSA design requirements:

- Nonloaded cable only.
- The length of 26-gauge cable (used alone or in combination with other gauge cables) should not exceed a total length of 9 kilofeet (kft) including bridged tap.
- Total bridged tap length should not exceed 2.5 kft. No single tap should exceed 2.0 kft.
- Multigauge cable is restricted to 2 gauges (excluding short links for stubbing and fusing).
- For single or multigauge cable consisting of 19-, 22-, or 24-gauge cable, the total length including bridged tap should not exceed 12 kft.
- The maximum values of loss and resistance for CSA cable are 4.7 dB and 750 ohms.
- Where an existing cable containing a 26-gauge segment has a total length including bridged tap that is longer than 9 kft (but less than 12 kft), that cable is considered to meet the CSA definition provided it satisfies the following restriction:

$$l_{TOT} < 12 - \frac{3 \times L_{26}}{9 - L_{BTAP}}$$

*where:*

$L_{TOT}$  is the total length including bridged tap

$L_{26}$  is the total length of 26-gauge sections of the cable (excluding any 26-gauge bridged tap)

$L_{BTAP}$  is the total length of bridged tap in the cable.

In the limiting case where the cable is entirely 26 gauge, total length is limited to 9 kft including bridged tap.



## Channel Assignment

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Procedures that can be used for assigning channels (circuits) in a digital loop carrier (DLC) are contained in BR 680-201-023 Bellcore practice. These procedures were based on the paper record [manual exchange customer cable record (ECCR)] system, and they were converted to the automated Facility Assignment and Control System (FACS). FACS is capable of mechanizing this process.

The *SLC-2000* Access System uses the *SPQ*-type quad channel units providing four channels per pack. *SLC* Series 5 Carrier System channel units can also be used, but these are single and dual channel units. Series 5 dual channel units access the first two channels of the slot (for example, Channels 5 and 6 in the slot labeled 5-8) in the *SLC-2000* MDS assembly (Slots 7 and 8 are unassigned and, therefore, are unavailable). Single channel units access only the first odd-numbered channel of the slot (for example, Channel 1 in the slot labeled 1-4) in the *SLC-2000* MDS assembly (Slots 2, 3, and 4 are unassigned and, therefore, are unavailable).

In the MDS assembly slots, the channels not used by the Series 5 channel units cannot be recovered. However, time slot interchange (TSI) allows grooming of the DS1 bit stream so that unused time slots are not transmitted. See Chapter 2 and Chapter 3 for more information on TSI.

In universal configurations with the *SLC 96* COT, if the channel unit provides only one channel, it limits the *SLC-2000* Access System channel unit to one channel also. For example, manual ring or PLAR applications use the D4 2RD/PLAR channel unit, which has only one channel. Thus, even though the corresponding channel units, AUA45() and AUA75, are dual channel units, they can use only one channel for service.

Table 8-32, Table 8-33, and Table 8-34 list the typical service codes for various services and the *SLC-2000* Access System or *SLC* Series 5 Carrier System channel units that provide these functions. In these tables, the channel units listed for the central office terminal (COT) are the channel units installed in a *SLC 96* COT connected to the DDM-2000 multiplexer in the service node or in a *SLC-2000* COT. For channel units compatible with *SLC-2000* Access System channel units in other applications, refer to Chapter 4, "Services."

**Table 8-32. Basic Telephone Services**

| Service Description                                                                                                                         | Channel Unit (CU)                                      |                            |                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------|---------------------------------------|
|                                                                                                                                             | SLC <sup>®</sup> 96 COT<br>or SLC-2000<br>COT          | SLC-2000<br>RT (Note)      | Line Terminal (LT)<br>Status Code, RT |
| Single party                                                                                                                                | WP10(C/D),<br>AUA38( ),<br>AUA39,<br>SPQ300,<br>SPQ340 | SPQ <sup>®</sup> 400( ) CU | ESQ                                   |
|                                                                                                                                             |                                                        | XSPQ400 CU                 | ESQ                                   |
|                                                                                                                                             |                                                        | SPQ401 CU                  | ESQ                                   |
|                                                                                                                                             |                                                        | SPQ440( ) CU               | ESQ, ETQ, ETQX                        |
|                                                                                                                                             |                                                        | SPQ450 CU                  | ESQ, ETQ                              |
|                                                                                                                                             |                                                        | AUA25( )                   | ES, ET                                |
|                                                                                                                                             |                                                        | AUA27                      | ES                                    |
|                                                                                                                                             |                                                        | AUA51                      | ES, ET                                |
|                                                                                                                                             |                                                        | AUA58( )                   | ES                                    |
|                                                                                                                                             |                                                        | AUA59                      | ES, ET                                |
|                                                                                                                                             |                                                        | AUA150                     | ES, ET                                |
|                                                                                                                                             |                                                        | AUA158( )                  | ES                                    |
|                                                                                                                                             |                                                        | AUA159( )                  | ES, ET                                |
|                                                                                                                                             |                                                        | AUA179                     | ES, ET                                |
| Coin — Dial tone first or<br>Prepay                                                                                                         | WP12,<br>AUA33( ),<br>SPQ333,<br>SPQ318                | AUA53( )                   | EC                                    |
|                                                                                                                                             |                                                        | SPQ453                     | ECD                                   |
|                                                                                                                                             |                                                        | SPQ419                     | ECQ                                   |
| Multiparty                                                                                                                                  | WP11,<br>AUA35                                         | AUA55( )                   | EM                                    |
| Frequency selective<br>ringing                                                                                                              | WP33,<br>AUA37                                         | AUA57                      | EM                                    |
| <b>Note:</b> For ranges and engineering considerations, refer to 915-710-115, <i>SLC Series 5 Carrier System, Application Engineering</i> . |                                                        |                            |                                       |

**Table 8-33. Locally-Switched Special Services**

| Service Description         | Channel Unit (CU)                       |                                 | Typical Line Terminal Status Code | Typical Service Code |
|-----------------------------|-----------------------------------------|---------------------------------|-----------------------------------|----------------------|
|                             | SLC <sup>®</sup> 96 COT or SLC-2000 COT | SLC-2000 RT (Note)              |                                   |                      |
| PBX-CO trunk                | WP36, SPQ340, AUA39                     | AUA150/159( ), SPQ440( )/450 CU | ET, ETQ, ETX, ETQX                | TK                   |
| WATS line (to end offices)  | WP36, SPQ340, AUA39                     | AUA150/159( ), SPQ440( )/450 CU | ET, ETQ, ETX, ETQX                | WO, WZ               |
| WATS trunk (to end offices) | WP36, SPQ340, AUA39                     | AUA150/159( ), SPQ440( )/450 CU | ET, ETQ, ETX, ETQX                | WS, WY               |
| CENTREX line                | WP36, SPQ340, AUA39                     | AUA150/159( ), SPQ440( )/450 CU | ET, ETQ, ETX, ETQX                | CL                   |
| Secretarial line            | WP36, SPQ340, AUA39                     | AUA150/159( ), SPQ440( )/450 CU | ET, ETQ, ETX, ETQX                | SL                   |
| Direct inward dial          | WP42, SPQ336, AUA36( )                  | AUA56( ), SPQ456                | DID, DIDQ                         | DI                   |
| ISDN                        | N/A                                     | AUA94, SPQ494                   | EBD, EBQ                          | IB                   |
| EBS (P-Phone)               | SPQ328                                  | SPQ429                          | EPQ                               | —                    |

**Note:** Channel units provide service in the carrier serving area (CSA).

**Table 8-34. Designed Special Services**

| <b>Service Description</b>         | <b>Channel Unit</b>               |                             | <b>Typical Service Code (Note 2)</b> |
|------------------------------------|-----------------------------------|-----------------------------|--------------------------------------|
|                                    | <b>SLC 96 COT or SLC-2000 COT</b> | <b>SLC-2000 RT (Note 1)</b> |                                      |
| Private line auto ring             | 2RD/PLAR, AUA75                   | AUA75                       | PL                                   |
| Manual ring                        | 2RD/PLAR, AUA45( )                | AUA45( )                    | PL                                   |
| 4-wire foreign exchange station    | 4FXO, 4TDM, SPQ <sup>®</sup> 444  | AUA41( )/141                | FT, FX                               |
| Tie trunk                          | 4DX, AUA41( )                     | AUA41( )/141                | TA, TL                               |
| 4-wire transmission only           | 4TO, AUA41( )                     | AUA41( )/141                | FD                                   |
| 4-wire equalized transmission only | 4ETO, AUA41( )                    | AUA41( )/141                | FD                                   |
| 2-wire foreign exchange office     | 2FXO, SPQ442, AUA42( )            | AUA43( )                    | FT, FX                               |
| 2-wire transmission only           | 2TO, SPQ442, AUA42( )             | AUA42( )/142/43( )          | FD, PL                               |
| Digital Data System                | DS0, SPQ334, AUA34( )             | AUA52( )/152/252( ), SPQ452 | DR, DW                               |
| ISDN (AMI line coding)             | AHG13, AUA90                      | AUA90                       | IB                                   |
| ISDN (2B1Q line coding)            | AHG18, AUA92                      | AUA93                       | IB                                   |
| Audio Program                      | PGM <sup>*</sup> -2000            | PGM-2000                    | PF, PJ, PK                           |

**Notes:**

1. For other engineering considerations, refer to 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting*.
2. Lucent Technologies service codes are listed in 795-402-100AC; Bellcore service codes are listed in SR-STS-000307.

\* Trademark of Tollgrade Communications, Inc.

There are three Bellcore documents related to Table 8-34 that define network channel interface (NCI) codes. The NCI codes are used by Bellcore to specify the channel interface characteristics between a local exchange carrier (LEC) and an interexchange carrier (IXC) or between an LEC and an end-user. For example, the NCI code 04DS015B specifies a 4-wire DS1 interface at an IXC point of termination with a superframe framing format, B8ZS zero code suppression, and 110 ohms impedance. *SLC-2000 Access System* and *SLC Series 5 Carrier System* channel units provide the proper interface for most NCI codes. The documents are as follows:

- Special Report SR-ST5-000307, *NC/NCI Code Dictionary, Industry Support Interface*, February 1993.
- Technical Report TR-TSY-000054, *High Capacity Digital Service (1.544 Mb/s) Interface, Generic Requirements for End Users*, April 1989.
- Technical Report TR-INS-000342, *High Capacity Digital Special Access Service — Transmission Parameter Limits and Interface Combinations*, February 1991.

The service code is a key part of the loop assignment process. The service codes listed for special service circuits are used in the *COMMON LANGUAGE CLCI\** code. The *CLCI* code provides a code for the work order record detail (WORD) document for identifying the circuit to be worked. This code provides the following information:

- A specific identifier
- A form that people can read and decipher
- A form that is acceptable for manual and mechanized procedures.

### **Assignment Information (Line Termination Status)**

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Service capability codes are assigned to specific services as needed. Service capabilities of equipped *SLC-2000 Access System* channels have been coded with line terminal (LT) status codes by Bellcore as follows:

- D — (Reserved for designed service)
- DID — Equipped for DID service
- EC — Equipped for coin service
- ED — Equipped for designed circuits
- EM — Equipped for multiparty service
- EP — Equipped for P-Phone service

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\* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

- ES — Equipped for single-party service
- ET — Equipped for trunk-type service
- ETB — Equipped for trunk-type service; bridged at CO
- EY — E *SPOTS* CU code; AUA42 at COT, AUA43 at RT
- EW — E *SPOTS* CU code; AUA43 at COT, AUA42 at RT
- EZ — E *SPOTS* CU code; AUA43 at COT, AUA43 at RT



**NOTE:**

Special service order and assignment processes are required to take advantage of E *SPOTS* channel units. The processes and services associated with each orientation of sets of E *SPOTS* channel units (EY, EZ, EW) have been provided in BR 680-201-023.

- NE — Not equipped
- null — [For Loop Facility Assignment and Control System (LFACS) use only]
- RD — (Assigned to a DDS circuit).

More detail on the assignment process is provided in 915-710-115 in the chapters on VF plant beyond the RT and special service applications.

### **Engineering Support for Loop Assignment**

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Certain information must be furnished to the loop assignment center (LAC) by the outside plant engineer so LAC records can be prepared. The following information is normally furnished with the engineering work order for installing the equipment:

- The *SLC*-2000 Access System number, the RT site location identity (*ALL* code and street address) and the pair gain cable number and count.
- The cable pairs that are to be used for carrier support (primary transmit, primary receive, protection transmit, and protection receive) pairs, and any miscellaneous (order wire, fault-locating, voice-frequency test lines) pairs that are required.
- The locations of feeder distribution interfaces (FDIs), serving area interfaces (SAIs), and/or terminal(s) served by the RT site.
- The pair gain cable complements that are to be terminated at the FDI or SAI and related terminating binding posts.
- The system configuration (feature release and system arrangement) and its compatibility for special service usage.
- A list of distribution terminals to be served by the *SLC*-2000 Access System and the boundary codes involved for the carrier zone and CSA, if established.
- The fixed or preferred counts of existing or new serving terminals.

- The resistance zone boundary codes for all terminals, if the feed is shared by one or more physical cables.
- Details to assist the LAC in facility priority selection.
- Number, arrangement, and types of channel units to be installed (line termination status).
- The administrative spare pair levels of the cable for the system.
- Requirements for special service protection of each support pair at any location that is subject to *hands on* interruption.
- Identification of the distribution terminals associated with extended-range or keyset-compatible channel units (circuit packs), or information indicating that all distribution terminals associated with the RT are keyset-compatible or are extended range (EXR) types.
- A notation or list that specifies the types of services other than POTS that can be assigned to the system.
- The pair gain cable pairs reserved for special services.

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**Engineering and Installation Services**

The Lucent Technologies Customer Support and Operations (CS&O) organization is committed to providing customers with quality product support services. Whether you need assistance in engineering, installation, normal system maintenance, or disaster recovery, the support staff provides you with the quality technical support you need to get your job done. Each segment of the CS&O organization regards the customer as its highest priority and understands your obligation to maintain quality service for your customer.

Within the CS&O organization, the Engineering and Installation Services group provides a highly skilled force of support personnel to provide customers with quality engineering and installation services. These engineering and installation specialists use state-of-the-art technology, equipment, and procedures to provide customers with highly competent, rapid response services. These services include analyzing your equipment request, preparing a detailed specification for installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

When the CS&O organization provides job records and installs the equipment, operationally effective changes to the system are automatically identified and applied to the system at no additional cost.

The Engineering and Installation Services group provides the customer with an individually tailored, quality-tested job that meets our published high standards and the customer's operational requirements. The group ensures that the customer's system order is integrated into a complete working system tailored to office conditions and preferences. This process provides for the customer's complete needs. It includes provisions for cabling, lighting, power equipment, and

ancillary connections to local and/or remote alarm systems. The group responds to any customer changes that occur during installation.

All equipment engineered and installed by Lucent Technologies is thoroughly tested and integrated into a reliable system at cutover. Once approved by Lucent Technologies Quality Assurance Test group (the industry's toughest), the system is turned over to your company.

The group also provides any specialized engineering and installation services required for unusual or highly individualized applications. These specialized services may include engineering consultations and data base preparation. Your local Account Executive can provide more information about these services.

## **Technical Support**

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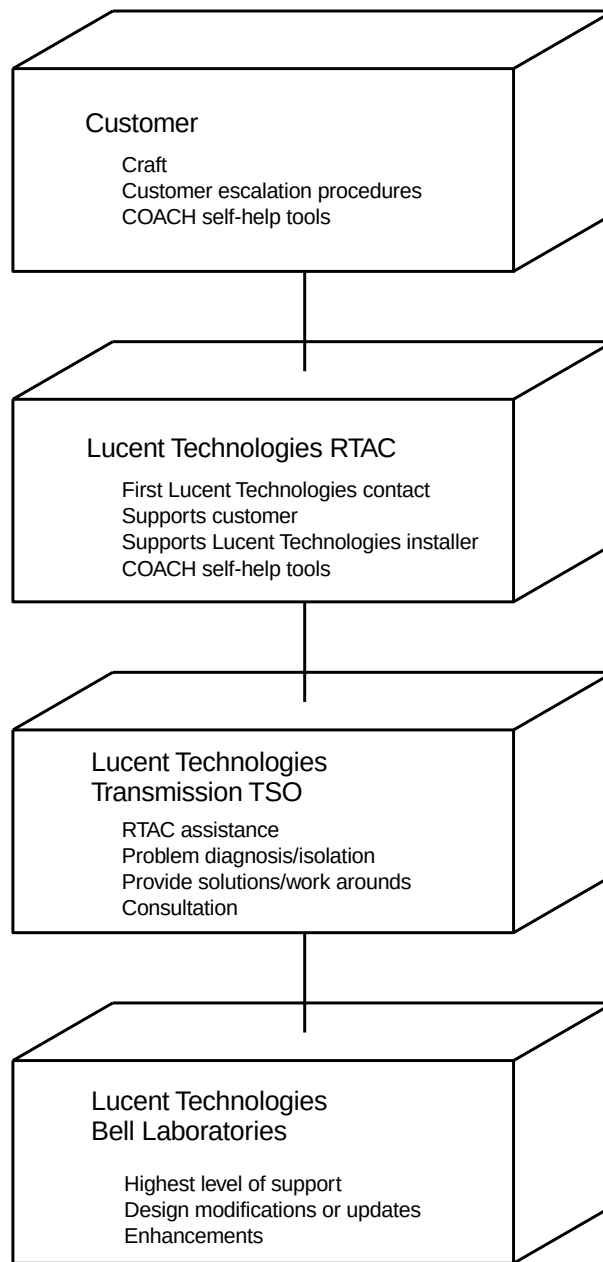
Assistance in maintaining your installed system is available through the Regional Technical Assistance Center (RTAC) and the Technical Support Organization (TSO). As shown in Figure 9-1, your single point of contact is the RTAC. RTAC personnel troubleshoot field problems 24 hours a day over the phone and, if necessary, on-site. For technical assistance, simply call 1-800-225-RTAC — one call guarantees support.

RTAC organizations are supported by a centralized TSO for transmission products. The TSO maintains a close relationship with Bell Laboratories and other Lucent Technologies organizations to expedite resolutions and maintain contact with the development community. This association provides continuous accessibility to every phase of a product life cycle and assures a prompt resolution to all inquiries.

The TSO has also established a technical support medium: the customized on-line aid for customer help (COACH) customer support tools. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. COACH tools reside on a dedicated time-share computer accessible over toll free lines and are available 24 hours a day, 7 days a week.

Many transmission products are currently supported by COACH, and the *SLC*<sup>®</sup>-2000 Access System is among them.

Once connected to COACH, the user specifies the product to access and COACH grants the appropriate combination of tools and commands. The user reaches each one of these tools and commands through a centralized, menu-driven computer program. Every screen provides help in making appropriate menu selections. COACH users can achieve proficiency quickly because of the consistency of menu selections among products.



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**Figure 9-1. Product Support**

The following COACH tools are available to the user:

- ***Diagnostic dictionary*** — The diagnostic dictionary contains histories of previously encountered problems and the descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem. Your support staff is allowed to enter problems and solutions into the customer input area of the diagnostic dictionary. TSO personnel evaluate the data daily and, when appropriate, the data is moved to the general area.
- ***News and bulletins*** — Immediately after a user logs into the COACH tools, the news and bulletins tool displays bulletins containing urgent information relating to all the user's products. All users are automatically notified about urgent matters such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.
- ***Compatibility data*** — Occasionally, hardware/software configuration problems arise when new software generics are issued. The compatibility data tools permit users to view the correct hardware configuration associated with a specific software generic. The user simply enters the appropriate software generic number, and COACH responds with page-formatted lists of circuit packs compatible with the selected software generic.
- ***Ordering guides*** — With the COACH ordering guide tool, users can obtain an electronic copy of the latest version of the ordering guide for selected products served by COACH tools. This eliminates the time-consuming delays experienced in distributing hard-copy documentation.
- ***COACH user's guide*** — COACH supplies an on-line version of its user's guide. The COACH user's guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

The TSO strives to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, the TSO provides you with the best possible customer support.

## **Documentation Support**

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The Lucent Technologies Customer Training and Information Products (CTIP) organization provides a contact to report errors or to ask questions about information in this document. The document support telephone number is:

- **USA Callers:** 1-888-LTINFO6 (1-888-584-6366)
- **International Callers:** +1-317-322-6848.

***The contact number for technical support is 1-800-225-RTAC.***

## **Training**

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No product offering is complete without a formal training package. The Lucent Technologies Customer Training and Information Products centers in Dublin, Ohio, provide management courses for system planning, engineering and ordering, as well as training telecommunications technicians in installation, operations, and maintenance. Suitcasing of these courses is also available. Consult your local Account Executive for more information or reservations.

The following *SLC-2000* Access System courses are provided by the Lucent Technologies Customer Training and Information Products organization:

- LE2000, *SLC-2000 Management Overview*

Content — Applications, planning considerations, features and benefits, functional description, testing, basic maintenance, and ordering procedures.

Audience — Telecommunications managers responsible for the planning, implementation, and maintenance of the *SLC-2000* Access System.

Prerequisite — Previous knowledge of the DDM-2000 as provided in course **LW2212**, DDM-2000 OC-3 and OC-12 Multiplexers Applications and Architecture.

- LE2010, *SLC-2000 Overview*

Audience — This course is designed for anyone who would like an overview of the *SLC-2000 Access System*.

Length — 4 hours.

Content — This interactive multimedia course is intended to provide students with an overview of the *SLC-2000 Access System*. Many topics are covered in an overview fashion that will help the student better understand the purpose of the *SLC-2000 Access System* and how it fits into the telephony network.

Media — CD-ROM-based self-paced course. Students who wish to take this training must have an MPCII compatible computer. All software needed to view the training is included on the CD-ROM.

Prerequisite — Students need to be familiar with basic transmission concepts as provided by TR0510, *Transmission Principles*.

- TR4610, *SLC-2000 Access System Operations and Maintenance*

Content — A comprehensive study of the *SLC-2000 Access System*, including a physical description, functional description, testing, and basic maintenance.

Audience — Telecommunications personnel responsible for installing and maintaining the system.

Prerequisite — Students **must** be familiar with the DDM-2000 as provided in course **LW2603X**, DDM-2000 Multiplexer OC-3 or **LW2612**, DDM-2000 Multiplexer OC-12.

The following DDM-2000 courses are provided by the Lucent Technologies Product Training Services (PTS) center:

- LW1030, *Digital SONET, DDM-1000/2000 Seminar*

Content — Practical overview of digital transmission principles and the synchronous optical network (SONET), and a working knowledge of the DDM-1000 multiplexer and the DDM-2000 multiplexers.

Audience — Fundamental planners, current planners, account management personnel, and telecommunications managers.

- LW2203, *DDM-2000 Multiplexer Applications and Architecture*

Content — General information about the DDM-2000 network multiplexers including a product overview, applications, architecture, and deployment planning.

Audience — Fundamental planners, account executives, and private telecommunications network technical consultants.

- LW2303, *DDM-2000 Multiplexer Equipment Engineering and Planning*

Content — Information and guidelines required to plan and order DDM-2000 network multiplexer equipment for loop feeder and interoffice applications.

Audience — Facility planners, outside plant engineers, central office equipment engineers, and private network design engineers.

- LW2503, *DDM-2000 Multiplexer Advanced Operations and Maintenance*

Content — Technical support and maintenance engineering.

Audience — Operations supervisors, maintenance engineers, and operations support personnel.

- LW2603, *DDM-2000 Multiplexer Acceptance, Operations, and Maintenance*

Content — Initial turn-up and day-to-day operations and maintenance.

Audience — Technicians and supervisors involved in the day-to-day provisioning and maintenance.

For information on these and other training courses available, on schedules, fees, and registration, call your company's training coordinator. If your company does not have an assigned training coordinator, call this toll-free number (Monday through Friday, 7:30 a.m. to 5:30 p.m. EST) to order a product training catalog, get more information on a course, find out about new courses, or register for a class:

- **USA Callers:** 1-888-LUCENT8 (1-888-582-3688) Prompt 2.

- **Canada Callers:** 1-800-221-1647.

You may also use a computer and modem to log into the on-line catalog, COMCATS (Computerized Catalog System):

**DIAL:** 1-800-662-0662 or 614-764-5566

**login:** comcats

**password:** lucent1

Set your terminal options to the following values:

- 300/1200/2400 baud rate
- Full duplex
- Space parity
- 7 data bits
- 1 stop bit.

If you have trouble accessing COMCATS, call 1-888-LUCENT8 and ask to speak with the COMCATS Administrator.

For internet users, you can request a catalog from the following internet site:

**<http://www.lucent.product-training.com/catalog>**

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External Transmission Interfaces

The *SLC*<sup>®</sup>-2000 Access System transmission interfaces adhere to industry standards as listed in Table 10-1.

Table 10-1. Transmission Interface Standards

| Interface            | Standard                                                                       |
|----------------------|--------------------------------------------------------------------------------|
| Voice frequency (VF) | All supported VF interfaces meet appropriate requirements of Bellcore TR-57    |
| DS1 low-speed*       | CB-119, <i>ANSI</i> <sup>†</sup> T1.102-1993, TR-499                           |
| DSX-1 Feeder         | <i>ANSI</i> T1.102-1993, TR-499, CB-113                                        |
| OC-1/OC-3/OC-12      | <i>ANSI</i> T1.106/88, <i>ANSI</i> T1.105/91, TR-253, Issue 2; TR-496, Issue 3 |

\* B8ZS/AMI option

† Registered trademark of American National Standards Institute, Inc.

## Low-Speed Interfaces

---

### Voice Frequency Interfaces

The SLC-2000 Access System supports POTS, *SPOTS*® channel units, coin, multiparty, direct inward dial (DID), private line auto ring (PLAR), frequency selective ringing (FSR), and manual ring. All supported VF interfaces meet TR-57.

### DS1 Low-Speed (BBF1B or BBF3)

The SLC-2000 Access System supports DS1 electrical low-speed interfaces.

**Electrical Specification.** The DS1 low-speed interface transmits and receives a standard electrical DS1 signal as specified in *ANSI*\* T1.102-1993 (1.544 Mb/s nominal rate, DSX-1 interconnect specification). Line coding is provisionable to bipolar 8-zero substitution (B8ZS) or alternate mark inversion (AMI). Line buildout is provisionable per the following guidelines:

- 613C (22 gauge) — 0 to 655 ft.
- 1249-C1 (26 gauge) — 0 to 450 ft.

**Format Specification.** The DS1 low-speed interface provides clear channel transport of any DSX-1 compatible signal. There are no format constraints on this interface.

## Performance

---

### Wander

- The OC-3 interface accommodates at least 10 microseconds of wander per 24-hour period without buffer overflow or depletion.
- For Synchronous Optical Network (SONET) optical interfaces, the maximum time interval error (MTIE) does not exceed 60 nanoseconds phase variation when timed with a wander-free reference.

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\* Registered trademark of American National Standards Institute, Inc.

## Signal Performance

- For DS1 pipes, the number of errored seconds during a 2-hour, one-way loopback test is less than 10.
- The bit error rate (BER) is less than  $10^{-9}$  for the DS1 rate. Burst error seconds are excluded.
- The frequency of burst errored seconds, other than those caused by protection switching induced by hard equipment failures, averages less than four per day.

## Synchronization

### SONET Configuration

For the *SLC-2000* Access System in a synchronous optical network (SONET) configuration, the TGS circuit pack supports the following timing modes:

- Loop timing. Locked to recovered clock from OC-3 or STS-1 signal.
- Free running (only for turn-up). Timing derived from high-stability TCVCXO with a long-term accuracy of  $\pm 15$  ppm and temperature stability of  $\pm 8.8$  ppm ( $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ ).
- Holdover mode. Entered on failure of external timing or loop-timing reference, providing a long-term (10 years) accuracy of  $\pm 20$  ppm and stability of  $\pm 8.8$  ppm ( $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ ).

The TGS circuit pack meets the specifications of TR-253\*.

### Metallic Feeder Configuration

For the *SLC-2000* Access System in a DSX-1 metallic feeder configuration, the TSI supports a stratum 4 clock as per the following:

- Loop timing. Timing is locked to recovered clock from metallic DSX-1 facility. It will support  $\pm 32$  ppm pull-in range.
- Free running. The timing is derived from system CORE with an accuracy not less than  $\pm 32$  ppm over 10 years in an uncontrolled environment.

In a metallic configuration, protection of the DSX-1 facility is provided by customer-supplied external protection equipment.

Internal equipment protection is provided by the *SLC-2000* Access System. DSX-1 circuit packs (VTUs or LIUs) are protected 1:N, and CORE circuit packs (TSI and BMP) are protected 1:1.

---

\* Bellcore Technical Reference TR-NWT-000253 Issue 2, December 1991, and all revisions and supplements, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*.

## **Protection Switching**

In a SONET configuration, automatic line switches are initiated by signal fail and signal degrade conditions on the received OC-3 signal. This BER of this signal is calculated from violations of the SONET line overhead B2 parity byte. Signal fail is declared for incoming loss of signal, loss of frame, line alarm indication signal (AIS) or a BER exceeding  $10^{-3}$ , while a BER exceeding a provisionable threshold between  $10^{-5}$  and  $10^{-9}$  causes a signal degrade to be declared. Line protection is completed within 60 milliseconds of the onset of a signal fail or signal degrade, or a hard failure such as a fiber cut. For a protection switch in response to an external command, the interrupt interval is less than 50 milliseconds.

## **Core Switching**

The system provides switching from active to standby CORE with less than 2.5 seconds interruption in transmission.

## **Transient Performance**

### **Power Loss Restart**

After system shutdown from power loss, the system exhibits a 2-second error-free transmission interval that begins within 1 minute of restoration of power.

### **Transmission Start-Up on Signal Application**

The system, after having no signal applied for greater than 1 minute at the DSX-n interface or at any nonhierarchical interface, exhibits a 2-second error-free transmission interval that begins within 5 seconds of the reapplication of a signal.

## **Delay**

The transmission delay within a SLC-2000 Access System between DS1 and OC-3 interfaces is less than 50 microseconds.

## **OAM&P Interfaces**

---

This section presents the operation, maintenance, administration, and provisioning (OAM&P) interfaces that are required to support user access to the system and allow alarms and status information generated by the system to be reported. The local operations interfaces include the craft interface terminal (CIT) interface, the user interface panel, and the equipment indicators. The SLC-2000 Access System supports user-definable miscellaneous discrete alarms.

## **Equipment Indicators**

A red FAULT indicator is provided on all circuit packs except channel units. A green ACTIVE indicator is provided on all 1×1 protected circuit packs to indicate the circuit packs that are actively carrying traffic.

## **User Interface Panel (UIP) Indicators**

The UIP provides a central focus for system alarms and status displays. It contains alarm and status indicators and a single-line 24-character alphanumeric display that provides system maintenance and alarm information. The alarm indicators are: CR (critical), MJ (major), MN (minor), PMN (power minor), and Panel Fault. Status indicators include: NE (near end) Activity, FE (far end) Activity, Abnormal, Power, ACO (alarm cutoff), and Session. The display is controlled with push buttons to view the maintenance and alarm information.

## **Craft Interface Terminal Interface**

The system provides an EIA-232-D compatible CIT interface (front access only) on the user interface panel. The CIT interface provides data rates of 300, 1200, 2400, 4800, 9600, and 19200 baud.

## **Embedded Operations Channel (EOC)**

For Release 4.0 and later, the SLC-2000 Access System supports the EOC in a TR-303 configuration. The EOC uses link access protocol for the D-channel (LAPD) on layer 2 over a dedicated 64-kb/s DS0 channel for message-based communication with the local digital switch (LDS).

## **Transaction Language 1 (TL1) Interface**

The SLC-2000 Access System TL1/X.25 interface complies with Bellcore TR-TSY-000833, Issue 3, Revision 1; TR-NWT-000833, Issue 4, Supplement 1; and TR-NWT-000833, Issue 5, Revision 1. The X.25 "short stack" protocol is based on TR-TSY-000827, Issue 1. It supports four virtual channels for remote access via a packet data network. The TL1 message set is similar to that used by the DDM-2000 multiplexer.

## **Order Wire**

The SLC-2000 Access System provides a complementary-symmetry metal oxide semiconductor (CMOS) order-wire interface. This interface can be used with an external order-wire shelf to provide point-to-point voice communication between SLC-2000 Access Systems using the SONET overhead channel. The order-wire shelf should be installed in the same bay as the SLC-2000 Access System to which it is connected.

## **SLC-2000 Access System Reliability**

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This section describes the Bellcore reliability requirements that apply to the *SLC-2000* Access System and the calculations used to predict how the *SLC-2000* Access System meets those standards.

The *SLC-2000* Access System meets all the applicable Bellcore reliability requirements.

### **System Reliability**

---

The *SLC-2000* Access System has been designed and manufactured using advanced techniques and components in order to achieve extraordinary hardware and software reliability. The duplex core architecture used in the *SLC-2000* Access System provides enhanced hardware reliability over that available in the earlier 96-line *SLC* systems. The object-oriented design techniques and extensive software reuse contribute to high reliability in the software.

Based on the present estimates, the individual line downtime due to hardware failures is better than the Bellcore requirements of 13 minutes per year\* and the system maintenance rate for the hardware is better than the objective of not more than two maintenance actions per 100 lines per year\*.

### **Transmission Availability**

The Bellcore objective states the outage per two-way channel within a SONET multiplexer (for example, DS1 to OC-3 or DS3 to OC-3) should be less than 2 minutes per year (50 percent hardware, 50 percent software)†.

This objective affects any part of the product needed to receive one low-speed channel (for example, DS1), multiplex it, and transmit a high-speed signal (for example, OC-3), the reverse direction included (for example, OC-3 to DS1). An outage is defined, for this and all other outage requirements, as any 1-second interval with a bit error rate of  $10^{-3}$  or worse‡.

The *SLC-2000* Access System supports a DS1 to OC-3 system. The predicted hardware outage for a DS1 to OC-3 configured SONET subsystem is 0.303 minutes per year per DS1 channel.

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\* TR-TSY-000057, "Functional Criteria for Digital Loop Carrier Systems" (A Module of TSGR, FR-NWT-000440), Issue 1 (Bellcore, April 1987) plus Revision 1 (November 1988), Supplement 2 (June 1988), and Supplement 3 (November 1991).

† TA-TSY-000418, Issue 2, p. 22.

‡ TR-TSY-000009, Issue 1, May 1986, p. 4-11.

## Standards Compliance

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The *SLC-2000* Access System complies with *ANSI* standards and Bellcore requirements on SONET, TR-08, TR-303, ISDN and asynchronous interface standards. Environmental standards include Bellcore NEBS FCC electromagnetic compatibility (EMC) and safety requirements, FCC electromagnetic compliance (EMC) requirements, and *UL*<sup>\*</sup> standards for telephone equipment.

## UL Requirements

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The *SLC-2000* Access System has been listed by Underwriters Laboratories, Inc. This listing<sup>†</sup>, performed to demonstrate compliance with the National Electric Code of the United States and the corresponding electrical standard of Canada, is achieved by testing to the standards of *UL* 1459 to demonstrate that all components of the *SLC-2000* Access System perform safely during prescribed conditions.

All plug-ins exposed to outside plant are tested for safe performance when stressed by lightning and power cross. Plug-ins not exposed to outside plant, such as channel units AUA38, AUA54B, AUA232, *SPQ*<sup>®</sup>300, and *SPQ*454, are tested for stresses limited to the indoors. Table 4-1 on page 4-4 lists all the channel units that are limited to central office terminal (COT) use only. If any of the channel units listed for COT use only, or the *SPQ*300, *SPQ*454, AUA54, AUA54B, or AUA232, are installed in a customer premises remote terminal (RT), the user must ensure that the channel unit is not connected to a loop that leaves the protected premises. All plug-ins listed in this document have been tested to the appropriate standard and have been recognized by Underwriters Laboratories, Inc.

The following shelves of the *SLC-2000* system have been separately tested for *UL* listing:

- Access resource manager (ARM) Shelf and attached power interface unit (PIU)
- Metallic Distribution Shelf (MDS) and High Density Optic Shelf (HDOS) assemblies
- Bulk Power Shelf (J1C182BD-1).

The following parts of this section explain the cautions and warnings pertaining to these shelves. See the specific label on each shelf for the exact wording and any additional information.



**NOTE:**

The part of the warning restricting plug-ins to those manufactured by Lucent Technologies should not be interpreted as disqualifying plug-ins manufactured under license from Lucent Technologies.

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\* Registered trademark of Underwriters Laboratories Inc.

† *UL* Report E60667, March 29, 1995



## ARM Shelf and PIU

The ARM shelf (including the PIU) bears the following caution and warning in both English and French:



**CAUTION:**

*Disconnect all two (2) power supply connections and up to four (4) ring supply connections when removing power from this system.*

*For continued protection against risk of fire, all fuses used in this product must be replaced only with the same type and rating.*



**WARNING:**

*Refer to Remote Terminal Applications schematic SD-7C174-01 for DC input power source circuit breaker rating and proper wire size for electrical connection to this equipment.*

*The telecommunications interfaces should not leave the building premises unless connected to telecommunication devices providing primary and secondary protection, as applicable.*

*Installation must include an independent frame ground drop to building ground.*

*Install only equipment identified in 363-208-000, SLC-2000 Access System Applications, Planning, and Ordering Guide.*

*Use only Lucent Technologies manufactured circuit packs designated for use with this equipment. Use of other circuit packs may result in improper connection of circuitry leading to fire or injury of persons.*

*This equipment is To Be Installed Only in Restricted Access Areas (Dedicated Equipment Rooms, Equipment Closets, Or the Like) in Accordance With Articles 110-16, 110-17, and 110-18 Of The National Electrical Code, ANSI/NFPA No. 70. Other Installations Exempt from The Enforcement Of the National Electrical Code May Be Engineered According To The Accepted Practices Of The Local Telecommunication Utility.*

## MDS and HDOS Assemblies

The MDS and HDOS assemblies bear the following caution and warning statements:



### **CAUTION:**

*This Equipment is For installation With the SLC-2000 Access Resource Manager (ARM) Shelf Only.*

*For continued protection against risk of fire, all fuses used in this product must be replaced only with the same type and rating.*



### **WARNING:**

*The telecommunications interfaces should not leave the building premises unless connected to telecommunication devices providing primary and secondary protection, as applicable.*

*Installation must include an independent frame ground drop to building ground.*

*Install only equipment identified in 363-208-000 SLC-2000 Access System Applications, Planning, and Ordering Guide.*

*Use only Lucent Technologies manufactured circuit packs designated for use with this equipment. Use of other circuit packs may result in improper connection of circuitry leading to fire or injury of persons.*

*This equipment is To Be Installed Only in Restricted Access Areas (Dedicated Equipment Rooms, Equipment Closets, Or the Like) in Accordance With Articles 110-16, 110-17, and 110-18 Of The National Electrical Code, ANSI/NFPA No. 70. Other Installations Exempt from The Enforcement Of the National Electrical Code May Be Engineered According To The Accepted Practices Of The Local Telecommunication Utility.*

## Bulk Power Shelf (J1C182BD-1)

The Bulk Power Shelf (J1C182BD-1) bears a *UL* listed label and contains the following wording:

*THE 20 AMP POWER SHELF, MODEL J1C182BD-1 IS UL LISTED FOR RESTRICTED ACCESS INSTALLATION IN BUSINESS AND CUSTOMER PREMISES. APPLICATIONS INSTALLED IN ACCORDANCE WITH ARTICLES 110-16 AND 110-17 OF THE NATIONAL ELECTRIC CODE, ANSI/NFPA NUMBER 70-87. OTHER INSTALLATION EXEMPT FROM THE ENFORCEMENT OF THE NATIONAL ELECTRICAL CODE MAY BE ENGINEERED ACCORDING TO THE ACCEPTED PRACTICES OF THE LOCAL TELECOMMUNICATION UTILITY.*

## ANSI/ISO/CCITT

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The SLC-2000 Access System complies with ANSI, ISO, and CCITT standards for system interfaces [SONET, DS1, synchronization, and telecommunications management network (TMN) OS-NE interfaces], ISDN, and ASN.1.

- T1.102-1993, *Telecommunications Digital Hierarchy — Digital Hierarchy Electrical Interface*, (American National Standards Institute, 1993).
- T1.105-1991, *Telecommunications Digital Hierarchy — Optical Interface Rates and Formats Specification*, (American National Standards Institute, 1991).
- T1.106-1988, *Telecommunications Digital Hierarchy — Optical Interface Specifications (Single Mode)*, (American National Standards Institute, 1988).
- T1.403-1989, *Carrier to Customer Installation — DS1 Metallic Interface*, (American National Standards Institute, 1989).
- T1.601-1992, *Integrated Services Digital Network (ISDN) — Basic Access Interface Use on Metallic Loops for Application on the Network Side of the NT (Layer 1 Specification)*, (American National Standards Institute, 1992).
- T1M1.2/89-029R, September 1989 *ISDN Management— Primary Rate Physical Layer*, (American National Standards Institute).
- T1M1.3/89-090R1, May 1990 and T1M1.3/93-005, March 1993 *Layer 1 IN-Service Digital Transmission Performance Monitoring*, (American National Standards Institute).
- CCITT Recommendation Q.921 (I.441), Volume III, Fascicle III.5, *Integrated Services Digital Network (ISDN) User-Network Interface Data Link Layer Specification*, October 1984.
- CCITT Recommendation Q.931 (I.451), Volume III, Fascicle III.5, *Integrated Services Digital Network (ISDN) User-Network Interface Layer 3 Specification*, October 1984.
- CCITT Recommendation X.208, *Specification of Abstract Syntax Notation One (ASN.1)*, 1988.
- ISO (International Organization for Standardization) 8824, *Information Processing Systems — Open Systems Interconnection-Specification of Abstract Syntax Notation One (ASN.1)*, 1989.
- ISO (International Organization for Standardization) 8825, *Information Processing Systems — Open Systems Interconnection-Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*, 1989.
- ISO/IEC 9072-1, *Information Processing System — Text Communication — Remote Operations — Part 1: Model, Notation and Service Definition*, First Edition, May 15, 1989.

- ISO/IEC 9595, *Information Processing System — Open Systems Interconnection — Management Information Service Definition — Common Management Information Service*, May 15, 1990.
- ISO/IEC 9596, *Information Processing System — Open Systems Interconnection — Management Information Protocol Specification — Common Management Information Protocol*, May 15, 1990.

### **Bellcore Technical Advisories (TAs), Technical References (TRs) and SRs**

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The SLC-2000 Access System complies with Bellcore standards for SONET, integrated and universal digital loop carrier (DLC) systems, transport systems generic requirements (TSGRs), ISDN, operations technology generic requirements (OTGRs), and Network Equipment-Building Systems (NEBS). All SLC-2000 apparatus and equipment comply, with minor exceptions in the case of some new channel units' compliance with TR-TSY-000057, with the following Bellcore standards or their predecessor issues in effect when the apparatus and equipment were first deployed. Exceptions, if any, are noted in Customer Qualification Package (CQP) documents submitted to customers upon initial availability of new channel units.

- TR-TSY-000008, *Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch*, Issue 2 (Bellcore, August 1987).
- TR-TSY-000057, *Functional Criteria for Digital Loop Carrier Systems* (A Module of TSGR, FR-NWT-000440), Issue 1 (Bellcore, April 1987) plus Revision 1 (November 1988), Supplement 2 (June 1988), and Supplement 3 (November 1991).
- TR-NWT-000063, *Network Equipment-Building System (NEBS): Generic Equipment Requirements* (A Module of TSGR, FR-NWT-000440), Issue 4 (Bellcore, July 1991).
- TR-NWT-000253, *SONET Transport Systems: Common Criteria* (A Module of TSGR, FR-NWT-000440), Issue 2, (Bellcore, December, 1991).
- TR-NWT-000303, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface* (A Module of TSGR, FR-NWT-000440), Issue 2 (Bellcore, December 1992) plus Revision 1 (December, 1993), Supplement 2 (October, 1989), and Supplement 3 (March, 1990); also TA-TSY-000303, Issue 2 July 1987 (Supplement 1 to TR).
- TA-TSY-000313, *Generic Requirements for Circuit Maintenance of POTS and Special Services on Digital Loop Carrier (DLC) Systems*, Issue 2 (Bellcore, July 1988).
- TA-TSY-000367, *ISDN Basic Access Line Maintenance Requirements*, Issue 2 (Bellcore, September 1987).
- TR-NWT-000393, *Generic Requirements for ISDN Basic Access Digital Subscriber Lines*, Issue 2, January, 1991.

- TR-NWT-000397, *ISDN Basic Access Transport System Requirements* (A Module of TSGR, FR-NWT-000440), Issue 2, (Bellcore, January, 1991).
- TR-TSY-000496, *SONET Add-Drop Multiplex Equipment* (A Module of TSGR, FR-NWT-000440), Issue 2, (Bellcore, September, 1989 plus Supplement 1, September 1991).
- TR-NWT-000499, *Transport Systems Generic Requirements (TSGR): Common Requirements* (A Module of TSGR, FR-NWT-000440). Issue 4 (Bellcore, November 1991).
- TA-TSY-000784, *ISDN Basic Access Mediation Function for Operations, Administration, Maintenance, and Provisioning*, Issue 1, (Bellcore, August 1988).
- TR-TSY-000820, *Network Maintenance: Transport Surveillance — Generic Digital Transmission Surveillance* (A Module of Operation Technology Generic Requirements (OTGR), FR-NWT-000439), Issue 1, (Bellcore, June 1990).
- TR-TSY-000821, *Network Maintenance: Transport Surveillance — Additional Transport and Transport Based Surveillance* (A Module of Operation Technology Generic Requirements (OTGR), FR-NWT-000439), Issue 1 (Bellcore, June 1990) plus Revision 1, December 1991.
- TR-NWT-000834, *Operations Application Messages — Network Maintenance: Access and Testing Messages*, Issue 4, (Bellcore, December, 1992).
- TR-NWT-000909, *Generic Requirements and Objectives for Fiber-in-the-Loop Systems*, Issue 1, (Bellcore, December 1991).
- SR-NWT-001937, *National ISDN-1*, Issue 1 (Bellcore, February 1991).
- SR-NWT-002120, *National ISDN-2*, Issue 1, (Bellcore, May, 1992).
- GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety — Generic Criteria for Network Telecommunications Equipment* (A Module of LSSGR, FR-NWT-000064 and TSGR, FR-NWT-000440), Issue 1 (November, 1994)

## Technical Specifications Summary

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### Transmission Interface Characteristics

---

|                                                                            |                                                                                                                                |
|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| ■ Voice Frequency                                                          | POTS, <i>SPOTS</i> channel units, Coin, Multiparty, DID, PLAR, FSR, Manual Ring Down.<br>All Supported VF Interfaces Meet TR57 |
| ■ DS1 Low-Speed Interface<br>(BBF1B Quad DS1 Card)                         | Conforms to CB-119, <i>ANSI</i> T1.102-1993, TR-499 [Bipolar 8-Zero Substitute/Alternate Mark Indicator (B8ZS/AMI) option]     |
| ■ OC-3 Interface<br>(21G OLIU)<br>— Transmitter Type<br>— Receiver Type    | Conforms to <i>ANSI</i> T1.106-1988, T1.105-1991, and TR-253.<br>InGaAsP Laser<br>InGaAsP PIN                                  |
| ■ OC-3 Interface<br>(22G OLIU)<br>— Transmitter Type<br>— Receiver Type    | Conforms to <i>ANSI</i> T1.106-1988, T1.105-1991, and TR-253.<br>InGaAsP Laser<br>InGaAsP PIN                                  |
| ■ OC-12 Interface<br>(24G-2 OLIU)<br>— Transmitter Type<br>— Receiver Type | Conforms to <i>ANSI</i> T1.106-1988, T1.105-1991, and TR-253, Issue 2; and TR-496, Issue 3<br>InGaAsP Laser<br>InGaAsP PIN     |

## **Alarm and Control Interface Requirements**

---

### **Remote Alarms**

|                                           |                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------|
| ■ Remote Office Audible Alarms (see Note) | Critical, Major, Minor, Power Minor                                                |
| — Alarm Contact Closure Rating            | 1.0 Amp, 60 V (Max.)                                                               |
| ■ Remote Office Visual Alarms (see Note)  | Critical, Major, Minor, Power Minor                                                |
| — Alarm Contact Closure Rating            | 1.0 Amp, 60 V (Max.)                                                               |
| ■ User-Definable Miscellaneous Discretes  | Up to 14 Alarms or Status Inputs at the RT Site                                    |
| ■ Order Wire                              | Provides a CMOS Order-Wire Interface to Provide Point-to-Point Voice Communication |



#### **NOTE:**

For remote audible and visual alarms on events in the DLC subsystem, the RT can report these alarms to the CO alarm system or OS as follows:

- Through a COT connected to a CO alarm system
- Through connections to an OS
- On TR-303 systems, through the EOC to the TR-303 CO interface.

In addition, the RT can accept alarms from collocated equipment, then report these alarms through one of the items above.

## OAM&P Interface Flexibility

|                                                                   |                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ■ User Interface Panel Push Buttons                               | Up/Down Scroll, Enter, Escape, LED Test, ACO, Update                                                                                                                                                                                                                      |
| ■ User Interface Panel Indicators (Display Section)               | Critical, Major Alarms, Panel Fault (red indicators), MN (Minor), PMN (Power Minor) Alarms, and ABN (Abnormal), FE-Activity (Far-End Activity) and NE-Activity (Near-End Activity), Session (Yellow indicators), PWR ON, ACO (Green indicators), and 24 Character Display |
| ■ User Interface Panel Connector/Test Jacks (Maintenance Section) | Electrostatic Discharge (ESD)<br>One 25-pin EIA-232-D for Craft Interface Terminal (CIT)<br><br>Power Test Points for –48 V Feeders                                                                                                                                       |
| ■ Baud Rate                                                       | 300, 1200, 2400, 4800, 9600, or 19,200 b/s (Selectable)                                                                                                                                                                                                                   |
| ■ Craft Interface Interconnections                                | Connectorized                                                                                                                                                                                                                                                             |
| ■ SONET DCC                                                       | Data Communications Channel Connectivity for Remote Operations                                                                                                                                                                                                            |
| ■ Integral Test Head                                              | Supports POTS Testing Without RTU or Bypass Pair. Complies with TR-834.                                                                                                                                                                                                   |

## Feeder Format

|          |                                                                                                                                                                                                                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ■ TR-08  | Mode 1 (Supports Seven 96-Line Systems for 672 Lines)<br>Mixed Mode 1 and 2 (Supports Two Mode 1 and Six Mode 2 96-Line Systems for 768 Lines)<br>Mode 2 (Supports eight 96-Line Systems for 768 Lines).                                                                                                                         |
| ■ TR-303 | Supports up to 2 TR-303 VRTs with the total number of lines using 2 to 28 feeder DS1s as follows: <ul style="list-style-type: none"> <li>■ <b>Release 4.4 or Earlier:</b> 768 lines</li> <li>■ <b>Release 4.5 or Later (Metallic only):</b> 768 lines</li> <li>■ <b>Release 4.5 or Later (FITL only):</b> 1152 lines.</li> </ul> |
| ■ INA    | Nonswitched specials can be optionally separated and assigned to specific INA feeder facilities (supports up to 28 DS1s).                                                                                                                                                                                                        |



## Physical Characteristics

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ■ Appearance                       | Coordinated with other equipment in the Lucent Technologies 2000 product family.                                                                                                                                                                                                                                                                                                                                             |
| ■ Network Bay and Cabinet Mounting | Can be mounted in ED-8C500 or ED-8C501 network bay frames. Can also be packaged with other equipment in 80-type cabinets, controlled environment vaults (CEVs), or huts.                                                                                                                                                                                                                                                     |
| ■ Maximum Configuration            | One ARM shelf with four MDS assemblies partially fill a 7-foot bay. One ARM shelf with four MDS assemblies for a fully equipped 90A cabinet. One ARM shelf with two MDS assemblies for a partially equipped 90A cabinet. One ARM shelf with four MDS assemblies fill an 80A-HX cabinet. Two ARM shelves with eight MDS assemblies fill an 80D-HX cabinet. Three ARM shelves with 12 MDS assemblies fill an 80G-type cabinet. |

## Dimensions

|                                     | Height   | Width    | Depth     | Weight*               |
|-------------------------------------|----------|----------|-----------|-----------------------|
| ■ ARM shelf assembly                | 12.0 in. | 21.4 in. | 12.0 in.  | 31.0 lb.<br>(14.1 kg) |
| ■ Metallic Distribution Shelf (MDS) | 9.0 in.  | 21.4 in. | 12.75 in. | 12.0 lb.<br>(4.45 kg) |
| ■ User Interface Panel (UIP)        | 1.55 in. | 21.4 in. | 2.5 in.   | 1.5 lb.<br>(0.68 kg)  |
| ■ Fan Unit                          | 3.25 in. | 21.4 in. | 10.0 in.  | 14.25 lb.             |
| ■ HDOS                              | 5 in.    | 21.4 in. | 8 in.     | 6.5 lb.               |

\* Weight does not include cables or circuit packs.

## Primary Power Supply

|                          |                                         |
|--------------------------|-----------------------------------------|
| ■ Primary Supply Voltage | –48 V DC Nominal (–41.75 to –60.0 V DC) |
| ■ Two –48 V Feeders      | Fuse Protection                         |

## Environmental Considerations

### Thermal Characteristics

The *SLC-2000* Access System meets Bellcore NEBS requirements (TR-63, NEBS Generic Equipment Requirements) for use in central office environments. The *SLC-2000* Access System also operates in uncontrolled environments with the following characteristics:

|                               |                                                                                                                                                                       |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ■ Shelf Air Inlet Temperature | –40°F to +167°F (–40°C to +75°C)                                                                                                                                      |
| ■ Operating Relative Humidity | 5% to 95% (Noncondensing)                                                                                                                                             |
| ■ Cooling                     | Forced Convection (fans) Above +104°F (+40°C) Air Inlet<br>The <i>SLC-2000</i> Access System provides optional control and alarming for the 4G fan unit.              |
| ■ Operational Altitude        | From 200 ft. Below to 13,000 ft. (–61 to 3963 m) Above Sea Level                                                                                                      |
| ■ Fire Resistance             | The <i>SLC-2000</i> Access System meets the ignitability requirements specified in T1Y1.4/88-014 and the fire resistance requirements of <i>UL</i> 1459, 2nd Edition. |

### Handling and Transportation

|                                              |                             |
|----------------------------------------------|-----------------------------|
| ■ Vibration and Shock Design Criteria        | Conforms to TR-63, Issue 3. |
| ■ Temperature (Transportation/Storage)       | Conforms to TR-63, Issue 3. |
| ■ Relative Humidity (Transportation/Storage) | Conforms to TR-63, Issue 3. |
| ■ Storage/Shipment Altitude                  | Up to 40,000 ft. (12,191 m) |

### Earthquake, Acoustical Noise, and Electromagnetic Compatibility (EMC)

|                                   |                                                                                       |
|-----------------------------------|---------------------------------------------------------------------------------------|
| ■ Earthquake and Office Vibration | Conforms to TR-63.                                                                    |
| ■ EMC (Radiated Emissions)        | Meets the EMC requirements of FCC Title 47, Part 15, Subpart J for Class A equipment. |

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### Introduction

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This chapter is designed to simplify the equipment engineer's job of issuing *SLC*<sup>®</sup>-2000 equipment orders. It gives the ordering information for each separate part of the system. It is not intended to replace standard engineering documentation (for example, schematic drawings, equipment drawings, etc.). It also describes the Applications Configurator software for commonly purchased configurations.

### Where to Find the Latest Ordering Information

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Ordering information is constantly changing. In the future, you can find the latest version of this chapter with the current ordering information at the following Internet URL:

<http://www.wr.lucent.com/slc2000/>

From this page, click on **Ordering Information Updates (APOG Chapter 11)** under **Document Updates**.

At the present, this site is available to Lucent Technologies employees only. External customers should contact their Sales Team Account Representative for the latest information.

## Ordering for Fiber-in-the-Loop (FITL) Applications

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Refer to 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service and Ordering Manual*, for ordering specifically for the MSDT.

Refer to 363-206-300, *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide*, for ordering specifically for the MSDT.

For the Fiber Services Module (FSM) apparatus and equipment ordering, refer to Table D-1 in Appendix D.

This chapter does contain ordering information for FITL equipment located in the remote terminal/host digital terminal (RT/HDT).

## SLC-2000 Equipment Ordering Guide

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### Introduction

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The information in this section is arranged in tables that contain basic product identification, a brief description, and the number of the Lucent Technologies Data Sheet where applicable. These tables contain the most frequently ordered equipment codes for the *SLC-2000* Access System.

The configuration assumed in these tables is a single *SLC-2000* Access System access resource manager (ARM) shelf, one or more metallic distribution shelf (MDS) assemblies, the high density optics shelf (HDOS) [remote terminal/host digital terminal (RT/HDT) only], plug-ins, software, and miscellaneous equipment and tools. Shelves, standardized cable assemblies, and plug-ins are stocked at Lucent Technologies material distribution centers (MDCs) to make order turnaround short for most common arrangements.

This section contains the following tables:

- Table 11-1 on page 11-5, "Guidelines for Equipping a *SLC*<sup>®</sup>-2000 Access System (ARM Shelf and UIP)"
- Table 11-2 on page 11-7, "*SLC-2000* Access System Software Ordering Guidelines"
- Table 11-3 on page 11-10, "J1C265B-1, L3 Shop-Wired COT Bay — Fully Equipped Configuration"
- Table 11-4 on page 11-11, "J1C265C-1, L3 Shop-Wired COT Bay - Fully Equipped Configuration (GTE)"
- Table 11-5 on page 11-12, "*SLC-2000* Access System COT Bay Orderable Cables"

- Table 11-6 on page 11-15, "*SLC-2000* Access System COT Common Plug-In Units"
- Table 11-7 on page 11-16, "*SLC-2000* Access System COT Channel Unit Plug-Ins"
- Table 11-8 on page 11-20, "Overview of RT/HDT Bay List Structures"
- Table 11-9 on page 11-20, "J1C265A-1, L13 Shop-Wired FITL RT Bay — Traditional Applications"
- Table 11-10 on page 11-21, "J1C265A-1, L14 Shop-Wired Metallic RT Bay — Traditional Applications — Fully Equipped Configuration"
- Table 11-11 on page 11-22, "J1C265A-1, L19 Shop-Wired Metallic RT Bay — Traditional Applications — Start-up Configuration"
- Table 11-12 on page 11-23, "J1C265A-1, L20 Shop-Wired Metallic RT Bay — Physical Collocation Applications — Fully Equipped Configuration"
- Table 11-13 on page 11-24, "J1C265A-1, L21 Shop-Wired Metallic RT Bay — Physical Collocation Applications — Start-up Configuration"
- Table 11-14 on page 11-25, "J1C265E-1, L1 Shop-Wired Metallic RT Bay — Virtual Collocation Applications — Fully Equipped Configuration"
- Table 11-15 on page 11-26, "J1C265E-1, L2 Shop-Wired Metallic RT Bay — Virtual Collocation Applications — Start-up Configuration"
- Table 11-16 on page 11-27, "Required Equipment That Must Be Ordered Separately"
- Table 11-17 on page 11-28, "*SLC-2000* Access System Unequipped RT Frames and Associated Equipment"
- Table 11-18 on page 11-29, "*SLC-2000* Access System RT Cabinets and Enclosures"
- Table 11-19 on page 11-29, "Cabinet Ordering References"
- Table 11-20 on page 11-30, "*SLC-2000* Access System Cabling Requirements for RT Frames"
- Table 11-21 on page 11-33, "*SLC-2000* Access System RT Common Plug-In Units"
- Table 11-22 on page 11-35, "*SLC-2000* Access System RT Channel Unit Plug-Ins"
- Table 11-23 on page 11-39, "Plug-Ins Compatible with the *SLC-2000* Access System That Are Rated DA"
- Table 11-24 on page 11-41, "Dual Power Feed Unit (DPFU) Ordering Information — Comcode 601869118"
- Table 11-25 on page 11-44, "Local Alarm Relay Unit (LARU) Kit — Comcode 601869134"
- Table 11-26 on page 11-47, "DDM-2000 OC-3 Software Order Form"
- Table 11-27 on page 11-56, "Miscellaneous Equipment and Tools"

## Equipping the ARM Shelf and UIP

Table 11-1 lists the possible plug-ins that can be used in the ARM shelf depending on the *SLC-2000* software release. The table also provides comments for specific configurations and applications.

**Table 11-1. Guidelines for Equipping a SLC-2000 Access System (ARM Shelf and UIP)**

| Equipment Code                   | SLC <sup>®</sup> -2000 Release & Required Equipment Quantity |                |         | Comments                                                                                                        |
|----------------------------------|--------------------------------------------------------------|----------------|---------|-----------------------------------------------------------------------------------------------------------------|
|                                  | R3.1                                                         | R3.2 and Later | R4.X    |                                                                                                                 |
| 404( ) UIP                       | 1                                                            | 1              | 1       | You must use the 404B UIP when using the local alarm relay unit (LARU)                                          |
| BBF240 PDC                       | 1                                                            | 1              | 0       |                                                                                                                 |
| BBF241 PDC                       | 0                                                            | 0              | 1       | RT only                                                                                                         |
| BBF261 SMU                       | 1                                                            | 1              | 1       | BBF261 comes with R3.1 system software loaded on it.                                                            |
| BBG266 VTU                       | up to 8                                                      | up to 8        | up to 8 | For SONET feeder applications only                                                                              |
| BBG267 LIU                       | up to 8                                                      | up to 8        | up to 8 | For DSX-1 feeder applications only                                                                              |
| BBG268 Retainer                  | up to 6                                                      | up to 6        | up to 6 | For DSX-1 feeder applications only                                                                              |
| BBF220 PCU                       | 1                                                            | 1              | 1       | Optional; for local craft access and/or remote MLT testing                                                      |
| BBF225 CAU                       | 1                                                            | 1              | 1       | Optional; for local craft access                                                                                |
| BBG220 THC                       | 1                                                            | 1              | 1       | Optional; for local craft access and/or remote MLT testing                                                      |
| BBF2B TGS                        | 2                                                            | 2              | 2       | For SONET feeder applications only                                                                              |
| 21-, 22-, or 24-Type OLIU (Main) | 2                                                            | 2              | 2       | For SONET feeder applications only; choose from 21D, 21G, 22D-U, 22G-U, or 24G-U based on topology requirements |

*Continued on next page*

**Table 11-1. Guidelines for Equipping a SLC-2000 Access System (ARM Shelf and UIP)  
(Continued)**

| <b>SLC<sup>®</sup>-2000 Release &amp; Required Equipment Quantity</b> |             |                           |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------|-------------|---------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Equipment Code</b>                                                 | <b>R3.1</b> | <b>R3.2 and<br/>Later</b> | <b>R4.X</b> | <b>Comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| BBG2 MXRVO (Function A)                                               | 2           | 2                         | 2           | For SONET feeder applications only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| SYSCTL*                                                               | 1           | 1                         | 1           | SYSCTL and OHCTL are required for SONET feeder and DSX-1 feeder applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| OHCTL†                                                                | 1           | 1                         | 1           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 27G2-U OLIU (Function C or MAIN Slots)                                | —           | —                         | 2           | <p><b>Release 4.3 and later:</b> Optional: The 27G2-U OLIU is used when the ARM shelf hosts a DDM-2000 FiberReach WBS in an OC-1 ring. When using these OLIUs in Function Group C of a J1C265AA-1, L3 ARM shelf, BBF5 JMPR cards must be installed in slots 4 and P of the DS1 low-speed section of the ARM shelf.</p> <p>If your system contains DSX-1 metallic feeders, you can install this OLIU in the MAIN slots. When configured along with MXRVOS in Function Group C and DS1 low speed packs, you can multiplex DSX-1s from the DT servers onto an OC-1 ring for transport to a NBS. The 27G2-U also allows the ARM shelf to serve as host for the ring. See Chapter 8 configuration details.</p> |

\* The SYSCTL circuit pack has the following equipment code depending on the SONET Subsystem Software Release:

**Release 7.2 and earlier:** BBG5

**Release 9.0 and later:** BBG8B

† The OHCTL circuit pack has the following equipment code depending on the SONET Subsystem Software Release:

**Release 7.2 and earlier:** BBG7

**Release 9.0 and later:** BBG9

*Continued on next page*



**Table 11-1. Guidelines for Equipping a SLC-2000 Access System (ARM Shelf and UIP)  
(Continued)**

| <b>SLC<sup>®</sup>-2000 Release &amp; Required Equipment Quantity</b> |             |                           |             |                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------|-------------|---------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Equipment Code</b>                                                 | <b>R3.1</b> | <b>R3.2 and<br/>Later</b> | <b>R4.X</b> | <b>Comments</b>                                                                                                                                                                                                                                                                                                                                                                                         |
| 26G2-U OLIU (Function C)                                              | —           | —                         | 2           | <b>Release R4.4 or later:</b> Optional: These plug-ins require the J1C265AA-1,L4 and SONET subsystem software release R13 or later. By using DS1 low speed packs, you can multiplex DSX-1s from the DT servers onto an OC-1 ring for transport to a NBS. The 26G2-U interfaces with a single OC-1 ring and also allows the ARM shelf to serve as host for the ring. See Chapter 8 configuration details |
| BBG2 MXRVO<br>(Function C)                                            | 2           | 2                         | 2           | Optional; SONET feeder applications w/DS1 extensions. Also used when the MAIN slots contain 27G2-U OLIUs. (see comments on 27G2-U OLIU in this table).                                                                                                                                                                                                                                                  |
| BBF1B (DS1 low speed)                                                 | up to 8     | up to 8                   | up to 8     | Optional; SONET feeder applications w/DS1 extensions. Also used with 27G2-U and 26G2-U OLIUs in OC-1 configurations.                                                                                                                                                                                                                                                                                    |
| BBF3 (DS1 low speed w/perf. mont.)                                    | up to 8     | up to 8                   | up to 8     | Optional; SONET feeder applications w/DS1 extensions. Also used with 27G2-U and 26G2-U OLIUs in OC-1 configurations.                                                                                                                                                                                                                                                                                    |
| BBF5 JMPR                                                             | —           | —                         | 2           | Optional: When using the J1C265AA-1, L3 ARM shelf to host DDM-2000 FiberReach WBSs with the 27G2-U OLIUs, these packs must be installed in slots 4 and P of the DS1 low-speed section of the ARM shelf.                                                                                                                                                                                                 |
| 177A Retainer                                                         | up to 6     | up to 6                   | up to 6     | Optional; SONET feeder applications w/DS1 extensions                                                                                                                                                                                                                                                                                                                                                    |
| DLC Subsystem Software                                                | —           | —                         | —           | See Table 11-2                                                                                                                                                                                                                                                                                                                                                                                          |
| SONET Subsystem Software                                              | —           | —                         | —           | See Table 11-26                                                                                                                                                                                                                                                                                                                                                                                         |

### Ordering SLC-2000 DLC System Software

Table 11-2 lists the SLC-2000 DLC software releases and the related compatibility and ordering information.

**Table 11-2. SLC-2000 Access System Software Ordering Guidelines**

| <b>SLC<sup>®</sup>-2000 Release</b> | <b>Order Number for Required Software</b>                                                                                                                                                                                                                                                                          | <b>Compatible DDM-2000 Software — Select One (Note)</b>                                                                              |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 3.1                                 | NONE - SLC-2000 Release 3.1 software resides directly on BBF261 SMU.                                                                                                                                                                                                                                               | 6.2 (OC-3 Linear)<br>7.0 (OC-3 Ring)<br>2.2 (OC-12 Linear)                                                                           |
| 3.2                                 | DA (order R3.22.1)                                                                                                                                                                                                                                                                                                 | —                                                                                                                                    |
| 3.22.1                              | <b>For new sites:</b><br>J1C265XG-1, L1, M2S<br><br><b>For upgrades from existing R3.2 and R3.22 systems:</b><br>J1C265XG-1, L1, M2T                                                                                                                                                                               | 6.2 (OC-3 Linear)<br>7.1 (OC-3 Ring)<br>2.2 (OC-12 Linear)<br>3.1 (OC-12 Ring)                                                       |
| 3.3.1                               | <b>For new sites:</b><br>J1C265XE-1, L2, M2R, P2R<br><br><b>For upgrades from R3.2 only:</b><br>J1C265XE-1, L2, M2S, P2S<br><br><b>For upgrades from existing R3.2 systems:</b><br>J1C265XE-1, L2, M2T, P2T                                                                                                        | 6.2 (OC-3 Linear)<br>7.1 (OC-3 Ring)<br>7.2 (OC-3 Ring)<br>9.0 (OC-3 Ring)<br>2.2 (OC-12 Linear)<br>3.1 (OC-12 Ring)                 |
| 4.2                                 | <b>For new sites and upgrades of existing R2.0 or R3.1 sites:</b><br>J1C265XF-1, L1, P1R, M1R<br><br><b>For upgrades from R3.2 only:</b><br>J1C265XF-1, L1, P1X, M1X<br><br><b>For upgrades from R4.0 only:</b><br>J1C265XF-1, L1, P1Y, M1Y<br><br><b>For upgrades from R4.1 only:</b><br>J1C265XF-1, L1, P1S, M1S | 6.2.2 or higher (OC-3 Linear)<br>7.1.2 or higher (OC-3 Ring)<br>9.0.3 or higher (OC-3)<br>2.2.1 (OC-12 Linear)<br>3.1.1 (OC-12 Ring) |

**Note:** DDM-2000 software must be ordered separately from the SLC-2000 Access System software. Refer to the section in this chapter on DDM-2000 software ordering. DDM-2000 Release 6.2 (Linear) is recommended for DSX-1 feeder applications.

*Continued on next page*

**Table 11-2. SLC-2000 Access System Software Ordering Guidelines (Continued)**

| <b>SLC®-2000 Release</b> | <b>Order Number for Required Software</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Compatible DDM-2000 Software - Select One (Note)</b>                                                                                                     |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.4.2                    | <p><b><i>For new sites:</i></b><br/>J1C265XJ-1, L3, P3R, M3R</p> <p><b><i>For sites upgrading from R3.2 only:</i></b><br/>J1C265XJ-1, L3, P3X, M3X</p> <p><b><i>For sites upgrading from R4.0 only:</i></b><br/>J1C265XJ-1, L3, P3Y, M3Y</p> <p><b><i>For sites upgrading from R4.1 only:</i></b><br/>J1C265XJ-1, L3, P3W, M3W</p> <p><b><i>For sites upgrading from R4.2 only:</i></b><br/>J1C265XJ-1, L3, P3S, M3S</p> <p><b><i>For sites upgrading from existing R4.4 point releases:</i></b><br/>J1C265XJ-1, L3, P3T, M3T</p> | <p>6.2.2 or higher (OC-3 Linear)</p> <p>7.1.2 or higher (OC-3 Ring)</p> <p>9.0.3 or higher (OC-3)</p> <p>2.2.1 (OC-12 Linear)</p> <p>3.1.1 (OC-12 Ring)</p> |
| 4.5                      | <p><b><i>For new sites:</i></b><br/>J1C265XK-1, L1, P1R, M1R</p> <p><b><i>For sites upgrading from R3.2 only:</i></b><br/>J1C265XK-1, L1, P1X, M1X</p> <p><b><i>For sites upgrading from R4.0 only:</i></b><br/>J1C265XK-1, L1, P1Y, M1Y</p> <p><b><i>For sites upgrading from R4.1 only:</i></b><br/>J1C265XK-1, L1, P1W, M1W</p> <p><b><i>For sites upgrading from R4.2 only:</i></b><br/>J1C265XK-1, L1, P1S, M1S</p> <p><b><i>For sites upgrading from R4.4 only:</i></b><br/>J1C265XK-1, L1, P1Z, M1Z</p>                    | <p>6.2.2 or higher (OC-3 Linear)</p> <p>7.1.2 or higher (OC-3 Ring)</p> <p>9.0.3 or higher (OC-3)</p> <p>2.2.1 (OC-12 Linear)</p> <p>3.1.1 (OC-12 Ring)</p> |

**Note:** DDM-2000 software must be ordered separately from the SLC-2000 Access System software. Refer to the section in this chapter on DDM-2000 software ordering. DDM-2000 Release 6.2 (Linear) is recommended for DSX-1 feeder applications.

*Continued on next page*

**Table 11-2. SLC-2000 Access System Software Ordering Guidelines (Continued)**

| <b>SLC<sup>®</sup>-2000<br/>Release</b> | <b>Order Number for Required Software</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Compatible DDM-<br/>2000 Software -<br/>Select One (Note)</b>                                                                                            |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.6                                     | <p><b><i>For new sites:</i></b><br/>J1C265XM-1, L1, P1R, M1R</p> <p><b><i>For sites upgrading from R3.2 or R3.22 only:</i></b><br/>J1C265XM-1, L1, P1X, M1X</p> <p><b><i>For sites upgrading from R4.0 only:</i></b><br/>J1C265XM-1, L1, P1Y, M1Y</p> <p><b><i>For sites upgrading from R4.1 only:</i></b><br/>J1C265XM-1, L1, P1W, M1W</p> <p><b><i>For sites upgrading from R4.2 only:</i></b><br/>J1C265XM-1, L1, P1S, M1S</p> <p><b><i>For sites upgrading from R4.4 only:</i></b><br/>J1C265XM-1, L1, P1Z, M1Z</p> <p><b><i>For sites upgrading from R4.5 only:</i></b><br/>J1C265XM-1, L1, P1V, M1V</p> | <p>6.2.2 or higher (OC-3 Linear)</p> <p>7.1.2 or higher (OC-3 Ring)</p> <p>9.0.3 or higher (OC-3)</p> <p>2.2.1 (OC-12 Linear)</p> <p>3.1.1 (OC-12 Ring)</p> |

**Note:** DDM-2000 software must be ordered separately from the SLC-2000 Access System software. Refer to the section in this chapter on DDM-2000 software ordering. DDM-2000 Release 6.2 (Linear) is recommended for DSX-1 feeder applications.

### Selecting COT Bay Equipment

This section provides the following ordering information for SLC-2000 bay configured as a COT:

- Equipment available with specific list numbers for shop-wired COT bays (The list numbers include only the equipment shown in the specific table. It may be necessary to order cables and other equipment separately.)
- Orderable COT bay cables
- Common plug-ins for the COT bay
- Channel units compatible with the COT bay.

Items that can **not** be order but are compatible with the COT bay are listed in Table 11-23 on page 11-39.

**Table 11-3. J1C265B-1, L3 Shop-Wired COT Bay — Fully Equipped Configuration**

| <b>Description</b>                                                                   | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|--------------------------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 3 — COT application (J1C265B-1, L3; COMCODE 601819436; CLEI Code SABACBE</b> |                 |                |                                           |                           |
| Network Bay Frame                                                                    | 1               | —              | —                                         | ED-8C500-50,G1            |
| ARM Shelf                                                                            | 1               | 601817513      | SAMA5R0                                   | J1C265AD-1, L3            |
| MDS Assembly                                                                         | 4               | 601817497      | SAMA7S0                                   | J1C265AE-1, L3            |
| Power Interface Unit (PIU) assembly                                                  | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Bay Cable                                                                        | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| Baffles                                                                              | 3               | 845448307      | —                                         | —                         |
| 1A ATU                                                                               | 1               | 107417537      | SAMYAA7                                   | APA-843906                |
| Cable Support                                                                        | 1               | 842094922      | —                                         | —                         |
| 353A Terminal Block                                                                  | 1               | 102436250      | —                                         | —                         |
| ARM DS1 Cable Kit                                                                    | 1               | 601824246      | —                                         | ED-7C723-31,G2B           |

\* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

**Table 11-4. J1C265C-1, L3 Shop-Wired COT Bay - Fully Equipped Configuration (GTE)**

| <b>Description</b>                                                                       | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|------------------------------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 3 — COT GTE application (J1C265C-1, L3; COMCODE 601817547; CLEI Code SABACEC</b> |                 |                |                                           |                           |
| Network Bay Frame                                                                        | 1               | —              | —                                         | ED-8C801-50,G1            |
| ARM Shelf                                                                                | 1               | 601817521      | SAMA6R0                                   | J1C265AD-1, L4            |
| MDS Assembly                                                                             | 4               | 601817505      | SAMA8S0                                   | J1C265AE-1, L4            |
| Power Interface Unit (PIU) assembly                                                      | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Bay Cable                                                                            | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| Baffles                                                                                  | 3               | 845448307      | —                                         | —                         |
| 1A ATU                                                                                   | 1               | 107417537      | SAMYAA7                                   | APA-843906                |
| Cable Support                                                                            | 1               | 842094922      | —                                         | —                         |
| 353A Terminal Block                                                                      | 1               | 102436250      | —                                         | —                         |
| ARM DS1 Cable Kit                                                                        | 1               | 601824246      | —                                         | ED-7C723-31,G2B           |

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**Table 11-5. SLC-2000 Access System COT Bay Orderable Cables**

| <b>Description</b>                                                        | <b>Quantity</b>          | <b>Product Identifier</b>           | <b>Code</b>                                                                                |
|---------------------------------------------------------------------------|--------------------------|-------------------------------------|--------------------------------------------------------------------------------------------|
| DS1 distrib. to ARM shelf<br>(J165 - J168) or DS1<br>Feeder (J160 - J163) | 4/ARM<br>or<br>4/Bay     | 601446370<br>601446388<br>601446578 | ED-7C723-37, G1 (75 ft.)<br>ED-7C723-37, G2 (150 ft.)<br>ED-7C723-37, G3 (As req'd)        |
| MDS assembly VF distrib.<br>(J101 - J104)                                 | 1/MDS                    | 601446396<br>601446404<br>601446412 | ED-7C723-37, G4 (75 ft.)<br>ED-7C723-37, G5 (150 ft.)<br>ED-7C723-37, G6 (As req'd)        |
| MDS assembly VF distrib.<br>(J201 - J204)                                 | 1/MDS                    | 601446420<br>601446438<br>601446446 | ED-7C723-37, G7 (75 ft.)<br>ED-7C723-37, G8 (150 ft.)<br>ED-7C723-37, G9 (As req'd)        |
| MDS assembly E&M cables<br>(J105 & J106)                                  | 1/MDS                    | 601446453<br>601446461<br>601446479 | ED-7C723-37, G10 (75 ft.)<br>ED-7C723-37, G11 (150 ft.)<br>ED-7C723-37, G12 (As req'd)     |
| MDS assembly E&M cables<br>(J205 & J206)                                  | 1/MDS                    | 601446487<br>601446495<br>601446503 | ED-7C723-37, G13 (75 ft.)<br>ED-7C723-37, G14 (150 ft.)<br>ED-7C723-37, G15 (As req'd)     |
| ARM shelf misc. alarms<br>(J171)<br>or bypass pair to 1A ATU<br>(J120)    | 1/ATU<br>and/or<br>1/ARM | 601446511<br>601446529<br>601446537 | ED-7C723-37, G16 (75 ft.)<br>ED-7C723-37, G17 (150 ft.)<br>ED-7C723-37, G18 (As req'd)     |
| Telemetry cables to 1A<br>ATU (J113)                                      | 1/ATU                    | 601446545<br>601446552<br>601446560 | ED-7C723-37, G19 (75 ft.)<br>ED-7C723-37, G20 (150 ft.)<br>ED-7C723-37, G21 (As req'd)     |
| ARM shelf DS1 timing input<br>synchronization (J37)                       | 1/ARM*                   | —<br>—<br>—                         | ED-8C724-20, G339 (100 ft.)<br>ED-8C724-20, G340 (300 ft.)<br>ED-8C724-20, G341 (As req'd) |
| DS1 timing mult cable                                                     | 1/ARM*                   | —                                   | ED-8C724-20, G374 (As req'd)                                                               |

\* One DS1 timing cable is required per ARM shelf *in a lineup*. Group 374 then provides multiple connection to other ARM shelves in the lineup.

***Continued on next page***

**Table 11-5. SLC-2000 Access System COT Bay Orderable Cables (Continued)**

| Description                                       | Quantity       | Product Identifier                                            | Code                                                                                                       |
|---------------------------------------------------|----------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| ARM shelf LAN card cable (J45)                    | 1/ARM          | —<br>—                                                        | ED-8C724-20, G342 (150 ft.)<br>ED-8C724-20, G343 (As req'd)                                                |
| ARM shelf TBOS cable for ACORN* application (J53) | 1/ARM          | —<br>—                                                        | ED-8C724-20, G348 (150 ft.)<br>ED-8C724-20, G349 (As req'd)                                                |
| ARM shelf TBOS cable for GTP applic. (J53)        | 1/ARM          | —<br>—                                                        | ED-8C724-20, G396 (150 ft.)<br>ED-8C724-20, G395 (As req'd)                                                |
| ARM shelf CIT remote modem interface (J182)       | 1/ARM<br>1/ARM | —<br>—                                                        | ED-8C724-20, G319 (150 ft.)<br>ED-8C724-20, G350 (As req'd)                                                |
| PGTC cable to bay connector P115                  | 1/Bay          | —<br>—<br>—                                                   | ED-3C861-20, G20 (100 ft.)<br>ED-3C861-20, G21 (150 ft.)<br>ED-3C861-20, G22 (225 ft.†)                    |
|                                                   | 1/2 Bays       | —                                                             | ED-3C861-20, G29 (As req'd)                                                                                |
| <b>Lightguide jumpers‡</b>                        |                |                                                               |                                                                                                            |
| Single-mode jumpers with ST® - ST connectors§     | 4/Bay          | 105357727<br>105357768<br>105357800<br>105357859<br>105357875 | FS1E-E-2 (2 ft.)<br>FS1E-E-10 (10 ft.)<br>FS1E-E-25 (25 ft.)<br>FS1E-E-50 (50 ft.)<br>FS1E-E-100 (100 ft.) |

\* Service mark of AT&T.

† When cable distance exceeds 225 feet, order ED-3C861-20, G24 (1 per 2 bays). This group provides the cable connectors required for custom cables or cables longer than 225 feet. Group 24 is used with 254A cable (ordered bulk) and is field formed (see ED-3C861-20).

‡ Interface to LGX® panel. **Multimode outside plant lightguide:** single-mode or multimode jumpers can be used on the transmit (OUT) side between the LGX panel and the SLC-2000 Access System. Multimode must be used on the receive (IN) side of all optical line interface units (OLIUs) except the 21D or 22D-U OLIU. **Single-mode outside plant lightguide:** single-mode jumpers must be used for the transmit side; single-mode or multimode jumpers can be used for the receive side of all OLIUs except the 21D or 22D-U OLIU. **Intershelf OC-3/OC-12 interconnection:** The 21D or 22D-U OLIU requires multimode jumpers on the transmit and receive sides.

§ Jumpers are available with other types of connectors (such as SC, FC-PC, etc.).

*Continued on next page*



**Table 11-5. SLC-2000 Access System COT Bay Orderable Cables (Continued)**

| <b>Description</b>                                                          | <b>Quantity</b> | <b>Product Identifier</b> | <b>Code</b>          |
|-----------------------------------------------------------------------------|-----------------|---------------------------|----------------------|
| Single-mode jumpers with <i>ST</i> <sup>®</sup> - 2016A Biconic connectors* | 4/Bay           | 105420905                 | FS1E-A-2 (2 ft.)     |
|                                                                             |                 | 105420947                 | FS1E-A-10 (10 ft.)   |
|                                                                             |                 | 105423958                 | FS1E-A-25 (25 ft.)   |
|                                                                             |                 | 105424006                 | FS1E-A-50 (50 ft.)   |
|                                                                             |                 | 105424022                 | FS1E-A-100 (100 ft.) |
| Multimode jumpers with <i>ST</i> - <i>ST</i> connectors*                    | 4/Bay           | 105351795                 | FL1E-E-2 (2 ft.)     |
|                                                                             |                 | 105351837                 | FL1E-E-10 (10 ft.)   |
|                                                                             |                 | 105351860                 | FL1E-E-25 (25 ft.)   |
|                                                                             |                 | 105351910                 | FL1E-E-50 (50 ft.)   |
|                                                                             |                 | 105351936                 | FL1E-E-100 (100 ft.) |
| Multimode jumpers connectors*                                               | 4/Bay           | 105351795                 | FL1E-A-2 (2 ft.)     |
|                                                                             |                 | 105351837                 | FL1E-A-10 (10 ft.)   |
|                                                                             |                 | 105351860                 | FL1E-A-25 (25 ft.)   |
|                                                                             |                 | 105351910                 | FL1E-A-50 (50 ft.)   |
|                                                                             |                 | 105351936                 | FL1E-A-100 (100 ft.) |

\* Jumpers are available with other types of connectors (such as SC, FC-PC, etc.).

**Table 11-6. SLC-2000 Access System COT Common Plug-In Units**

|                                     |                                                                   | COMMON<br>LANGUAGE CLEI* |           |
|-------------------------------------|-------------------------------------------------------------------|--------------------------|-----------|
| Equipment Code                      | Description                                                       | Code                     | COMCODE   |
| Access Resource Manager (ARM) Shelf |                                                                   |                          |           |
| 404B                                | User interface panel (UIP)                                        | SAPQADKBAA               | 108165838 |
| BBF240                              | Provisioning display controller (PDC)                             | SAPQAAPBAB               | 106626153 |
| BBF250                              | Link to alarms and networks (LAN)                                 | SAIUN60BAA               | 107061558 |
| BBF261 (S1:1)                       | System memory unit (SMU2)                                         | SAIUPD0BAA               | 106972128 |
| BBG2                                | STS-1 multiplexer card (MXRVO)                                    | SNCMAA2AAB               | 106439409 |
| BBG5 <sup>†</sup>                   | System controller (SYSCTL)                                        | DMPQ00WAAB               | 106633688 |
| BBG8B <sup>‡</sup>                  | System controller (SYSCTL)                                        | SNC5U79DAA               | 107830549 |
| BBG7 <sup>†</sup>                   | Overhead channel controller (OHCTL)                               | DMPQ0AJAAB               | 106633704 |
| BBG9 <sup>‡</sup>                   | Overhead channel controller (OHCTL)                               | SNC11VLAAA               | 106008121 |
| BBG266                              | Virtual tributary unit (VTU)                                      | SAIUH0EBAC               | 106626179 |
| BBG267 <sup>§</sup>                 | Metallic line interface unit (LIU)                                | SAIUNC0BAD               | 106932825 |
| BBG268 <sup>§</sup>                 | Retainer card                                                     | SAPQABTBAA               | 106943814 |
| BDK <sup>®</sup> 250                | Time slot interchange (TSI)                                       | SAIUK50BAF               | 106939085 |
| 21D-U                               | Optical line interface unit (OLIU)                                | SNRXDJ0AAA               | 107092637 |
| 21G                                 | Optical line interface unit (OLIU)                                | SNTRABCAAD               | 106064462 |
| 21G2-U                              | Optical line interface unit (OLIU)                                | SNRXDRMAAB               | 107931628 |
| 22F-U                               | OLIU — Ring                                                       | SNi22Z0BAA               | 107713836 |
| 22D-U                               | Optical line interface unit (OLIU)                                | SNCMVE0                  | 106926595 |
| 22G3-U                              | Optical line interface unit (OLIU)                                | SNRXDZ0                  | 108057944 |
| 24G-U <sup>¶</sup>                  | OLIU — OC12 ring                                                  | SNRXDW0                  | 107735086 |
| 177A                                | Retainer card                                                     | SNPQWACAAB               | 105774061 |
| BBF1B                               | Optional DS1 low-speed interface                                  | SNCLA70AAB               | 106543606 |
| BBF3                                | Optional DS1 low-speed interface unit with performance monitoring | SNPQAM4AAB               | 106008071 |
| BBF2B                               | Synchronizer timing generator (TGS)                               | SNPQA16AAB               | 106995046 |
| BBF4 <sup>**</sup>                  | Stratum 3 Timing Generator (TG3)                                  | SNC6LK0EAA               | 106008089 |
| MDS Assembly                        |                                                                   |                          |           |
| BDJ <sup>®</sup> 200                | Power and test unit (PTU)                                         | SAPQADBBAB               | 107831208 |
| BDJ205                              | TR-08 processing unit (T8U)                                       | SAIUJ0GBAB               | 107101057 |
| BDJ240                              | Metallic distribution controller (MDC)                            | SARTB00AAC               | 106626138 |
| Integral Test Head (ITH)            |                                                                   |                          |           |
| BBG220                              | Test head controller (THC)                                        | SARTA03AAA               | 107152761 |
| BBF220                              | Power converter unit (PCU)                                        | SAPQAARBAA               | 106588791 |
| BBF225B                             | Craft access unit (CAU)                                           | SAPQACZBAA               | 107617821 |

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† SONET Subsystem Software Release 7 and earlier.

‡ SONET Subsystem Software Release 9 and later.

§ Requires Release 3.2 or later software.

¶ SONET Subsystem Software Release 11 or later.

\*\* Requires SONET Subsystem Software Release R13 or later and the J1C265AA-1, L4 ARM shelf.

**Table 11-7. SLC-2000 Access System COT Channel Unit Plug-Ins**

| <b>Equipment</b> | <b>Description</b>                  | <b>COMMON<br/>LANGUAGE<br/>CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent<br/>Technologies Data<br/>Sheet</b> |
|------------------|-------------------------------------|-------------------------------------------|----------------|-----------------------------------------------|
| AUA33B           | Coin CS                             | 5SC3RE0                                   | 107590093      | 363-005-103                                   |
| AUA34B           | DS0 dataport                        | 5SC133A                                   | 107748436      | 363-005-104                                   |
| AUA35            | Multiparty                          | 5SCU540                                   | 103840526      | 363-005-109                                   |
| AUA36B           | Dual DID DPO                        | 5SCU900                                   | 107392292      | 363-005-114                                   |
| AUA37B           | FSR                                 | 5SCUSK4                                   | 106222656      | 363-005-121                                   |
| AUA38C           | POTS CU                             | 5SC1Y2X                                   | 107187429      | 363-005-118                                   |
| AUA38D           | POTS CU (CS+OHT+CLASS)              | 5SC4W3V                                   | 108041583      | 363-005-118                                   |
| AUA39B           | SPOTS CU                            | 5SC1X0B                                   | 106223217      | 363-005-120                                   |
| AUA41B           | 4W VF SS                            | 5SC3HJE                                   | 106988082      | 363-005-105                                   |
| AUA42B           | 2W E SPOTS CU (CS)                  | 5SCU6E0                                   | 106932189      | 363-005-106                                   |
| AUA43B           | 2W E SPOTS CU (CF)                  | 5SCU6F0                                   | 106932197      | 363-005-107                                   |
| AUA45B           | Dual ringing repeater               | 5SCUUJ5                                   | 105717987      | 363-005-123                                   |
| AUA52B           | OCU dataport (TR-08/ INA<br>VRTs)   | 5SC1430                                   | 106244163      | 363-005-111                                   |
| AUA75            | 2W-PLAR                             | 5SC1FF2                                   | 103840963      | 363-005-132                                   |
| AUA90            | ISDN T-BRITE (TR-08/INA<br>VRTs)    | 5SC1EEC                                   | 106436678      | 363-005-129                                   |
| AUA150C          | POTS/SPOTS CU<br>(CF+OHT+CLASS)     | 5SC3PV0                                   | 107627325      | 363-005-133                                   |
| AUA232           | RS-232 CU (DDS, TR-08/ INA<br>VRTs) | 5SCTCBO                                   | 107050445      | 363-005-312                                   |
| AUA252B          | OCU Dataport w/SW56                 | 5SCTFFF                                   | 107727521      | 363-005-212                                   |
| AUA293           | BRITE III ANS/ U                    | 5SC4PT0                                   | 107940538      | 363-005-347                                   |

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**Table 11-7. SLC-2000 Access System COT Channel Unit Plug-Ins (Continued)**

| <b>Equipment</b>       | <b>Description</b>                   | <b>COMMON<br/>LANGUAGE<br/>CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent<br/>Technologies Data<br/>Sheet</b> |
|------------------------|--------------------------------------|-------------------------------------------|----------------|-----------------------------------------------|
| AUA45B                 | Dual ringing repeater                | 5SCUUJ5                                   | 105717987      | 363-005-123                                   |
| AUA52B                 | OCU dataport (TR-08/ INA VRTs)       | 5SC1430                                   | 106244163      | 363-005-111                                   |
| AUA75                  | 2W-PLAR                              | 5SC1FF2                                   | 103840963      | 363-005-132                                   |
| AUA90                  | ISDN T-BRITE (TR-08/INA VRTs)        | 5SC1EEC                                   | 106436678      | 363-005-129                                   |
| AUA150C                | POTS/SPOTS CU (CF+OHT+CLASS)         | 5SC3PV0                                   | 107627325      | 363-005-133                                   |
| AUA232                 | RS-232 CU (DDS, TR-08/ INA VRTs)     | 5SCTCBO                                   | 107050445      | 363-005-312                                   |
| AUA252B                | OCU Dataport w/SW56                  | 5SCTFFF                                   | 107727521      | 363-005-212                                   |
| AUA293                 | BRITE III ANS/ U                     | 5SC4PT0                                   | 107940538      | 363-005-347                                   |
| MCU5205 <sup>†</sup>   | DC alarm CU <sup>‡</sup>             | 5SC26TV                                   | —              | TLGD-5205 <sup>§</sup>                        |
| MCU5405 <sup>†</sup>   | DC bypass CU <sup>‡</sup>            | 5SC26T0                                   | —              | TLGD-5405 <sup>§</sup>                        |
| PGM <sup>†</sup> -2000 | Program CU <sup>‡</sup>              | SAC1CSN                                   | —              | TLGD-2000 <sup>§</sup>                        |
| SPQ <sup>®</sup> 300   | Quad POTS (Q POTS) CU (CS+OHT+CLASS) | SAC1ACF                                   | 107049660      | 363-005-380                                   |
| SPQ300                 | Quad POTS (Q POTS) CU (CS+OHT+CLASS) | SAC1ACF                                   | 107049660      | 363-005-380                                   |

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† Trademark of Tollgrade Communications, Inc.

‡ Direct orders to Tollgrade Order Entry at:  
Tollgrade Communications, Inc.  
493 Nixon Road  
Cheswick, PA 15024  
Telephone 1-800-878-3399 or 412-274-2156  
Fax 412-274-8014  
Specify CLEI code.

§ Available from Tollgrade Communications, Inc. 1-800-878-3399

*Continued on next page*

**Table 11-7. SLC-2000 Access System COT Channel Unit Plug-Ins (Continued)**

| <b>Equipment</b>             | <b>Description</b>                                  | <b>COMMON<br/>LANGUAGE<br/>CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent<br/>Technologies Data<br/>Sheet</b> |
|------------------------------|-----------------------------------------------------|-------------------------------------------|----------------|-----------------------------------------------|
| <i>SPQ</i> <sup>®</sup> 300B | Quad POTS (Q POTS) CU<br>(CS+OHT+CLASS)             | SAC1AX0                                   | 108058652      | 363-005-380                                   |
| <i>SPQ</i> 318               | Quad Coin CS                                        | SAC1AR0                                   | 107590119      | 363-005-330                                   |
| <i>SPQ</i> 328               | Quad P-Phone COT <sup>†</sup>                       | SAC1AJ0                                   | —              | TLGD-328C <sup>‡</sup>                        |
| <i>SPQ</i> 333               | Dual Coin CS                                        | 5SC3EE0                                   | 107500738      | 363-005-331                                   |
| <i>SPQ</i> 334               | Dual DS0 Dataport                                   | 5SC3240                                   | 107590127      | 363-005-332                                   |
| <i>SPQ</i> 336               | Quad DID 2W DPO                                     | SACPCC0                                   | 107580409      | 363-005-334                                   |
| <i>SPQ</i> 340               | Quad POTS CU<br>(CS+OHT+CLASS+CLSS)                 | SAC1ADL                                   | 107437956      | 363-005-381                                   |
| <i>XSPQ</i> 400 <sup>§</sup> | Quad POTS CU (CF+OHT/<br>CLASS)                     | —                                         | 107989519      | 363-005-345                                   |
| <i>SPQ</i> 401               | Quad POTS (CF+OHT/<br>CLASS+CLSS)                   | SAC1EWT                                   | 108053703      | 363-005-344                                   |
| <i>SPQ</i> 401B              | Quad POTS VFDE (CF+OHT/<br>CLASS+CLSS)              | SAC1EWU                                   | 108049107      | 363-005-344                                   |
| <i>SPQ</i> 440C <sup>¶</sup> | Quad POTS/ <i>SPOTS</i> CU<br>(ALC, CF + Ext. Rng.) | SAC1AC0                                   | 107500746      | 363-005-369                                   |

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493 Nixon Road  
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Telephone 1-800-878-3399 or 412-274-2156  
Fax 412-274-8014  
Specify CLEI code.

‡ Available from Tollgrade Communications, Inc. 1-800-878-3399

§ For international applications only.

¶ The *SPQ*440C CU will be replaced by the *SPQ*440D during the third quarter of 1998.

*Continued on next page*

**Table 11-7. SLC-2000 Access System COT Channel Unit Plug-Ins (Continued)**

| <b>Equipment</b> | <b>Description</b>                                        | <b>COMMON<br/>LANGUAGE<br/>CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent<br/>Technologies Data<br/>Sheet</b> |
|------------------|-----------------------------------------------------------|-------------------------------------------|----------------|-----------------------------------------------|
| <i>SPQ440D</i>   | Quad POTS/ <i>SPOTS</i> CU<br>(ALC, CF + Ext. Rng., VFDE) | SAC1ACX                                   | 108123605      | 363-005-369                                   |
| <i>SPQ442</i>    | Quad E <i>SPOTS</i> CU (CS)                               | SAC1AH0                                   | 107100562      | 363-005-382                                   |
| <i>SPQ443</i>    | Quad E <i>SPOTS</i> CU (CF)                               | SAC1AEH                                   | 107098873      | 363-005-383                                   |
| <i>SPQ444</i>    | 4W VF CU                                                  | SAC1BF0                                   | 107226730      | 363-005-385                                   |
| <i>SPQ452</i>    | Dual OCU Dataport w/SW56                                  | 5SCTFFG                                   | 107590150      | 363-005-341                                   |
| <i>SPQ454</i>    | 4W E&M CU                                                 | SAC1BG0                                   | 107226748      | 363-005-386                                   |

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### Selecting RT/HDT Bay Equipment

This section provides the following ordering information for *SLC-2000* bay configured as a RT/HDT bay:

- Equipment available with specific list numbers for shop-wired RT/HDT bays — plus other needed equipment **not** included in the list structure. Table 11-8 on page 11-20 provides an overview of the list structures that includes:
  - Application
  - Equipage (fully equipped or start up)
  - Type of access (front or rear)
  - Table number and page number.
- Unequipped RT/HDT frames and associated equipment
- Cabinets, enclosures and associated documentation
- Orderable RT/HDT bay cables
- Common plug-ins for the RT/HDT bay
- Channel units compatible with the RT/HDT bay.

Items that can **not** be order but are compatible with the RT/HDT bay are listed are listed in Table 11-23 on page 11-39.

**Table 11-8. Overview of RT/HDT Bay List Structures**

| RT/HDT Bay    | Application          | Equipage       | Access | Table Number and Page Number |
|---------------|----------------------|----------------|--------|------------------------------|
| J1C265A-1,L13 | Traditional FITL     | Fully Equipped | Front  | Table 11-9 on page 11-20     |
| J1C265A-1,L14 | Traditional Metallic | Fully Equipped | Front  | Table 11-10 on page 11-21    |
| J1C265A-1,L19 | Traditional Metallic | Start Up       | Front  | Table 11-11 on page 11-22    |
| J1C265A-1,L20 | Physical Co-located  | Fully Equipped | Front  | Table 11-12 on page 11-23    |
| J1C265A-1,L21 | Physical Co-located  | Start Up       | Front  | Table 11-13 on page 11-24    |
| J1C265E-1,L1  | Virtual Co-located   | Fully Equipped | Rear   | Table 11-14 on page 11-25    |
| J1C265E-1,L2  | Virtual Co-located   | Start Up       | Rear   | Table 11-15 on page 11-26    |

**Table 11-9. J1C265A-1, L13 Shop-Wired FITL RT Bay — Traditional Application**

| Description                                                          | Quantity | COMCODE   | COMMON LANGUAGE CLEI* Code | Produce Identifier |
|----------------------------------------------------------------------|----------|-----------|----------------------------|--------------------|
| <b>List 13 — J1C265A-1, L13; COMCODE 601817554; CLEI Code SABAEB</b> |          |           |                            |                    |
| Network Bay Frame                                                    | 1        | —         | —                          | ED-8C800-50,G5     |
| ARM Shelf                                                            | 1        | 601817596 | SAMA3R0                    | J1C265AA-1, L4     |
| MDS Assembly                                                         | 4        | 601817539 | SAMA4S0                    | J1C265AB-1, L3     |
| HDOS Shelf                                                           | 2        | 601465669 | LFMAEL0                    | J1C265AC-1,L4      |
| HDOS Power Cable                                                     | 1        | 601424039 | —                          | ED-7C723-34 G5     |
| HDOS Interconnect Cable                                              | 8        | 601448012 | —                          | ED-7C723-34 G6     |
| Power Interface Unit (PIU) assembly                                  | 1        | 601442700 | —                          | ED-7C734-30, G2    |
| TAP Cable                                                            | 1        | 601393267 | —                          | ED-7C723-34, G1    |
| 4G Fan Unit                                                          | 2        | 107378036 | —                          | 4G                 |
| ARM DS1 Cable Kit                                                    | 1        | 601824246 | —                          | ED-7C723-31,G2B    |
| External Test Head Interface Cable Kit                               | 1        | 601461619 | —                          | ED-7C723-31,G4     |

**See Table 11-16 on page 11-27 for additional required items that must be ordered separately**

**Notes:** RT bays require power and ringing supplies that are separate from the bay equipment. Table 11-17 (unequipped RT frames) lists equipment that may be used to provide power and ringing.

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**Table 11-10. J1C265A-1, L14 Shop-Wired Metallic RT Bay — Traditional Application — Fully Equipped Configuration**

| <b>Description</b>                                                    | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|-----------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 14 — J1C265A-1, L14; COMCODE 601817562; CLEI Code SABAECC</b> |                 |                |                                           |                           |
| Network Bay Frame                                                     | 1               | —              | —                                         | ED-8C800-50,G5            |
| ARM Shelf                                                             | 1               | 601817596      | SAMA3R0                                   | J1C265AA-1, L4            |
| MDS Assembly                                                          | 4               | 601817539      | SAMA4S0                                   | J1C265AB-1, L3            |
| Power Interface Unit (PIU) assembly                                   | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Cable                                                             | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| 4G Fan Unit                                                           | 2               | 107378036      | —                                         | 4G                        |
| ARM DS1 Cable Kit                                                     | 1               | 601824246      | —                                         | ED-7C723-31,G2B           |
| External Test Head Interface Cable Kit                                | 1               | 601461619      | —                                         | ED-7C723-31,G4            |

**See Table 11-16 on page 11-27 for additional required items that must be ordered separately**

**Notes:** RT bays require power and ringing supplies that are separate from the bay equipment.  
Table 11-17 (unequipped RT frames) lists equipment that may be used to provide power and ringing.

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**Table 11-11. J1C265A-1, L19 Shop-Wired Metallic RT Bay — Traditional Application — Start-up Configuration**

| <b>Description</b>                                                    | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|-----------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 19 — J1C265A-1, L19; COMCODE 601888977; CLEI Code SABAEP0</b> |                 |                |                                           |                           |
| Network Bay Frame                                                     | 1               | —              | —                                         | ED-8C800-50,G5            |
| ARM Shelf                                                             | 1               | 601817596      | SAMA3R0                                   | J1C265AA-1, L4            |
| MDS Assembly                                                          | 1               | 601817539      | SAMA4S0                                   | J1C265AB-1, L3            |
| Power Interface Unit (PIU) assembly                                   | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Cable                                                             | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| 4G Fan Unit                                                           | 2               | 107378036      | —                                         | 4G                        |
| ARM DS1 Cable Kit                                                     | 1               | 601824246      | —                                         | ED-7C723-31,G2B           |
| External Test Head Interface Cable Kit                                | 1               | 601461619      | —                                         | ED-7C723-31,G4            |

**See Table 11-16 on page 11-27 for additional required items that must be ordered separately**

**Notes:** RT bays require power and ringing supplies that are separate from the bay equipment.  
Table 11-17 (unequipped RT frames) lists equipment that may be used to provide power and ringing.

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**Table 11-12. J1C265A-1, L20 Shop-Wired Metallic RT Bay — Physical Collocation Application — Fully Equipped Configuration**

| <b>Description</b>                                                    | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|-----------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 20 — J1C265A-1, L20; COMCODE 601888985; CLEI Code SABAER0</b> |                 |                |                                           |                           |
| Network Bay Frame                                                     | 1               | —              | —                                         | ED-8C800-50,G5            |
| ARM Shelf                                                             | 1               | 601817596      | SAMA3R0                                   | J1C265AA-1, L4            |
| MDS Assembly                                                          | 4               | 601817539      | SAMA4S0                                   | J1C265AB-1, L3            |
| Power Interface Unit (PIU) assembly                                   | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Cable                                                             | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| RT Baffles                                                            | 3               | 601364136      | —                                         | ED-8C733-30 G1            |
| ARM DS1 Cable Kit                                                     | 1               | 601824246      | —                                         | ED-7C723-31,G2B           |
| External Test Head Interface Cable Kit                                | 1               | 601461619      | —                                         | ED-7C723-31,G4            |
| Dual Power Feed Unit (DPFU)                                           | 1               | 601869118      | —                                         | NJ00675A2-L1              |
| Local Alarm Relay Unit (LARU) <sup>†</sup>                            | 1               | 601869134      | —                                         | NE00676-70, G1            |

**See Table 11-16 on page 11-27 for additional required items that must be ordered separately**

**Notes:** RT bays require power and ringing supplies that are separate from the bay equipment. Table 11-17 (unequipped RT frames) lists equipment that may be used to provide power and ringing.

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† The LARU requires the use of a 404B UIP.

**Table 11-13. J1C265A-1, L21 Shop-Wired Metallic RT Bay — Physical Collocation Application — Start-up Configuration**

| <b>Description</b>                                                    | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON LANGUAGE CLEI* Code</b> | <b>Produce Identifier</b> |
|-----------------------------------------------------------------------|-----------------|----------------|-----------------------------------|---------------------------|
| <b>List 21 — J1C265A-1, L21; COMCODE 601888993; CLEI Code SABAE00</b> |                 |                |                                   |                           |
| Network Bay Frame                                                     | 1               | —              | —                                 | ED-8C800-50,G5            |
| ARM Shelf                                                             | 1               | 601817596      | SAMA3R0                           | J1C265AA-1, L4            |
| MDS Assembly                                                          | 1               | 601817539      | SAMA4S0                           | J1C265AB-1, L3            |
| Power Interface Unit (PIU) assembly                                   | 1               | 601442700      | —                                 | ED-7C734-30, G2           |
| TAP Cable                                                             | 1               | 601393267      | —                                 | ED-7C723-34, G1           |
| RT Baffles                                                            | 3               | 601364136      | —                                 | ED-8C733-30 G1            |
| ARM DS1 Cable Kit                                                     | 1               | 601824246      | —                                 | ED-7C723-31,G2B           |
| External Test Head Interface Cable Kit                                | 1               | 601461619      | —                                 | ED-7C723-31,G4            |
| Dual Power Feed Unit (DPFU)                                           | 1               | 601869118      | —                                 | NJ00675A2-L1              |
| Local Alarm Relay Unit (LARU) <sup>†</sup>                            | 1               | 601869134      | —                                 | NE00676-70, G1            |

**See Table 11-16 on page 11-27 for additional required items that must be ordered separately**

**Notes:** RT bays require power and ringing supplies that are separate from the bay equipment. Table 11-17 (unequipped RT frames) lists equipment that may be used to provide power and ringing.

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† The LARU requires the use of a 404B UIP.

**Table 11-14. J1C265E-1, L1 Shop-Wired Metallic RT Bay — Virtual Collocation Application — Fully Equipped Configuration**

| <b>Description</b>                                                                                 | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|----------------------------------------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 1 — J1C265E-1, L1; COMCODE 601888910; CLEI Code SABABM0</b>                                |                 |                |                                           |                           |
| Network Bay Frame                                                                                  | 1               | —              | —                                         | ED-8C500-50, G1           |
| ARM Shelf                                                                                          | 1               | 601817513      | SAMA5R0                                   | J1C265AD-1, L3            |
| MDS Assembly                                                                                       | 4               | 601817497      | SAMA7S0                                   | J1C265AE-1, L3            |
| Power Interface Unit (PIU) assembly                                                                | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Bay Cable                                                                                      | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| Baffles                                                                                            | 3               | 845448307      | —                                         | —                         |
| Dual Power Feed Unit (DPFU)                                                                        | 1               | 601869118      | —                                         | NJ00675A2-L1              |
| Local Alarm Relay Unit (LARU) <sup>†</sup>                                                         | 1               | 601869134      | —                                         | NE00676-70, G1            |
| ARM DS1 Cable Kit                                                                                  | 1               | 601824246      | —                                         | ED-7C723-31, G2B          |
| <b>See Table 11-16 on page 11-27 for additional required items that must be ordered separately</b> |                 |                |                                           |                           |

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† The LARU requires the use of a 404B UIP.

**Table 11-15. J1C265E-1, L2 Shop-Wired Metallic RT Bay — Virtual Collocation Application — Start-up Configuration**

| <b>Description</b>                                                                                 | <b>Quantity</b> | <b>COMCODE</b> | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Produce Identifier</b> |
|----------------------------------------------------------------------------------------------------|-----------------|----------------|-------------------------------------------|---------------------------|
| <b>List 2 — J1C265E-1, L2; COMCODE 601888928; CLEI Code SABABN0</b>                                |                 |                |                                           |                           |
| Network Bay Frame                                                                                  | 1               | —              | —                                         | ED-8C500-50, G1           |
| ARM Shelf                                                                                          | 1               | 601817513      | SAMA5R0                                   | J1C265AD-1, L3            |
| MDS Assembly                                                                                       | 1               | 601817497      | SAMA7S0                                   | J1C265AE-1, L3            |
| Power Interface Unit (PIU) assembly                                                                | 1               | 601442700      | —                                         | ED-7C734-30, G2           |
| TAP Bay Cable                                                                                      | 1               | 601393267      | —                                         | ED-7C723-34, G1           |
| Baffles                                                                                            | 3               | 845448307      | —                                         | —                         |
| Dual Power Feed Unit (DPFU)                                                                        | 1               | 601869118      | —                                         | NJ00675A2-L1              |
| Local Alarm Relay Unit (LARU) <sup>†</sup>                                                         | 1               | 601869134      | —                                         | NE00676-70, G1            |
| ARM DS1 Cable Kit                                                                                  | 1               | 601824246      | —                                         | ED-7C723-31, G2B          |
| <b>See Table 11-16 on page 11-27 for additional required items that must be ordered separately</b> |                 |                |                                           |                           |

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† The LARU requires the use of a 404B UIP.

**Table 11-16. Required Equipment That Must Be Ordered Separately**

| <b>Description</b>                                                    | <b>Produce Identifier</b>             | <b>Quantity</b> | <b>COMCODE</b> | <b>Front or Rear Access Frames</b> | <b>COMMON LANGUAGE CLEI* Code</b> |
|-----------------------------------------------------------------------|---------------------------------------|-----------------|----------------|------------------------------------|-----------------------------------|
| User Interface Panel (UIP)                                            | 404B <sup>†</sup>                     | 1               | 108165838      | Both                               | SAPQADK                           |
| VF Interface cables<br>(choose cables that apply to your application) | ED-7C723-35,G1 (30 ft.) <sup>‡</sup>  | 8/MDS           | 601396286      | Front                              | —                                 |
|                                                                       | ED-7C723-35,G2 (50 ft.) <sup>‡</sup>  | 8/MDS           | 601396294      | Front                              |                                   |
|                                                                       | ED-7C723-35,G3 (x ft.) <sup>‡</sup>   | 8/MDS           | 601396302      | Front                              |                                   |
|                                                                       | ED-7C723-37,G4 (75 ft.) <sup>§</sup>  | 1/MDS           | 601446396      | Rear                               |                                   |
|                                                                       | ED-7C723-37,G5 (150 ft.) <sup>§</sup> | 1/MDS           | 601446404      | Rear                               |                                   |
|                                                                       | ED-7C723-37,G6 (x ft.) <sup>§</sup>   | 1/MDS           | 601446412      | Rear                               |                                   |
|                                                                       | ED-7C723-37,G7 (75 ft.) <sup>¶</sup>  | 1/MDS           | 601446420      | Rear                               |                                   |
|                                                                       | ED-7C723-37,G8 (150 ft.) <sup>¶</sup> | 1/MDS           | 601446438      | Rear                               |                                   |
|                                                                       | ED-7C723-37,G9 (x ft.) <sup>¶</sup>   | 1/MDS           | 601446446      | Rear                               |                                   |
| External DC Test Pair                                                 | ED-7C723-35,G7                        | 1               | 601396344      | Both                               | —                                 |
| Minor/Major Power Alarm Cable                                         | ED-7C723-35,G8                        | 1               | 601397987      | Both                               | —                                 |

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† When using the LARU, you must order the 404B UIP.

‡ Connects to the VF dangles off the MDS shelves (P101 - P104; P201 - P204) or to the ARM miscellaneous discreet cable P171. ("x ft." indicates that the customer can specify the length.)

§ Connects to J101 - J104. ("x ft." indicates that the customer can specify the length.)

¶ Connects to J201 - J204 ("x ft." indicates that the customer can specify the length.).

**Table 11-17. SLC-2000 Access System Unequipped RT Frames and Associated Equipment**

| <b>Description</b>                       | <b>Equipment Code</b>                                                              | <b>COMCODE</b> | <b>CLEI Code</b> |
|------------------------------------------|------------------------------------------------------------------------------------|----------------|------------------|
| 7' unequipped framework                  | ED-8C800-50, G5                                                                    | N/A            | N/A              |
| Cable end-guard                          | ED-8C502-50, G1 e/w G4, G5, & G7                                                   |                |                  |
| Bulk ring shelf                          | J1C182BC-1, L3                                                                     | 601879166      | N/A              |
| Bulk power & ring shelf                  | J1C182BD-1, L2                                                                     | 601424740      | N/A              |
| Rectifiers                               | 336A1                                                                              | 105701726      | 5SCB723EXX       |
| Ring control unit                        | AUG3                                                                               | 104032750      | 5SCBM00GXX       |
| Battery int. unit                        | AUG4B                                                                              | 104032768      | 5SPQ10PAA        |
| Ring generator                           | 3H1                                                                                | 105727838      | 5SCB644DAB       |
| Fan unit                                 | 4G                                                                                 | 107378036      | N/A              |
| E&M cable kit                            | ED-7C723-31, G3                                                                    | 601461601      | N/A              |
| Fiber cable ARM OLIU to cross-connection | FS1E-A with <i>ST</i> <sup>®</sup> connector or<br>FS1E-E with <i>ST</i> connector |                |                  |

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**Table 11-18. SLC-2000 Access System RT Cabinets and Enclosures**

| <b>Order Wording</b> | <b>Group Numbers (See Notes)</b> | <b>Description</b>                | <b>COMCODE</b> | <b>Cabinet or Enclosure Powering</b> |
|----------------------|----------------------------------|-----------------------------------|----------------|--------------------------------------|
| ED-7C732-30          | G90                              | 80A-HX cabinet, <i>SLC</i> -2000  | N/A            | Bulk                                 |
| ED-7C733-30          | G90                              | 80D-HX cabinet, <i>SLC</i> -2000  | N/A            | Bulk                                 |
| ED-7C756-30          | G90                              | 80G-HX cabinet, <i>SLC</i> -2000  | N/A            | Bulk                                 |
| ED-7C699-30          | G1 through G3, G110              | 90A BRT cabinet, <i>SLC</i> -2000 | N/A            | Bulk                                 |
| ED-7C681-30          | G1 through G68                   | Concrete hut                      | N/A            | Bulk                                 |
| ED-7C682-30          | G1 through G68                   | 16-ft. CEV platform               | N/A            | Bulk                                 |
| ED-7C683-30          | G1 through G95                   | 24-ft. CEV platform               | N/A            | Bulk                                 |
| ED-7C684-30          | G1 through G68                   | Electronic equipment enclosure    | N/A            | Bulk                                 |

**Notes:**

1. The Group Numbers shown here are for cabinet or enclosure basic configuration. Refer to the listed ED drawings to identify combinations of Group Numbers for specific equipment configurations.
2. The 404( ) User Interface Panel (UIP, comcode 107044208: see Table 11-9 on page 11-20) is not included with the cabinets or enclosures and should be ordered separately for each *SLC*-2000 system.

Table 11-19 contains references to specific cabinet documents you can use to obtain cabinet ordering information. To order any of these documents, see “How to Order Documents” in the “About This Document” section in the front of this manual.

**Table 11-19. Cabinet Ordering References**

| <b>Cabinet Type</b> | <b>Lucent Technologies Document Number</b> |
|---------------------|--------------------------------------------|
| 80A-HX              | 631-600-282                                |
| 80D-HX              | 631-600-267                                |
| 80G-HX              | 631-600-266                                |
| 90A                 | 626-500-115                                |



**Table 11-20. SLC-2000 Access System Cabling Requirements for RT Frames**

| ED Number   | Group | Description                                                                                                                                                                                                                                                                            |
|-------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ED-7C734-30 | G2    | Required — per 7-foot bay power interface unit (PIU).<br>Not required for cabinets.<br>When the PIU is ordered, another cable (ED-7C723-34, G2) is attached to provide interbay powering/ringing distribution for 7-foot frames.<br>This cable does not need to be ordered separately. |
| ED-7C723-31 | G2B   | Required— per ARM shelf.<br>Provides front access dangles for the ARM shelf DS1 distribution or metallic feeder.                                                                                                                                                                       |
| ED-7C723-31 | G3    | Provides cable kit for E&M applications (two per metallic distribution shelf or four per MDS assembly).                                                                                                                                                                                |
|             | G4    | Required— per ARM shelf.<br>Provides ARM shelf connection to an external test head.                                                                                                                                                                                                    |
| ED-7C723-34 | G1    | Required— per 7-foot bay.<br>Interbay cable for test access paths (TAP), LED test function, and extension access to a DC bypass pair.                                                                                                                                                  |
|             | G3    | E&M cable assemblies (piece parts) for metallic distribution shelves. See also ED-7C723-31, G3.                                                                                                                                                                                        |
|             | G4    | Replaced by G6.                                                                                                                                                                                                                                                                        |
|             | G5    | One per bay. HDOS power cable.                                                                                                                                                                                                                                                         |
|             | G6    | Four per HDOS (or two per MDS assembly or one per metallic distribution shelf). FITL interface cabling from HDOS to MDS.                                                                                                                                                               |
|             | G7    | Replaced by G14.                                                                                                                                                                                                                                                                       |
|             | G8    | Replaced by G15.                                                                                                                                                                                                                                                                       |
|             | G9    | Required for 4TEL* RMU/ARM shelf interface.                                                                                                                                                                                                                                            |
|             | G10   | Required for 4TEL RMU/Aux power panel interface.                                                                                                                                                                                                                                       |
|             | G11   | Required for 4TEL RMU/LTF Aux power panel interface.                                                                                                                                                                                                                                   |
|             | G13   | Required for MDS shelf/VF pairs interface and 4TEL RMU.                                                                                                                                                                                                                                |
|             | G14   | Required for MDS test bus multiple, LTF, and 4TEL RMU.                                                                                                                                                                                                                                 |
|             | G15   | Required for LTF/Aux power panel interface.                                                                                                                                                                                                                                            |
|             | G16   | Required for LTF/Aux ringing interface.                                                                                                                                                                                                                                                |
|             | G17   | Required for LTF/ARM shelf multiple.                                                                                                                                                                                                                                                   |

\* Registered trademark of Teradyne, Inc.

*Continued on next page*

**Table 11-20. SLC-2000 Access System Cabling Requirements for RT Frames (Continued)**

| ED Number   | Group | Description                                                                                                                                                                                        |
|-------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ED-7C723-35 | G1    | Eight per MDS. Used for MDS VF interconnection.<br>One additional cable required for ARM miscellaneous discretes (one per ARM).<br>30-foot cable length.                                           |
|             | G2    | Eight per MDS. Used for MDS VF interconnection.<br>One additional cable required for ARM miscellaneous discretes (one per ARM).<br>50-foot cable length.                                           |
|             | G3    | Eight per MDS. Used for MDS VF interconnection.<br>One additional cable required for ARM miscellaneous discretes (one per ARM).<br>Customer specified cable length.                                |
|             | G4    | Four per ARM equipped for DS1 distribution.<br>Used for connection with ARM DS1 distribution dangles.<br>30-foot cable length.                                                                     |
|             | G5    | Four per ARM equipped for DS1 distribution.<br>Used for connection with ARM DS1 distribution dangles.<br>50-foot cable length.                                                                     |
|             | G6    | Four per ARM equipped for DS1 distribution.<br>Used for connection with ARM DS1 distribution dangles.<br>Customer specified cable length.                                                          |
|             | G7    | Replaced by Group 12.                                                                                                                                                                              |
|             | G8    | One per 7-foot bay.<br>Alarm cable used for major, minor, power minor, and ITH measurement ground.                                                                                                 |
|             | G9    | One per SLC-2000 System.<br>Used to supply ringing from J1C182BC-1 ring shelf to the SLC-2000 power interface unit.                                                                                |
|             | G10   | One per SLC-2000 system to a maximum of four per J1C182BC-1 Ring Shelf.<br>Used to interface between the J1C182BC-1 ring shelf power and alarm interface and the customer's -48V bulk power supply |
|             | G11   | One required per 4TEL remote measurement unit equipped in a 7-ft. RT frame. Cable provides DC test, communication, and signaling pairs plus frame GRD termination.                                 |
|             | G12   | Used to extend DC test and inhibit leads. <b>Replaces Group 7.</b> One per 7-ft. bay as required.                                                                                                  |

*Continued on next page*

**Table 11-20. SLC-2000 Access System Cabling Requirements for RT Frames (Continued)**

| ED Number                  | Group | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ED-7C723-35<br>(continued) | G17   | <p>(COMCODE 601831043) Required when connecting the MDS assembly to a DSX cross-connect if the SLC-2000 HDT is hosting any of the following:</p> <ul style="list-style-type: none"> <li>■ An MSDT through a metallic facility or an FSM (without using the cut-through-board)</li> <li>■ An MSDT through an HDOS (Software Release 4.5 or later)</li> <li>■ An NBS over a metallic facility or through an FSM</li> <li>■ An NBS over an OC-1 facility through a WBS.</li> </ul> <p>The maximum number of cables per MDS assembly is two (one for each MDS assembly shelf containing a DT or MSDT Server). Each cable is 4 ft. in length. One end of the cable connects to the MDS Assembly cable dangles. The other end connects to two cables — one for transmit pairs and one for receive pairs — of one of the following groups, depending on the length needed to reach the DSX cross-connect:</p> <ul style="list-style-type: none"> <li>■ <b>30 feet:</b> ED-7C723-35,G19 (COMCODE 601845472)</li> <li>■ <b>50 feet:</b> ED-7C723-35,G20 (COMCODE 601845480)</li> <li>■ <b>100 feet:</b> ED-7C723-35,G21 (COMCODE 601845498)</li> <li>■ <b>200 feet:</b> ED-7C723-35,G22 (COMCODE 601845506)</li> </ul> <p><b>You must use the G17 cable in conjunction with two cables from one of the above groups.</b></p> |
|                            | G18   | <p>(COMCODE 601840960) Required in a SLC-2000 HDT containing Software Release 4.5 or later when the HDT is hosting an MSDT ONU through an HDOS. One end of the cable connects to the cable dangles from the HDOS and the other end connects to the DSX cross-connect</p> <p> <b>CAUTION:</b><br/> <i>The combined length of all cables between the Server connection on the MDS assembly backplane and the connection on the HDOS backplane can <b>NOT</b> exceed 35 feet. This includes the cable dangles on both the MDS assembly and the HDOS; the ED-7C723-35, G17; the ED-7C723-35, G19; and the ED-7C723-35, G18 cables. If needed, cut the ED-7C723-35, G19 cable to meet the 35-foot restriction.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                            | G19   | (COMCODE 601845472) Length — 30 feet. You must order this cable in pairs. See ED-7C723-35, G17 for this cable's description and use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                            | G20   | (COMCODE 601845480) Length — 50 feet. You must order this cable in pairs. See ED-7C723-35, G17 for this cable's description and use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                            | G21   | (COMCODE 601845498) Length — 100 feet. You must order this cable in pairs. See ED-7C723-35, G17 for this cable's description and use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                            | G22   | (COMCODE 601845506) Length — 200 feet. You must order this cable in pairs. See ED-7C723-35, G17 for this cable's description and use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 11-21. SLC-2000 Access System RT Common Plug-In Units (Note)**

| <b>Equipment Code</b>                                       | <b>Description</b>                                           | <b>COMMON LANGUAGE CLEI* Code</b> | <b>COMCODE</b> |
|-------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------|----------------|
| <b>Access Resource Manager (ARM) Shelf (J1C265AA-1, L4)</b> |                                                              |                                   |                |
| 404B <sup>†</sup>                                           | User interface panel (UIP)                                   | SAPQADKBAA                        | 108165838      |
| BBF240                                                      | Provisioning display controller (PDC)                        | SAPQAAPBAB                        | 106626153      |
| BBF241                                                      | PDC for Release 4.0 and later                                | SAPQACNBAA                        | 107191157      |
| BBF261                                                      | System memory unit (SMU2)                                    | SAIUPD0BAA                        | 106972128      |
| BBG2                                                        | STS-1 multiplexer card (MXRVO)                               | SNCMAA2AAB                        | 106439409      |
| BBG5 <sup>‡</sup>                                           | System controller (SYSCTL)                                   | DMPQ00WAAB                        | 106633688      |
| BBG8B <sup>§</sup>                                          | System controller (SYSCTL)                                   | SNC5U79DAA                        | 107830549      |
| BBG7 <sup>‡</sup>                                           | Overhead channel controller (OHCTL)                          | DMPQ0AJAAB                        | 106633704      |
| BBG9 <sup>§</sup>                                           | Overhead channel controller (OHCTL)                          | SNC11VLAAA                        | 106008121      |
| BBG266                                                      | Virtual tributary unit (VTU)                                 | SAIUH0EBAC                        | 106626179      |
| BBG267 <sup>¶</sup>                                         | Metallic line interface unit (LIU)                           | SAIUNC0BAD                        | 106932825      |
| BBG268 <sup>¶</sup>                                         | Retainer card                                                | SAPQABTBAA                        | 106943814      |
| BDK <sup>®</sup> 250                                        | Time slot interchange (TSI)                                  | SAIUK50BAF                        | 106939085      |
| BDK270 <sup>**</sup>                                        | Bandwidth mgmt. processor (BMP)                              | SAIUR00BAA                        | 106939093      |
| 21D-U                                                       | Optical line interface unit (OLIU)                           | SNRXDJ0AAA                        | 107092637      |
| 21G                                                         | Optical line interface unit (OLIU)                           | SNTRABCAAD                        | 106064462      |
| 21G2-U                                                      | Optical line interface unit (OLIU)                           | SNRXDRMAAB                        | 107931628      |
| 22F-U                                                       | OLIU — Ring                                                  | SNI22Z0BAA                        | 107713836      |
| 22D-U                                                       | Optical line interface unit (OLIU)                           | SNCMVE0AAA                        | 106926595      |
| 22G3-U                                                      | Optical line interface unit (OLIU)                           | SNRXDZ0AAB                        | 108057944      |
| 24G-U <sup>††</sup>                                         | OLIU — OC-12                                                 | SNRXDW0AAA                        | 107735086      |
| 26G2-U <sup>‡‡</sup>                                        | OLIU — OC-1                                                  | SNC6JG0EAA                        | 107727745      |
| 27G2-U                                                      | OLIU — OC-1                                                  | SNC6JH0EAB                        | 107727752      |
| 177A                                                        | Retainer card                                                | SNPQWACAAB                        | 105774061      |
| BBF1B                                                       | Optional DS1 low-speed interface                             | SNCLA70AAB                        | 106543606      |
| BBF3                                                        | Optional DS1 low-speed interface with performance monitoring | SNPQAM4AAB                        | 106008071      |
| BBF2B                                                       | Synchronizer timing generator (TGS)                          | SNPQA16AAB                        | 106995046      |
| BBF4 <sup>‡‡</sup>                                          | Stratum 3 Timing Generator (TG3)                             | SNC6LK0EAA                        | 106008089      |
| BBF5 JMPR                                                   | Optional DS1 low-speed jumper card                           | SNPQBLAAAB                        | 107392334      |

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† 404B is required when using the local alarm relay unit (LARU).

‡ SONET Subsystem Software Release 7 and earlier.

§ SONET Subsystem Software Release 9 and later.

¶ Requires Release 3.2 or later software.

\*\* Requires Release 4.0 or later software.

†† Requires SONET Subsystem Software Release 11 or later.

‡‡ Requires SONET Subsystem Software Release R13 or R11.1 or later and the J1C265AA-1, L4 ARM shelf

*Continued on next page*

**Table 11-21. SLC-2000 Access System RT Common Plug-In Units (Note) (Continued)**

| <b>Equipment Code</b>                                    | <b>Description</b>                           | <b>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>COMCODE</b> |
|----------------------------------------------------------|----------------------------------------------|-------------------------------------------|----------------|
| <b>MDS Assembly (J1C265AB-1, L2)</b>                     |                                              |                                           |                |
| <i>BDJ</i> <sup>®</sup> 200                              | Power and test unit (PTU)                    | SAPQADBBAB                                | 107831208      |
| <i>BDJ</i> 205 <sup>†</sup>                              | TR-08 processing unit (T8U)                  | SAIUJ0GBAB                                | 107101057      |
| <i>BDJ</i> 240                                           | Metallic distribution controller (MDC)       | SARTB00AAC                                | 106626138      |
| <b>MSDT or DT Servers (FITL Applications)</b>            |                                              |                                           |                |
| <i>SPQ</i> <sup>®</sup> 808                              | MSDT or DT Server (optical or met. facility) | SAIUMBFBAB                                | 107063992      |
| <i>SPQ</i> 809 <sup>‡</sup>                              | MSDT or DT Server (w/remote inventory)       | 5SCF40JCAA                                | 107534984      |
| <i>SPQ</i> 810 <sup>§</sup>                              | MSDT or DT Server (w/remote inventory)       | LFIU80PBAA                                | 107838955      |
| <i>SPQ</i> 811 <sup>¶</sup>                              | MSDT or DT Server (w/remote inventory)       | LFI2V40EAA                                | 108049099      |
| <b>High Density Optics Shelf (HDOS) (J1C265AC-1, L4)</b> |                                              |                                           |                |
| AYB2                                                     | PCU (HDOS Interface)                         | LFOCEH0AAA                                | 104432984      |
| AYB3                                                     | FITL OU                                      | LFOCGP0AAA                                | 106358443      |
| AYB5                                                     | FITL OU (ER)                                 | 5SCFE0LCAA                                | 108042334      |
| <b>Integral Test Head (ITH)</b>                          |                                              |                                           |                |
| BBG220                                                   | Test head controller (THC)                   | SARTA03AAA                                | 107152761      |
| BBF220                                                   | Power converter unit (PCU)                   | SAPQAARBAA                                | 106588791      |
| BBF225B                                                  | Craft access unit (CAU)                      | SAPQACZBAA                                | 107617821      |

**Note:** Quantities of ARM shelf and ITH plug-ins required for each release are given in Table 11-1.

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† Required for TR-08 and FITL applications (not applicable to TR-303).

‡ Software Release 4.0 and later. To choose which Server is available for a specific software release and ONU type, see Chapter 8.

§ This Server is used with Software Release 4.4 or later when hosting the DDM-2000 FiberReach NBS. To choose which Server is available for a specific software release and ONU type, see Chapter 8.

¶ This Server is used with Software Release 4.4 or later when the VFDE feature is required. To choose which Server is available for a specific software release and ONU type, see Chapter 8.

**Table 11-22. SLC-2000 Access System RT Channel Unit Plug-Ins**

| <b>Equipment Code</b> | <b>Description</b>                        | <b>COMMON LANGUAGE CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent Technologies Data Sheet</b> |
|-----------------------|-------------------------------------------|-----------------------------------|----------------|---------------------------------------|
| AUA27                 | POTS CU (CF+OHT)                          | 5SC1DD1                           | 103840435      | 363-005-128                           |
| AUA39B                | <i>SPOTS</i> CU                           | 5SC1X0B                           | 106223217      | 363-005-120                           |
| AUA41B                | 4W VF Spec. Svc.                          | 5SC3HJE                           | 106988082      | 363-005-105                           |
| AUA42B                | 2W E <i>SPOTS</i> CU (CS)                 | 5SCU6E0                           | 106932189      | 363-005-106                           |
| AUA43B                | 2W E <i>SPOTS</i> CU (CF)                 | 5SCU6F0                           | 106932197      | 363-005-107                           |
| AUA44B <sup>†</sup>   | 4W VF Spec. Svc.                          | 5SC27C0                           | 107391732      | 363-005-108                           |
| AUA45B                | Dual ringing repeater                     | 5SCUUJ5                           | 105717987      | 363-005-123                           |
| AUA52B                | OCU dataport (TR-08/INA VRTs)             | 5SC1430                           | 106244163      | 363-005-111                           |
| AUA53B                | Coin (CF)                                 | 5SC3RS0                           | 107590101      | 363-005-112                           |
| AUA54B <sup>†</sup>   | 4W E & M CU                               | 5SC27D0                           | 107391740      | 363-005-113                           |
| AUA55                 | Multiparty (CF)                           | 5SCU570                           | 103840740      | 363-005-116                           |
| AUA56B                | DID 2W DPT                                | 5SCU9Y0                           | 107392300      | 363-005-115                           |
| AUA57                 | FSR (CF)                                  | 5SCUT04                           | 103840765      | 363-005-122                           |
| AUA75                 | 2W-PLAR                                   | 5SC1FF2                           | 103840963      | 363-005-132                           |
| AUA90                 | ISDN T-BRITE                              | 5SC1EE0                           | 104043823      | 363-005-129                           |
| AUA93                 | ISDN BRITE II, <i>ANSI</i> <sup>‡</sup> U | 5SC1HE0                           | 104043856      | 363-005-131                           |
| AUA94B                | ISDN <i>ANSI</i> /U BRITE                 | 5SC4RU0                           | 107966830      | 363-005-135                           |

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<sup>†</sup> Only in the ONU.

<sup>‡</sup> Registered trademark of American National Standards Institute, Inc.

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**Table 11-22. SLC-2000 Access System RT Channel Unit Plug-Ins (Continued)**

| <b>Equipment Code</b>  | <b>Description</b>                      | <b>COMMON LANGUAGE CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent Technologies Data Sheet</b> |
|------------------------|-----------------------------------------|-----------------------------------|----------------|---------------------------------------|
| AUA150C                | POTS/SPOTS CU<br>(CF + Ext. Rng. + ALC) | 5SC3PV0                           | 107627325      | 363-005-133                           |
| AUA159C                | ALC POTS/SPOTS CU                       | 5SC1WK9                           | 107184798      | 363-205-304                           |
| AUA178B                | ALC C-POTS                              | 5SC4CCC                           | 107744153      | 363-005-314                           |
| AUA200                 | Switched 56-kb/s dataport               | 5SCTB0D                           | 107392243      | 363-005-313                           |
| AUA232                 | RS-232 CU (DDS, TR-08/ INA VRTs)        | 5SCTCBO                           | 107050445      | 363-005-312                           |
| AUA252B                | OCU Dataport w/SW56                     | 5SCTFFF                           | 107727521      | 363-005-212                           |
| AUA293                 | ISDN BRITE III                          | 5SC4PT0                           | 107940538      | 363-005-347                           |
| MCU5205 <sup>†</sup>   | DC alarm CU <sup>‡</sup>                | 5SC26TV                           | —              | TLGD-5205 <sup>§</sup>                |
| MCU5405 <sup>†</sup>   | DC bypass CU <sup>‡</sup>               | 5SC26T0                           | —              | TLGD-5405 <sup>§</sup>                |
| PGM <sup>†</sup> -2000 | Program CU <sup>‡</sup>                 | SAC1CSN                           | —              | TLGD-2000 <sup>§</sup>                |
| SPQ <sup>®</sup> 300   | Quad POTS (Q POTS) CU<br>(CS+OHT+CLASS) | SAC1ACF                           | 107049660      | 363-005-380                           |
| SPQ300B                | Quad POTS (Q POTS) CU<br>(CS+OHT+CLASS) | SAC1AX0                           | 108058652      | 363-005-380                           |
| SPQ340                 | Quad POTS CU<br>(CS+OHT+CLASS+CLSS)     | SAC1ADL                           | 107437956      | 363-005-381                           |

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Cheswick, PA 15024  
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Fax 412-274-8014  
Specify CLEI code.

§ Available from Tollgrade Communications, Inc. 1-800-878-3399

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**Table 11-22. SLC-2000 Access System RT Channel Unit Plug-Ins (Continued)**

| <b>Equipment Code</b>        | <b>Description</b>                                                          | <b>COMMON LANGUAGE CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent Technologies Data Sheet</b> |
|------------------------------|-----------------------------------------------------------------------------|-----------------------------------|----------------|---------------------------------------|
| <i>SPQ</i> <sup>®</sup> 400B | Quad POTS CU (CF+OHT/CLASS)                                                 | SAC1AUA                           | 107719809      | 363-005-368                           |
| <i>XSPQ</i> 400 <sup>†</sup> | Quad POTS CU (CF+OHT/CLASS)                                                 | —                                 | 107989519      | 363-005-345                           |
| <i>SPQ</i> 401               | Quad POTS CU (CF+OHT/CLASS)                                                 | SAC1EWT                           | 108053703      | 363-005-344                           |
| <i>SPQ</i> 401B              | Quad POTS CU (CF+OHT/CLASS)<br>(VFDE R4.6 or later)                         | SAC1EWU                           | 108049107      | 363-005-344                           |
| <i>SPQ</i> 419               | Quad Coin (CF)                                                              | SAC1ARM                           | 107590143      | 363-005-340                           |
| <i>SPQ</i> 429               | Quad EBS P-Phone <sup>‡</sup>                                               | SAC1AK0                           | —              | 363-005-398                           |
| <i>SPQ</i> 440C <sup>§</sup> | Quad POTS/ <i>SPOTS</i> CU<br>(ALC, CF + Ext. Rng.)                         | SAC1AC0                           | 107500746      | 363-005-369                           |
| <i>SPQ</i> 440D              | Quad POTS/ <i>SPOTS</i> CU<br>(ALC, CF + Ext. Rng.)<br>(VFDE R4.6 or later) | SAC1ACX                           | 108123605      | 363-005-369                           |
| <i>SPQ</i> 442               | Quad E <i>SPOTS</i> CU (CS)                                                 | SAC1AH0                           | 107100562      | 363-005-382                           |
| <i>SPQ</i> 443               | Quad E <i>SPOTS</i> CU (CF)                                                 | SAC1AEH                           | 107098873      | 363-005-383                           |
| <i>SPQ</i> 444               | 4W VF CU                                                                    | SAC1BF0                           | 107226730      | 363-005-385                           |

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§ The *SPQ*440C CU will be replaced by the *SPQ*440D during the third quarter of 1998.

*Continued on next page*



**Table 11-22. SLC-2000 Access System RT Channel Unit Plug-Ins (Continued)**

| <b>Equipment Code</b> | <b>Description</b>                             | <b>COMMON LANGUAGE CLEI *Code</b> | <b>COMCODE</b> | <b>Lucent Technologies Data Sheet</b> |
|-----------------------|------------------------------------------------|-----------------------------------|----------------|---------------------------------------|
| <i>SPQ450</i>         | Quad <i>SPOTS</i> CU (CF+OHT+CLASS+ALIC5+CLSS) | SAC1AAD                           | 107001596      | 363-005-379                           |
| <i>SPQ452</i>         | Dual OCU Dataport w/SW56                       | 5SCTFFG                           | 107590150      | 363-005-341                           |
| <i>SPQ453</i>         | Dual Coin (CF)                                 | 5SC3EEC                           | 107500753      | 363-005-342                           |
| <i>SPQ454</i>         | 4W E&M CU                                      | SAC1BG0                           | 107226748      | 363-005-386                           |
| <i>SPQ456</i>         | Quad DID 2W DPT                                | SACPDC0                           | 107580417      | 363-005-343                           |
| <i>SPQ478</i>         | Quad ALC C-POTS CF                             | SAC1AAK                           | 107295016      | —                                     |
| <i>SPQ494</i>         | Quad ISDN <i>ANSI</i> U                        | 5SC2120                           | 107354458      | 363-005-388                           |
| <i>SPQ909</i>         | Low-power POTS CU                              | SAC1A00                           | 107188179      | 363-005-295                           |
| <i>SPQ909B</i>        | Low-power POTS CU                              | SAC1DTS                           | 107999336      | 363-005-295                           |

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### **Using Channel Units No Longer Manufactured (Rated DA)**

Table 11-23 lists the channel units that are no longer manufactured but are still compatible with the *SLC-2000* system.

**Table 11-23. Plug-Ins Compatible with the SLC-2000 Access System That Are Rated DA**

| <b>Channel Unit Code</b> | <b>Channel Unit Description</b>   | <b>Original<br/>COMMON<br/>LANGUAGE<br/>CLEI* Code</b> | <b>Original<br/>COMCODE</b> | <b>Lucent<br/>Technologies Data<br/>Sheet</b> | <b>Replacement<br/>Code</b> |
|--------------------------|-----------------------------------|--------------------------------------------------------|-----------------------------|-----------------------------------------------|-----------------------------|
| AUA25                    | M <i>SPOTS</i> ® CU               | 5SCURP7                                                | 103840419                   | 363-005-124                                   | AUA159C                     |
| AUA25B                   | M <i>SPOTS</i> ® CU (CF)          | 5SCURP8                                                | 105710289                   | 363-005-124                                   | AUA159C                     |
| AUA26                    | POTS CU (CS+OHT)                  | 5SC1CC1                                                | 103840427                   | 363-005-127                                   | —                           |
| AUA31                    | POTS CU (CS)                      | 5SCU110                                                | 103840484                   | 363-005-101                                   | AUA38C                      |
| AUA32                    | <i>SPOTS</i> CU                   | 5SCU820                                                | 103840492                   | 363-005-102                                   | AUA39B                      |
| AUA33                    | Coin                              | 5SCU231                                                | 103840500                   | 363-005-103                                   | AUA33B                      |
| AUA34                    | DS0 dataport                      | 5SCU380                                                | 103840518                   | 363-005-104                                   | AUA34B                      |
| AUA36                    | DID 2W                            | 5SCU9F0                                                | 103840534                   | 363-005-114                                   | AUA36B                      |
| AUA37                    | FSR                               | 5SCUS04                                                | 103840542                   | 363-005-121                                   | AUA37B                      |
| AUA38                    | POTS CU                           | 5SCU1G0                                                | 103840559                   | 363-005-118                                   | AUA38C                      |
| AUA38B                   | POTS CU<br>(CS+OHT+CLASS)         | 5SC1Y20                                                | 106222664                   | 363-005-118                                   | AUA38C                      |
| AUA39                    | <i>SPOTS</i> CU<br>(CS+OHT+CLASS) | 5SCU8M0                                                | 103840567                   | 363-005-120                                   | AUA39B                      |
| AUA41                    | 4W VF SS                          | 5SCU7D1                                                | 106064876                   | 363-005-105                                   | AUA41B                      |
| AUA42                    | 2-W SS E <i>SPOTS</i><br>CU       | 5SCU690                                                | 103840609                   | 363-005-106                                   | AUA42B                      |
| AUA43                    | 2-W SS E <i>SPOTS</i><br>CU       | 5SCU6A0                                                | 103840617                   | 363-005-107                                   | AUA43B                      |
| AUA44†                   | 4W VF Spec. Svc.                  | 5SCU7C6                                                | 105678171                   | 363-005-108                                   | AUA44B                      |
| AUA45                    | Dual ringing repeater             | 5SCUU05                                                | 103840633                   | 363-005-123                                   | AUA45B                      |
| AUA51                    | POTS/ <i>SPOTS</i> CU             | 5SCU150                                                | 103840708                   | 363-005-110                                   | AUA150                      |
| AUA52                    | OCU dataport (TR-08/INA VRTs)     | 5SCU480                                                | 103840716                   | 363-005-111                                   | AUA52B                      |
| AUA53                    | Coin (CF)                         | 5SCU261                                                | 106210396                   | 363-005-112                                   | AUA53B                      |
| AUA54†                   | 4W E & M CU                       | 5SCU7B0                                                | 103840732                   | 363-005-113                                   | AUA54B                      |
| AUA55B                   | Multiparty (CF)                   | 5SCU578                                                | 105722573                   | 363-005-116                                   | AUA55                       |

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**Table 11-23. Plug-Ins Compatible with the SLC-2000 Access System That Are Rated DA (Continued)**

| Channel Unit Code           | Channel Unit Description                                   | Original<br><i>COMMON<br/>LANGUAGE<br/>CLEI</i> <sup>*</sup> Code | Original<br>COMCODE | Lucent<br>Technologies<br>Data Sheet | Replacement<br>Code |
|-----------------------------|------------------------------------------------------------|-------------------------------------------------------------------|---------------------|--------------------------------------|---------------------|
| AUA56                       | DID 2W                                                     | 5SCU9E0                                                           | 103840757           | 363-005-115                          | AUA56B              |
| AUA58                       | POTS                                                       | 5SCU1H0                                                           | 103840773           | 363-005-117                          | AUA158C             |
| AUA58B                      | POTS                                                       | 5SCU1H8                                                           | 105710297           | 363-005-117                          | AUA158C             |
| AUA58C                      | POTS CF                                                    | 5SC1P00                                                           | 106933583           | 363-005-117                          | AUA178              |
| AUA59                       | POTS/ <i>SPOTS</i> CU                                      | 5SCU1L0                                                           | 103840781           | 363-005-119                          | AUA150              |
| AUA92                       | ISDN BRITE II (TR-08)                                      | 5SC1JE0                                                           | 104043849           | 363-005-131                          | AUA293              |
| AUA94                       | ISDN <i>ANSI</i> /U BRITE                                  | 5SC18E0                                                           | 104043864           | 363-005-135                          | AUA94B              |
| AUA141 <sup>†</sup>         | 4W VF (CF)                                                 | 5SCU7DZ                                                           | 106018401           | 363-005-300                          | AUA41B              |
| AUA142 <sup>†</sup>         | 2W E <i>SPOTS</i> SS (CS)                                  | 5SCU69Z                                                           | 106018419           | 363-005-301                          | AUA42B              |
| AUA150                      | POTS/ <i>SPOTS</i> CU<br>(CF+OHT+CLASS)                    | 5SCU1LV                                                           | 106018500           | 363-005-133                          | AUA150C             |
| AUA151                      | POTS/ <i>SPOTS</i> CU (w/o<br>OSIP+OHT+CLASS)              | 5SC1XXO                                                           | 106018518           | 363-005-134                          | AUA150C             |
| AUA152 <sup>†</sup>         | OCU dataport (TR-08/INA<br>VRTs)                           | 5SCU48Z                                                           | 106018526           | 363-005-302                          | AUA52B              |
| AUA158                      | ALC POTS CU                                                | 5SC1WW8                                                           | 106018583           | 363-205-303                          | AUA158C             |
| AUA158B                     | ALC POTS CU                                                | 5SC1WW0                                                           | 106903388           | 363-205-303                          | AUA158C             |
| AUA158C                     | ALC POTS CU                                                | 5SC1WK0                                                           | 107184780           | 363-205-303                          | AUA158D             |
| AUA159                      | ALC POTS/ <i>SPOTS</i> CU                                  | 5SC1WW9                                                           | 106018591           | 363-205-304                          | AUA159C             |
| AUA159B                     | ALC POTS/ <i>SPOTS</i> CU                                  | 5SC1W09                                                           | 106903396           | 363-205-304                          | AUA159C             |
| AUA178                      | ALC C-POTS                                                 | 5SC1WX0                                                           | 107184806           | 363-005-314                          | AUA178B             |
| AUA179                      | ALIC POTS/ <i>SPOTS</i> CU                                 | 5SCIHW9                                                           | 106856776           | 363-205-311                          | —                   |
| AUA252                      | OCU Dataport w/SW56                                        | 5SCTFFE                                                           | 107534307           | 363-005-212                          | AUA252B             |
| <i>SPQ</i> <sup>®</sup> 400 | Quad POTS CU (CF+OHT/<br>CLASS)                            | SAC1AAA                                                           | 106731821           | 363-005-368                          | <i>SPQ</i> 400B     |
| <i>SPQ</i> 440              | Quad POTS/ <i>SPOTS</i> CU<br>(CF+OHT+CLASS+CLSS)          | SAC1AAE                                                           | 106842594           | 363-005-384                          | <i>SPQ</i> 440D     |
| <i>SPQ</i> 440B             | Quad POTS/ <i>SPOTS</i> CU<br>(ALC, CF+OHT+CLASS+<br>CLSS) | SAC1AAG                                                           | 107119695           | 363-005-369                          | <i>SPQ</i> 440D     |

\* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

† Only for GTE applications.

## Equipping an Existing Bay with a Dual Power Feed Unit (DPFU)

The dual power feed unit (DPFU) enhances the reliability of the *SLC-2000* system. It monitors both primary feeders for a possible failure. As Figure 11-1 shows, if one primary source fails, the other primary source can supply the required power to perform all system functions with no interruption in call processing. If either of the incoming power sources fail, the DPFU can alert operating personnel through either of the following methods:

- Local faceplate alarm LED
- Two alarm contact closures for remote alarm access.



### NOTE:

For systems *not* equipped with the DPFU, the *SLC-2000* system allows partial operation with the failure of one of the two primary feeders. The failure of a primary feeder can cause the loss of up to 384 DS0 lines (or more under certain conditions).

If a DPFU fails or a redundant DPFU is required, the DPFU installation kit includes a “Y” cable (NE-00675-31, G2) that allows an in-service installation of an additional DPFU.

Figure 11-2 shows the possible area to mount the DPFU.

For detailed installation procedures, see 363-208-501, *SLC-2000 Access System, Modification Implementation Procedure*, NJ00675A-2 *Dual Power Feed Unit*, 363-208-010 *SLC-2000 Customer Assembly Manual RT Frames*, or 363-208-011 *SLC-2000 Customer Assembly Manual COT Frames*.

Table 11-24 lists the DPFU and its associated equipment obtained when ordered with Comcode 601869118.

**Table 11-24. Dual Power Feed Unit (DPFU) Ordering Information — Comcode 601869118**

| Quantity | Description                                                                       |
|----------|-----------------------------------------------------------------------------------|
| 1        | DPFU (NJ-00675A2,L1)                                                              |
| 1        | Cable Assembly (on DPFU) (NE-00675-31, G1)                                        |
| 1        | Cable Assembly (PIU to DPFU) (NE-00675-31, G2)                                    |
| 1        | Cable Assembly — Green (DPFU to GRD) (NE-00675-31, G3)                            |
| 4        | Mounting Screws                                                                   |
| 4        | 6 Gauge Crimp Terminals                                                           |
| 1        | 363-208-501, <i>SLC-2000 Access System, Modification Implementation Procedure</i> |

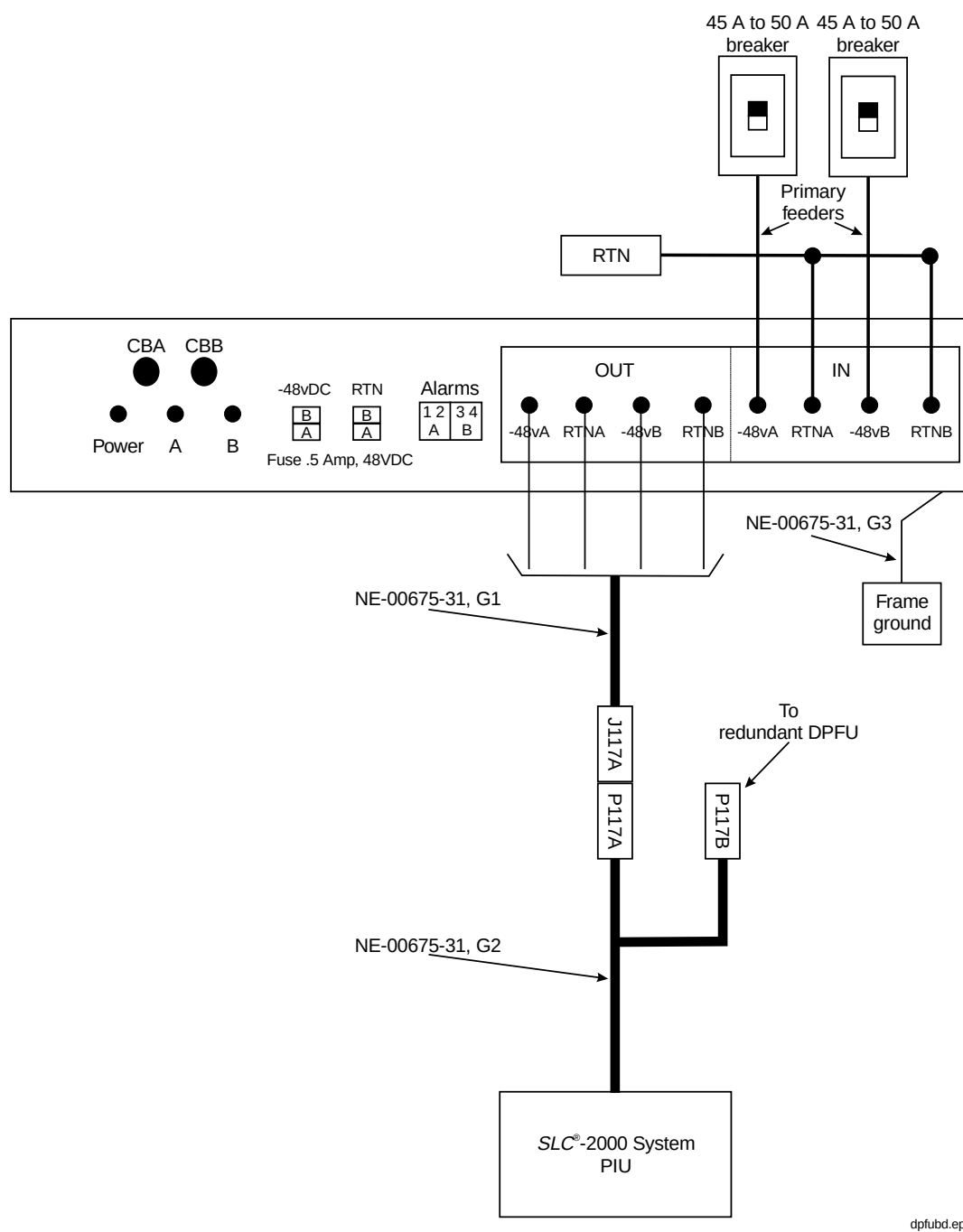
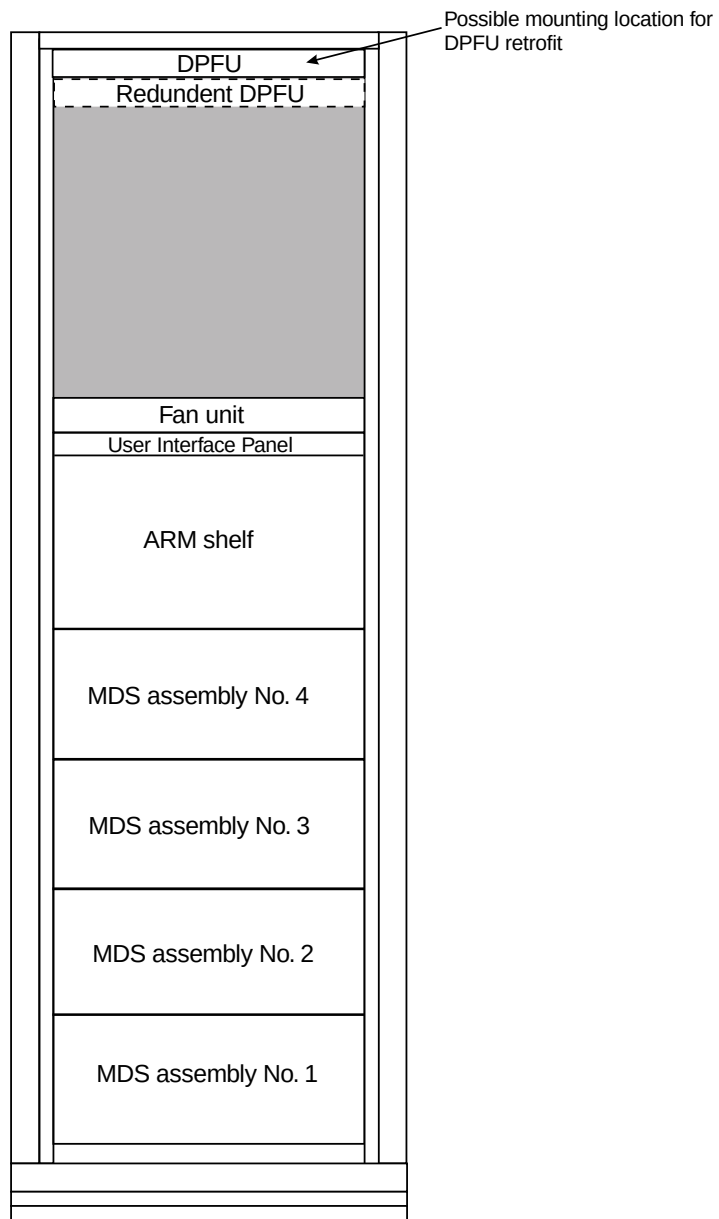


**Figure 11-1. Dual Power Feed Unit (DPFU)**



dpfuloc.eps

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**Figure 11-2. Possible DPFU Mounting Location in Existing Bays**

## Equipping an Existing Bay with a Local Alarm Relay Unit (LARU)

The local alarm relay unit (LARU) interfaces between the *SLC-2000* RT and the customer's alarm system. As shown in Figure 11-3, when the UIP detects a *SLC-2000* RT system alarm, the LARU provides a path — using contact closures — to the customer's alarm system.

**NOTE:**

For the LARU to provide this service, your system must contain a 404B UIP.

The LARU has two primary applications:

- Permits interfacing of *SLC-2000* system alarms with a local alarm system such as the type found in a central office
- Permits interfacing of *SLC-2000* system alarms with transmission equipment collocated with the *SLC-2000* system.

In both cases, the relay closures generated by the LARU supplement the alarms that would appear at the LDS.

Figure 11-4 shows the possible areas to mount the LARU depending on the *SLC-2000* terminal type and configuration.

Table 11-25 contains the equipment associated with the LARU kit — COMCODE 601869134.

For detailed installation procedures including cable identifications and connections, see 363-208-010 *SLC-2000 Customer Assembly Manual RT Frames* or 363-208-011 *SLC-2000 Customer Assembly Manual COT Frames*.

**Table 11-25. Local Alarm Relay Unit (LARU) Kit — Comcode 601869134**

| Quantity | Description                                    |
|----------|------------------------------------------------|
| 1        | LARU (NE00676-70, G1)                          |
| 1        | Mounting Plate (with 3 screws and lockwashers) |
| 2        | Cable Assembly                                 |

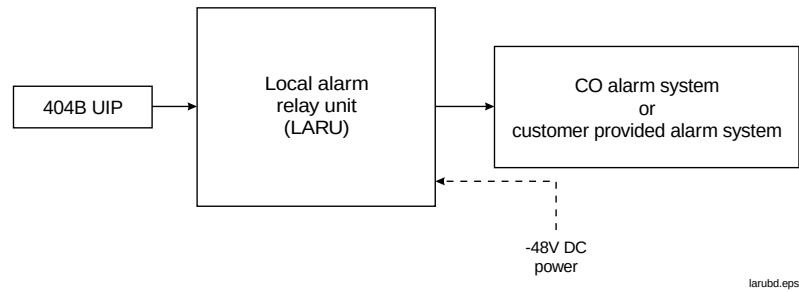


**Figure 11-3. Local Alarm Relay Unit (LARU)**

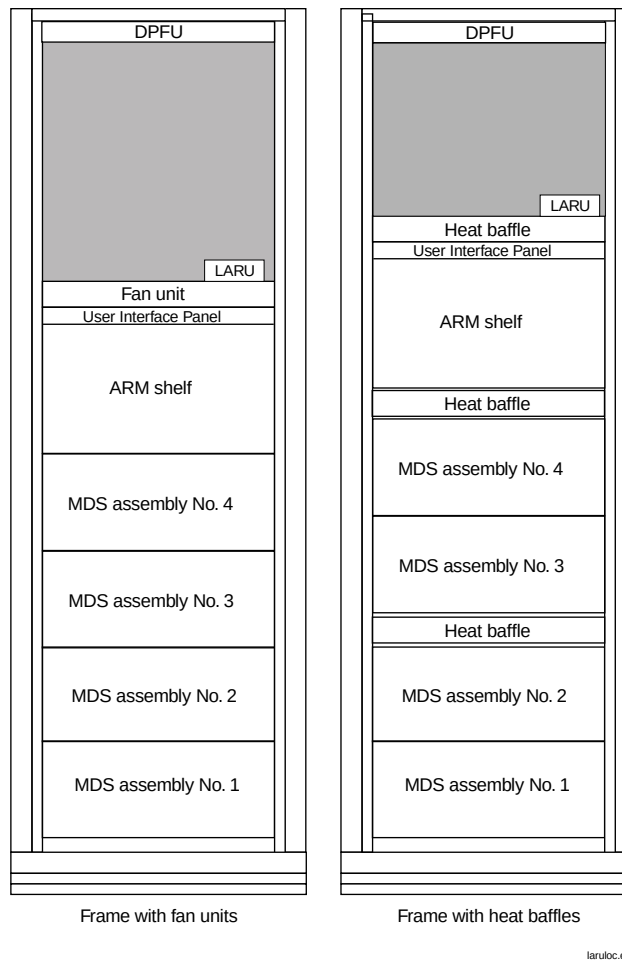


**Figure 11-4. Possible LARU Mounting Locations in Existing Bays — Front View**



## DDM-2000 Software Ordering

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This section includes ordering information for DDM-2000 software that must be loaded on the SYSCTL in the *SLC-2000* synchronous optical network (SONET) subsystem. Refer to 363-202-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*, for more detailed information on ordering DDM-2000 software.

For compatibility with *SLC-2000* Access System software releases, refer to Table 11-1.

The following DDM-2000 software releases are included in this section:

- Release 6.2 OC-3 Software (ED-8C724-37)
- Release 7.0 and 7.1 OC-3 Software (ED-8C724-38)
- Release 8.0 OC-3 Software (ED-8C724-39)
- Release 8.0 OC-3 Software (ED-8C724-39)
- Release 9.0 OC-3 Software (ED-8C724-40)
- Release 9.1 OC-3 Software (ED-8C724-40)
- Release 11.0 OC-3 Software (ED-8C724-41)
- Release 11.1 OC-3 Software (ED-8C724-41)
- Release 13.0 OC-3 Software (ED-8C724-42)

The SYSCTL circuit pack (BBG5) is shipped without software loaded on it. The software comes separately and usually is loaded during installation. Spare diskettes for each release may be ordered for backup or the first download.



**NOTE:**

All network elements (NEs) in a ring or linear network, which may be part of a larger network, must be running the same (or compatible) software. For example, in a Release 7 OC-3 ring, you cannot have some nodes running DDM-2000 R7.0 while others are running DDM-2000 R7.1. Also, each *SLC-2000* release is compatible only with specific DDM-2000 releases. For example, to interface a Release 7.1 OC-3 ring, the *SLC-2000* Access System must be running Release 3.2. In a maintenance subnetwork, which may be a mixture of ring and linear networks, all NEs must be running compatible software. Chapter 8 defines compatibility between *SLC-2000* releases and DDM-2000 releases.

In Table 11-26, optional feature package software should be ordered for each *SLC-2000* Access System SONET subsystem that uses the feature.

**Table 11-26. DDM-2000 OC-3 Software Order Form**

| <b>Quantity</b>                           | <b>Equipment Code</b>     | <b>Product Release</b> | <b>Description</b>                             |
|-------------------------------------------|---------------------------|------------------------|------------------------------------------------|
| <b>OC-3 Linear* applications</b>          |                           |                        |                                                |
|                                           | ED-8C724-37, G1, M3R, P3R | R6.2                   | New system software                            |
|                                           | ED-8C724-37, G1, M3A      | R6.2                   | Release 6.2 spare software                     |
|                                           | ED-8C724-37, G1, M3S, P3S | R6.2                   | Release 6.2 upgrade from 6.0 and 6.1           |
|                                           | ED-8C724-37, G1, M3X, P3X | R6.2                   | Release 6.2 upgrade from 3.1 and 3.2           |
|                                           | ED-8C724-37, GF1R         | R6.2                   | VT Performance Monitoring Option <sup>†</sup>  |
|                                           | ED-8C724-37, GF2R         | R6.2                   | DS1 Performance Monitoring Option <sup>†</sup> |
|                                           | ED-8C724-37, GF3R         | R6.2                   | OC-3c Option <sup>†</sup>                      |
| <b>OC-3 Ring<sup>‡</sup> applications</b> |                           |                        |                                                |
|                                           | ED-8C724-38, G1, M1R, P1R | R7.0                   | New system software                            |
|                                           | ED-8C724-38, G1, M1A      | R7.0                   | Release 7.0 spare software                     |
|                                           | ED-8C724-38, G1, M1S, P1S | R7.0                   | Release 7.0 upgrade from R5.1                  |
|                                           | ED-8C724-38, G1, M1X, P1X | R7.0                   | Release 7.0 upgrade from R6.0, 6.1, & 6.2      |
|                                           | ED-8C724-38, G1, M1Y, P1Y | R7.0                   | Release 7.0 upgrade from R3.1, & R3.2          |
|                                           | ED-8C724-38, GF1R         | R7.0                   | VT Performance Monitoring Option <sup>†</sup>  |
|                                           | ED-8C724-38, GF2R         | R7.0                   | DS1 Performance Monitoring Option <sup>†</sup> |
|                                           | ED-8C724-38, G1, M2R, P2R | R7.1                   | New system software                            |
|                                           | ED-8C724-38, G1, M2A      | R7.1                   | Release 7.1 spare software                     |
|                                           | ED-8C724-38, G1, M2S, P2S | R7.1                   | Release 7.1 upgrade from R5.1                  |
|                                           | ED-8C724-38, G1, M2X, P2X | R7.1                   | Release 7.1 upgrade from R6.0, 6.1, & 6.2      |

\* Release 6.2.2 is compatible with SLC<sup>®</sup>-2000 Releases 3.1, 3.2, and 4.0.

† Feature package option. Order in addition to the software release.

‡ OC-3 ring Release 7.0.2 is compatible with SLC-2000 Release 3.1. OC-3 ring Release 7.1.2 is compatible with SLC-2000 Releases 3.2 and 4.0

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                     |
|-----------------|-------------------------------------------|------------------------|----------------------------------------|
|                 | ED-8C724-38, G1, M2Y, P2Y                 | R7.1                   | Release 7.1 upgrade from R3.1 & R3.2   |
|                 | ED-8C724-38, G1, M2Z, P2Z                 | R7.1                   | Release 7.1 upgrade from R7.0          |
|                 | ED-8C724-38, GF1R                         | R7.1                   | VT Performance Monitoring Option *     |
|                 | ED-8C724-38, GF2R                         | R7.1                   | DS1 Performance Monitoring Option *    |
|                 | ED-8C724-38, G1, M3R, P3R<br>(SNX5BA0AAA) | R7.2                   | New system software                    |
|                 | ED-8C724-38, G1, M3A<br>(SNX5DAAAAA)      | R7.2                   | Release 7.2 backup software            |
|                 | ED-8C724-38, G1, M3S, P3S<br>(SNX9AAAAAA) | R7.2                   | Release 7.2 upgrade from R7.0 and R7.1 |
|                 | ED-8C724-38, G1, M3X, P3X<br>(SNX9AABAAA) | R7.2                   | Release 7.2 upgrade from R5.1          |
|                 | ED-8C724-38, G1, M3Y, P3Y<br>(SNX9AACAAA) | R7.2                   | Release 7.2 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-38, G1, M3Z, P3Z<br>(SNX9AADAAA) | R7.2                   | Release 7.2 upgrade from R3.1 and R3.2 |
|                 | ED-8C724-38, GF1R                         | R7.2                   | VT Performance Monitoring Option *     |
|                 | ED-8C724-38, GF2R                         | R7.2                   | DS1 Performance Monitoring Option *    |

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                     |
|-----------------|-------------------------------------------|------------------------|----------------------------------------|
|                 | ED-8C724-39, G1, M1R, P1R<br>(SNX5AA0AAA) | R8.0                   | New system software                    |
|                 | ED-8C724-39, G1, M1A<br>(SNX5AAAAAA)      | R8.0                   | Release 8.0 backup software            |
|                 | ED-8C724-39, G1, M1S, P1S<br>(SNX9AAFAAA) | R8.0                   | Release 8.0 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-39, G1, M1X, P1X<br>(SNX9AAGAAA) | R8.0                   | Release 8.0 upgrade from R3.1, R3.2    |
|                 | ED-8C724-39, GF1R                         | R8.0                   | VT Performance Monitoring Option*      |
|                 | ED-8C724-39, GF2R                         | R8.0                   | DS1 Performance Monitoring Option*     |
|                 | ED-8C724-39, GF3R                         | R8.0                   | OC-3c Option*                          |

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                     |
|-----------------|-------------------------------------------|------------------------|----------------------------------------|
|                 | ED-8C724-39, G1, M2R, P2R<br>(SNX6BB0AAA) | R8.1                   | New system software                    |
|                 | ED-8C724-39, G1, M2A<br>(SNX6BB0AAE)      | R8.1                   | Release 8.1 backup software            |
|                 | ED-8C724-39, G1, M2S, P2S<br>(SNX6BB0AAB) | R8.1                   | Release 8.1 upgrade from R8.0          |
|                 | ED-8C724-39, G1, M2X, P2X<br>(SNX6BB0AAC) | R8.1                   | Release 8.1 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-39, G1, M1Y, P1Y<br>(SNX6BB0AAD) | R8.1                   | Release 8.1 upgrade from R3.1, R3.2    |
|                 | ED-8C724-39, GF1R                         | R8.1                   | VT Performance Monitoring Option *     |
|                 | ED-8C724-39, GF2R                         | R8.1                   | DS1 Performance Monitoring Option *    |
|                 | ED-8C724-39, GF3R                         | R8.1                   | OC-3c Option*                          |

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                     |
|-----------------|-------------------------------------------|------------------------|----------------------------------------|
|                 | ED-8C724-40, G1, M1R, P1R<br>(SNX5CB0AAA) | R9.0                   | New system software                    |
|                 | ED-8C724-40, G1, M1A<br>(SNX5CAAAAA)      | R9.0                   | Release 9.0 backup software            |
|                 | ED-8C724-40, G1, M1B, P1B<br>(SNX9AAKAAA) | R9.0                   | Release 9.0 upgrade from 7.2           |
|                 | ED-8C724-40, G1, M1S, P1S<br>(SNX9AAJAAA) | R9.0                   | Release 9.0 upgrade from R7.0 and R7.1 |
|                 | ED-8C724-40, G1, M1W, P1W<br>(SNX9AALAAA) | R9.0                   | Release 9.0 upgrade from R5.1          |
|                 | ED-8C724-40, G1, M1X, P1X<br>(SNX9AAMAAA) | R9.0                   | Release 9.0 upgrade from R8.0          |
|                 | ED-8C724-40, G1, M1Y, P1Y<br>(SNX9AANAAA) | R9.0                   | Release 9.0 upgrade from R6.1 and R6.2 |
|                 | ED-8C724-40, G1, M1Z, P1Z<br>(SNX9AAPAAA) | R9.0                   | Release 9.0 upgrade from R3.1 and R3.2 |
|                 | ED-8C724-40, G1, GF1R                     | R9.0                   | VT Performance Monitoring Option *     |
|                 | ED-8C724-40, G1, GF2R                     | R9.0                   | DS1 Performance Monitoring Option *    |

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                     |
|-----------------|-------------------------------------------|------------------------|----------------------------------------|
|                 | ED-8C724-40, G1, M2R, P2R<br>(SNX6BC0AAA) | R9.1                   | New system software                    |
|                 | ED-8C724-40, G1, M2A<br>(SNX6BC0AAJ)      | R9.1                   | Release 9.1 backup software            |
|                 | ED-8C724-40, G1, M2S, P2S<br>(SNX6BC0AAB) | R9.1                   | Release 9.1 upgrade from R9.0          |
|                 | ED-8C724-40, G1, M2C, P2C<br>(SNX6BC0AAG) | R9.1                   | Release 9.1 upgrade from 7.2           |
|                 | ED-8C724-40, G1, M2W, P2W<br>(SNX6BC0AAC) | R9.1                   | Release 9.1 upgrade from R7.0 and R7.1 |
|                 | ED-8C724-40, G1, M2X, P2X<br>(SNX6BC0AAD) | R9.1                   | Release 9.1 upgrade from R5.1          |
|                 | ED-8C724-40, G1, M2Y, P2Y<br>(SNX6BC0AAE) | R9.1                   | Release 9.1 upgrade from R8.0, 8.1     |
|                 | ED-8C724-40, G1, M2Z, P2Z<br>(SNX6BC0AAF) | R9.1                   | Release 9.1 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-40, G1, M2B, P2B<br>(SNX6BC0AAH) | R9.1                   | Release 9.1 upgrade from R3.1 and R3.2 |
|                 | ED-8C724-40, G1, GF1R                     | R9.1                   | VT Performance Monitoring Option*      |
|                 | ED-8C724-40, G1, GF2R                     | R9.1                   | DS1 Performance Monitoring Option*     |

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code</b>                     | <b>Product Release</b> | <b>Description</b>                      |
|-----------------|-------------------------------------------|------------------------|-----------------------------------------|
|                 | ED-8C724-41, G1, M1R, P1R<br>(SNX6BD0AAA) | R11.0                  | New system software                     |
|                 | ED-8C724-41, G1, M1A<br>(SNX6BD0AAL)      | R11.0                  | Release 11.0 backup software            |
|                 | ED-8C724-41, G1, M1S, P1S<br>(SNX6BD0AAB) | R11.0                  | Release 11.0 upgrade from R9.1          |
|                 | ED-8C724-41, G1, M1W, P1W<br>(SNX6BD0AAC) | R11.0                  | Release 11.0 upgrade from R9.0          |
|                 | ED-8C724-41, G1, M1X, P1X<br>(SNX6BD0AAD) | R11.0                  | Release 11.0 upgrade from R7.2          |
|                 | ED-8C724-41, G1, M1Y, P1Y<br>(SNX6BD0AAE) | R11.0                  | Release 11.0 upgrade from R7.0 and R7.1 |
|                 | ED-8C724-41, G1, M1Z, P1Z<br>(SNX6BD0AAF) | R11.0                  | Release 11.0 upgrade from R5.1          |
|                 | ED-8C724-41, G1, M1B, P1B<br>(SNX6BD0AAG) | R11.0                  | Release 11.0 upgrade from R8.1          |
|                 | ED-8C724-41, G1, M1C, P1C<br>(SNX6BD0AAH) | R11.0                  | Release 11.0 upgrade from R8.0          |
|                 | ED-8C724-41, G1, M1D, P1D<br>(SNX6BD0AAJ) | R11.0                  | Release 11.0 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-41, G1, M1E, P1E<br>(SNX6BD0AAK) | R11.0                  | Release 11.0 upgrade from R3.1 and R3.2 |
|                 | ED-8C724-41, G1, GF1R                     | R11.0                  | VT Performance Monitoring Option *      |
|                 | ED-8C724-41, G1, GF2R                     | R11.0                  | DS1 Performance Monitoring Option *     |

\* Feature package option. Order in addition to the software release.

*Continued on next page*



**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| <b>Quantity</b> | <b>Equipment Code (Note)</b>              | <b>Product Release</b> | <b>Description</b>                      |
|-----------------|-------------------------------------------|------------------------|-----------------------------------------|
|                 | ED-8C724-41, G1, M2R, P2R<br>(SNX6B10AAA) | R11.1                  | New system software                     |
|                 | ED-8C724-41, G1, M2A<br>(SNX6B10AAM)      | R11.1                  | Release 11.1 backup software            |
|                 | ED-8C724-41, G1, M2S, P2S<br>(SNX6B10AAB) | R11.1                  | Release 11.1 upgrade from R11.0         |
|                 | ED-8C724-41, G1, M2V, P2V<br>(SNX6B10AAC) | R11.1                  | Release 11.1 upgrade from R9.1          |
|                 | ED-8C724-41, G1, M2W, P2W<br>(SNX6B10AAD) | R11.1                  | Release 11.1 upgrade from R9.0          |
|                 | ED-8C724-41, G1, M2X, P2X<br>(SNX6B10AAE) | R11.1                  | Release 11.1 upgrade from R7.2          |
|                 | ED-8C724-41, G1, M2Y, P2Y<br>(SNX6B10AAF) | R11.1                  | Release 11.1 upgrade from R7.0 and R7.1 |
|                 | ED-8C724-41, G1, M2Z, P2Z<br>(SNX6B10AAG) | R11.1                  | Release 11.1 upgrade from R5.1          |
|                 | ED-8C724-41, G1, M2B, P2B<br>(SNX6B10AAH) | R11.1                  | Release 11.1 upgrade from R8.1          |
|                 | ED-8C724-41, G1, M2C, P2C<br>(SNX6B10AAJ) | R11.1                  | Release 11.1 upgrade from R8.0          |
|                 | ED-8C724-41, G1, M2D, P2D<br>(SNX6B10AAK) | R11.1                  | Release 11.1 upgrade from R6.0 and R6.2 |
|                 | ED-8C724-41, G1, M2E, P2E<br>(SNX6B10AAL) | R11.1                  | Release 11.1 upgrade from R3.1 and R3.2 |
|                 | ED-8C724-41, G1, F1R                      | R11.1                  | VT Performance Monitoring Option*       |
|                 | ED-8C724-41, G1, F2R                      | R11.1                  | DS1 Performance Monitoring Option*      |

**Note:** Requires BBG8/BBG9 controller pair.

\* Feature package option. Order in addition to the software release.

*Continued on next page*

**Table 11-26. DDM-2000 OC-3 Software Order Form (Continued)**

| Quantity | Equipment Code (Note)                     | Product Release | Description                             |
|----------|-------------------------------------------|-----------------|-----------------------------------------|
|          | ED-8C724-42, G1, M1R, P1R<br>(SNX6BX0AAA) | R13.0           | New system software                     |
|          | ED-8C724-42, G1, M1A<br>(SNX6BX0AAN)      | R13.0           | Release 13.0 backup software            |
|          | ED-8C724-42, G1, M1S, P1S<br>(SNX6BX0AAB) | R13.0           | Release 13.0 upgrade from R11.0         |
|          | ED-8C724-42, G1, M1U, P1U<br>(SNX6BX0AAC) | R13.0           | Release 13.0 upgrade from R11.1         |
|          | ED-8C724-42, G1, M1V, P1V<br>(SNX6BX0AAD) | R13.0           | Release 13.0 upgrade from R9.1          |
|          | ED-8C724-42, G1, M1W, P1W<br>(SNX6BX0AAE) | R13.0           | Release 13.0 upgrade from R9.0          |
|          | ED-8C724-42, G1, M1X, P1X<br>(SNX6BX0AAF) | R13.0           | Release 13.0 upgrade from R7.2          |
|          | ED-8C724-42, G1, M1Y, P1Y<br>(SNX6BX0AAG) | R13.0           | Release 13.0 upgrade from R7.0 and R7.1 |
|          | ED-8C724-42, G1, M1Z, P1Z<br>(SNX6BX0AAH) | R13.0           | Release 13.0 upgrade from R5.1          |
|          | ED-8C724-42, G1, M1B, P1B<br>(SNX6BX0AAJ) | R13.0           | Release 13.0 upgrade from R8.1          |
|          | ED-8C724-42, G1, M1C, P1C<br>(SNX6BX0AAK) | R13.0           | Release 13.0 upgrade from R8.0          |
|          | ED-8C724-42, G1, M1D, P1D<br>(SNX6BX0AAL) | R13.0           | Release 13.0 upgrade from R6.0 and R6.2 |
|          | ED-8C724-42, G1, M1E, P1E<br>(SNX6BX0AAM) | R13.0           | Release 13.0 upgrade from R3.1 and R3.2 |
|          | ED-8C724-42, G1, F1R                      | R13.0           | VT Performance Monitoring Option*       |
|          | ED-8C724-42, G1, F2R                      | R13.0           | DS1 Performance Monitoring Option*      |

**Note:** Requires BBG8/BBG9 controller pair.

\* Feature package option. Order in addition to the software release.

## Miscellaneous Equipment and Tools

Although the SLC-2000 Access System is designed with built-in self-test capabilities for installation and normal maintenance routines and troubleshooting, additional equipment and tools may be useful to installers and maintenance personnel to provide more sophisticated performance monitoring and testing. Table 11-27 lists these items with recommended quantities.

**Table 11-27. Miscellaneous Equipment and Tools**

| Description                                                                                  | Code                             | Recommended Minimum Quantities | Notes (Beginning page 58) |
|----------------------------------------------------------------------------------------------|----------------------------------|--------------------------------|---------------------------|
| Notebook computer CIT<br>(standard ASCII terminal or PC<br>with terminal emulation software) | COMCODE 106841695                | 1                              | 1                         |
| 25-pin male RS-232<br>connector/cable to connect<br>CIT (100 ft.)                            | COMCODE 105706048                | 1                              |                           |
| Lightguide jumper                                                                            | FS1E-E-02<br>(COMCODE 105357727) | 2                              | 2, 3                      |
| Strap, wrist >6-inch circular                                                                | COMCODE 901011320                |                                | 4, 5                      |
| Strap, wrist <6-inch circular                                                                | COMCODE 900557075                |                                | 4, 5                      |
| Terminal, ESD grounding                                                                      | COMCODE 845264118                |                                | 5                         |
| Fuse, 10-amp WP90247, L115                                                                   | COMCODE 406203190                | 2/UIP                          | 2                         |
| Fuse, 5-amp WP90247, L113                                                                    | COMCODE 406203976                | 4/MDS                          | 6                         |
| Fuse, 2-amp WP90247, L109                                                                    | COMCODE 406421032                | 1/UIP                          | 6                         |
| Fuse, 0.5-amp WP90247, L103                                                                  | COMCODE 406203182                | 1/UIP, 2/MDS                   | 6                         |

*Continued on next page*

**Table 11-27. Miscellaneous Equipment and Tools (Continued)**

| <b>Description</b>                                      | <b>Code</b>           | <b>Recommended<br/>Minimum<br/>Quantities</b> | <b>Notes<br/>(Beginning<br/>page 58)</b> |
|---------------------------------------------------------|-----------------------|-----------------------------------------------|------------------------------------------|
| SAN-O AX1 fuse extraction tool                          | F-0431 WP-90247, L201 |                                               |                                          |
| RTG16L2H15A CU test cord                                | COMCODE 405755208     | 1                                             |                                          |
| Dummy bantam plugs for UIP                              | PJ750B                | 5                                             | 7                                        |
| Multimeter and probe to test power points ( $\pm 48$ V) | COMCODE 402131866     | 1                                             |                                          |
| HDOS splicing shelf                                     | COMCODE 405772591     | 1                                             |                                          |
| Allen wrench hex key (opens cabinets)                   | COMCODE 846244168     | 1                                             |                                          |
| 216C tool (for cabinets)                                | COMCODE 102450574     | 1                                             |                                          |
| 2-pin to RJ-45 Adapter Cable                            | —                     | 1                                             |                                          |
| Channel Access Test Adapter                             | CiTP-5                | 1                                             |                                          |
| RJ-11 to RJ-45 Adapter Cable                            | —                     | 1                                             |                                          |

**Table 11-27. Miscellaneous Equipment and Tools (Continued)**

| Description                                                                                                                                                                                                                                                                                                                                                                                                        | Code | Recommended<br>Minimum<br>Quantities | Notes |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------|-------|
| <b>Notes:</b>                                                                                                                                                                                                                                                                                                                                                                                                      |      |                                      |       |
| 1. A craft interface terminal (CIT) is recommended for maintenance and administrative activities on Releases 3.1 and later.                                                                                                                                                                                                                                                                                        |      |                                      |       |
| The <i>SLC</i> <sup>®</sup> -2000 Access System CIT port (on the user interface panel) is a standard EIA-232-D (supersedes RS-232C specification) interface configured as a data circuit-terminating equipment (DCE) for direct connection to a CIT. The CIT port supports rates of 300, 1200, 2400, 4800, 9600, and 19200 baud and should be compatible with most <i>ANSI</i> * 3.64 ASCII terminals.             |      |                                      |       |
| However, it is optimized for standard CIT screens with display areas of 24 lines by 72 (or more) columns. A <i>pager</i> function is included in the <i>SLC</i> -2000 Access System to accommodate screen lengths from 3 lines to 150 lines. CITs that are compatible with DDM-2000 (see 363-206-200 for a list of DDM-2000 compatible terminals) are directly compatible with the <i>SLC</i> -2000 Access System. |      |                                      |       |
| Any terminal compatible with the <i>ANSI</i> 3.64 standard should be compatible with the <i>SLC</i> -2000 Access System. The following terminals are examples:                                                                                                                                                                                                                                                     |      |                                      |       |
| ■ AT&T 610 terminal                                                                                                                                                                                                                                                                                                                                                                                                |      |                                      |       |
| ■ AT&T 615 terminal                                                                                                                                                                                                                                                                                                                                                                                                |      |                                      |       |
| ■ AT&T 630 terminal                                                                                                                                                                                                                                                                                                                                                                                                |      |                                      |       |
| ■ AT&T 5425 terminal                                                                                                                                                                                                                                                                                                                                                                                               |      |                                      |       |
| ■ ADM 5A terminal                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                      |       |
| ■ <i>HP</i> † 2621 terminal                                                                                                                                                                                                                                                                                                                                                                                        |      |                                      |       |
| ■ <i>HP</i> 2623 terminal                                                                                                                                                                                                                                                                                                                                                                                          |      |                                      |       |
| ■ <i>DEC</i> ‡ VT-100 terminal                                                                                                                                                                                                                                                                                                                                                                                     |      |                                      |       |
| Any <i>MS-DOS</i> § PC may be used to emulate a CIT through the CTRM terminal emulator software package provided with the system software. The <i>SLC</i> -2000 Access System SMU circuit pack uses flash EEPROM memory devices that are upgradable through direct download from an <i>MS-DOS</i> PC. Upgrades are made available through the distribution of floppy disks compatible with the recommended PCs.    |      |                                      |       |

**Table 11-27. Miscellaneous Equipment and Tools (Continued)**

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Code | Recommended<br>Minimum<br>Quantities | Notes |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------|-------|
| <p>The selected PC should have a minimum of 512K of random access memory (RAM) and <i>MS-DOS</i> Version 3.0, or newer. In addition, at least one disk drive of 720 kB or larger capacity is required. Although the disk drive may be a floppy drive or hard disk, a hard disk provides better performance. Most portable <i>MS-DOS</i> PCs with a single 3.5-inch disk drive (720 kB or larger capacity) satisfy the disk drive requirement. An <i>MS-DOS</i> PC with a hard disk and a 3.5-inch 720 kB or 5.25-inch 360 kB (or larger) floppy disk drive also may be used. The following PCs are examples:</p> |      |                                      |       |
| <ul style="list-style-type: none"> <li>■ AT&amp;T 6286 WGS computer</li> <li>■ AT&amp;T 6312 WGS computer</li> <li>■ AT&amp;T 6386 WGS computer</li> <li>■ AT&amp;T 6300 computer</li> <li>■ <i>Toshiba</i>† T1000 computer</li> <li>■ <i>IBM</i>** XT†† computer</li> <li>■ <i>HP</i> 110 computer</li> </ul>                                                                                                                                                                                                                                                                                                   |      |                                      |       |
| <p>2. Equipment noted is not required for normal maintenance routines but may be helpful for installation and troubleshooting testing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                                      |       |
| <p>3. Lightguide jumper is a 2-foot cable with <i>ST</i> lightguide cable connectors that can be used for a manual optical loopback at the OLIU circuit pack interface.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                                      |       |
| <p>4. It is recommended that one wrist strap be provided for each <i>SLC-2000</i> Access System bay arrangement to protect against circuit pack damage resulting from electrostatic discharge.</p>                                                                                                                                                                                                                                                                                                                                                                                                               |      |                                      |       |
| <p>5. Each <i>SLC-2000</i> Access System ARM shelf assembly comes equipped with an ESD jack on the user interface panel for an ESD wrist strap (see <i>Note 4</i>). ESD grounding terminals also may be mounted miscellaneously in unused #12-24 tapped holes in typical bay framework.</p>                                                                                                                                                                                                                                                                                                                      |      |                                      |       |
| <p>6. The <i>SLC-2000</i> Access System shelf inputs (power, ringing, and UIP/CIT) are protected by fuses that ship with the system. It is recommended that a supply of spare fuses be provided at <i>SLC-2000</i> Access System locations. Fuses may be ordered from the following:</p>                                                                                                                                                                                                                                                                                                                         |      |                                      |       |
| <p>SAN-O Industrial Corporation<br/>           91-3 Colin Drive<br/>           Holbrook, NY 11741<br/>           Telephone No. 516-472-6666<br/>           Fax No. 516-472-6777</p>                                                                                                                                                                                                                                                                                                                                                                                                                              |      |                                      |       |
| <p>7. These plugs are inserted in the T/R - CHAN and DROP and E/M - CHAN jacks on the UIP to release the test access pair for remote testing. The dummy plugs may be ordered from the following:</p>                                                                                                                                                                                                                                                                                                                                                                                                             |      |                                      |       |
| <p>ADC Telecommunications, Inc.<br/>           4900 W. 78th St.<br/>           Minneapolis, MN 55435<br/>           Telephone No. 612-938-8080</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |                                      |       |

**Table 11-27. Miscellaneous Equipment and Tools (Continued)**

| Description                                                                                                                                                                                                                                                                                                                                                   | Code | Recommended<br>Minimum<br>Quantities | Notes |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------|-------|
| 8. This cable is inserted in the <b>AUX T/R</b> faceplate connector of an <i>SPQ</i> <sup>®</sup> 494 Quad ISDN <i>ANSI</i> U channel unit. It provides access to the RJ-45 U-Interface similar to the AUA94 Dual ISDN <i>ANSI</i> U channel unit faceplate RJ-45 access.                                                                                     |      |                                      |       |
| 9. This adapter is for test access to faceplates of channel units other than ISDN and dataports. It is manufactured by CI Network Products. Telephone number: 708-806-6300. This cable is to be inserted in the RJ-11 faceplate jack on an <i>SPQ</i> 452 Dual OCU Dataport. It provides access at the RJ-45 similar to the AUA52B OCU Dataport channel unit. |      |                                      |       |
| 10. This cable is to be inserted in the RJ-11 faceplate jack on an <i>SPQ</i> 452 Dual OCU Dataport. It provides access at the RJ-45 similar to the AUA52B OCU Dataport channel unit.                                                                                                                                                                         |      |                                      |       |

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\* Registered trademark of American National Standards Institute, Inc.

† Registered trademark of Hewlett-Packard Company.

‡ Trademark of Digital Equipment Corporation.

§ Registered trademark of Microsoft Corporation.

¶ Registered trademark of Toshiba Corporation.

\*\* Registered trademark of International Business Machines Corporation.

†† Trademark of International Business Machines Corporation.

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## **Applications Configurator Software**

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Lucent Technologies provides application configurator software to aid in ordering commonly used *SLC-2000* system configurations. Account team members can obtain the software from the CIO organization of Lucent Technologies.

The application codes for the two *SLC-2000* applications are:

- ***Central Office Terminal:*** TE
- ***Remote Terminal:*** TH

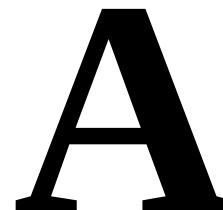
The Applications Configurator helps you with selecting various features and determining the secondary material and services for ordering a complete *SLC-2000* system for your application.

By asking a series of questions, the software determines the orderable items and attributes that make up the specific application. It then translates this information into the proper format for quoting and ordering.



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# Digital Loop Carrier Background



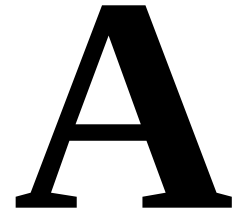
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# Digital Loop Carrier Background



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## Introduction

This appendix introduces the digital loop carrier systems that preceded the *SLC*<sup>®</sup>-2000 Access System by explaining the evolution of the subscriber loop.

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## Evolution of the Subscriber Loop

---

### Traditional Metallic Loop

Local telephone service is provided to customers by "Exchanges" (central offices). Historically, when a customer served by one Exchange calls someone served by another Exchange, one cable pair is required to complete the two-way call. The cable pair, called a trunk facility, ties the two Exchanges together. The number of trunk facilities between Exchanges depends on the calling volume between them. As calling volume increases, so does the number of trunk facilities.

Figure A-1 shows a traditional metallic loop without the benefits of digital conversion. The customer's voice-frequency or analog signal leaves the Exchange and travels over a loaded cable pair to the customer or subscriber at the far end.

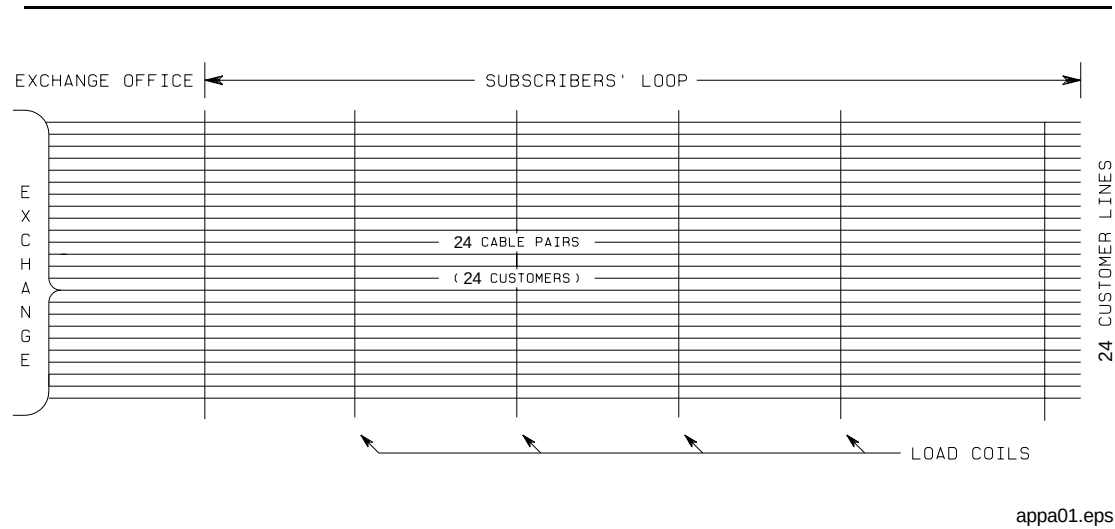


**Figure A-1. Traditional Metallic Loop**



**NOTE:**

An analog signal is a continuous electrical signal that varies in voltage with the variations in the pitch of the human voice. All analog signals are continuous in time and all values are permitted within the defined voltage limits.

Four disadvantages of transmitting an analog signal are as follows:

- Loss — The analog signal weakens as it travels over distance.
- Noise — Unwanted electrical interference impairs the quality of the signal.
- Distortion — Distortion changes the analog signal waveform.
- Cost — The cost of the copper wire for the amount needed is a factor.

An amplifier is used to restore the signal to its original amplitude, to compensate for loss. However, noise is amplified as well. Noise can be minimized, but not eliminated in an analog system. Noise generally controls the maximum design length of an analog transmission system.

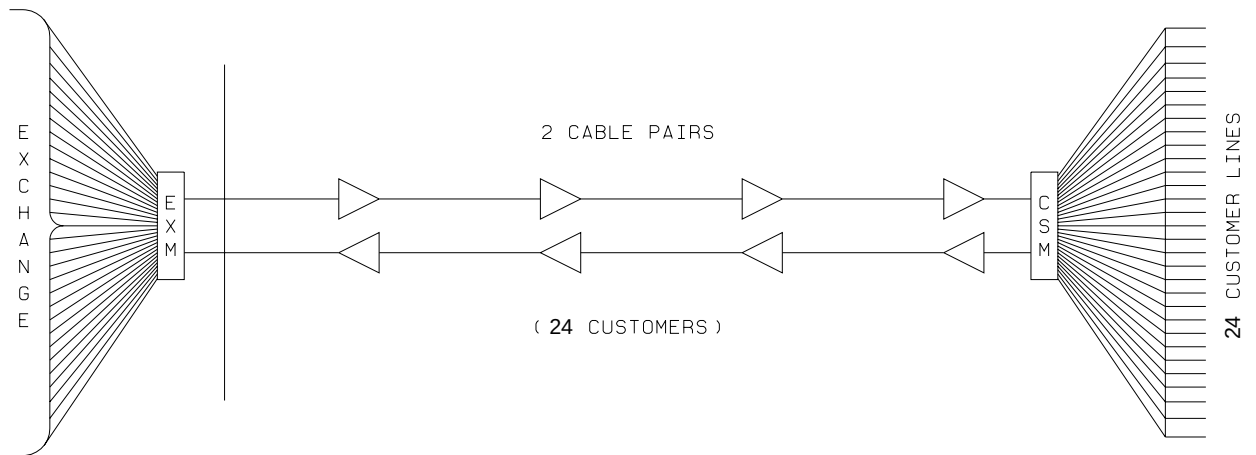
## Subscriber Loop Using a DLC

---

In the late 1950s and early 1960s there was an urgent need to use the metropolitan exchange cable pairs in a more efficient manner. Analog carrier was being used, but the amount of electronics was becoming excessive.

The answer was digital transmission, and the resulting system was called the T1 carrier. In 1962, the first digital carrier system was introduced as an alternative to metallic interoffice trunks. On this system, 24 voice signals were amplitude sampled (a digital representation of a voice-frequency signal), digitally encoded (converted from an analog signal to a digital signal), and time shared (placed on a digital line in a discrete order). Each direction of transmission was on a single pair of copper wires. This resulted in a 12:1 improvement in efficiency in the use of copper pairs as compared with the 2-wire metallic trunks. The terminal used with this new mode of transmission was a channel bank designated D1 (digital, first generation). Since 1962, digital transmission has spawned new technologies and industries, and has become the standard in today's telecommunications field.

Figure A-2 shows the addition of a digital loop carrier (DLC) at central office and RT. The obvious benefit here is that, instead of 24 cable pairs going from the exchange to the customers' locations, there are only two cable pairs resulting in a 12:1 improvement.



appa02.eps

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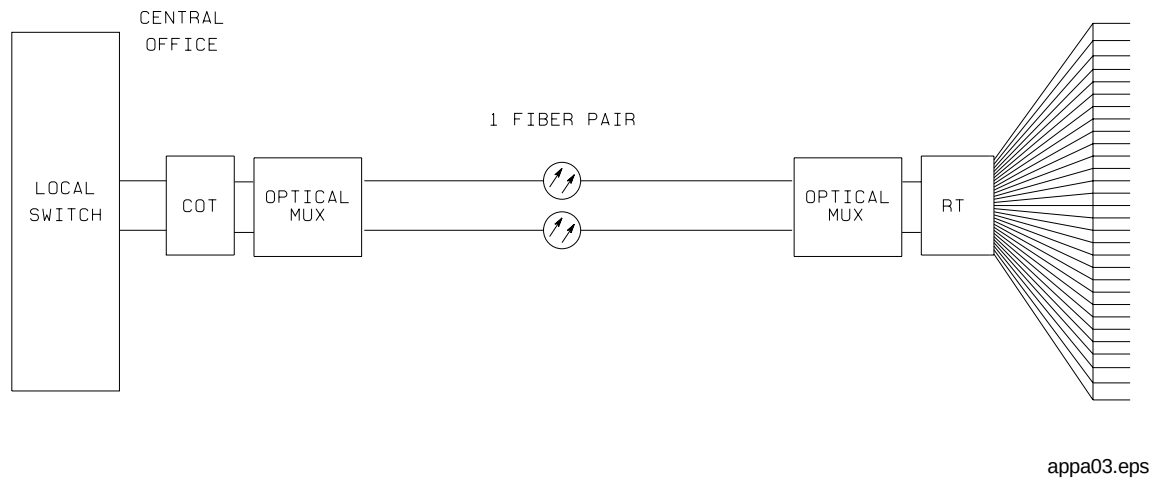
**Figure A-2. Subscriber Loop Using a DLC**

## Subscriber Loop Over Fiber

---

Figure A-3 shows a loop using a DLC at the exchange end and at the customer's end, with an optical multiplexer added at each end, and customer signals routed over single-mode fiber. This allows even more customers to be multiplexed on to each route. Using an optical multiplexer has many benefits. In addition to serving a greater number of customers, the benefits are as follows:

- Upgradable — Optical fiber can carry a much higher bit rate than copper. Also, the system is easier to maintain because there is no need for regenerators.
- Flexible — Fiber systems are easy to upgrade, expand, or reconfigure.
- Supervisable — Multiple sites can be controlled from a single location.



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**Figure A-3. Subscriber Loop Over Fiber**

### **Features and Benefits of DLC Systems**

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|                               |                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ease of Maintenance           | <ul style="list-style-type: none"> <li>• Single-ended maintenance procedures</li> <li>• Remote alarms</li> <li>• Comprehensive maintenance.</li> </ul>                                                                                                                                                                                                                                                    |
| Environmentally robust        | <ul style="list-style-type: none"> <li>• Wide operating temperature and humidity range</li> <li>• Can be housed in a variety of enclosures.</li> </ul>                                                                                                                                                                                                                                                    |
| Backup batteries at RT        | <ul style="list-style-type: none"> <li>• Protection against AC main failures.</li> </ul>                                                                                                                                                                                                                                                                                                                  |
| Flexible                      | <ul style="list-style-type: none"> <li>• Easy to maintain and provision</li> <li>• Quick effective modernization</li> <li>• Responsive to uncertain service demands (once installed, if service demand decreases, it can be moved easily)</li> <li>• Compatible with metallic, fiber, and a variety of exchanges</li> <li>• Modular growable system</li> <li>• Provides a variety of services.</li> </ul> |
| Economical                    | <ul style="list-style-type: none"> <li>• Reduced                             <ul style="list-style-type: none"> <li>- Cable/structure costs</li> <li>- Manhole costs</li> <li>- Engineering, installation, and maintenance.</li> </ul> </li> </ul>                                                                                                                                                        |
| Reliable                      | <ul style="list-style-type: none"> <li>• Design based on proven technology</li> <li>• Support from one of the largest telecommunications leaders.</li> </ul>                                                                                                                                                                                                                                              |
| Optional protection switching | <ul style="list-style-type: none"> <li>• No service interruptions.</li> </ul>                                                                                                                                                                                                                                                                                                                             |

### **Unquantified Benefits**

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In addition to the features and benefits listed above, DLC Systems have the following unquantified benefits:

- Improved telephone service
  - With digitalization of the voice-frequency signal, there is less chance for errors being transmitted.
- One-fourth to one-third the trouble rate compared to wire pair loops
  - With a fiber loop, there is no electrical interference or cross talk as associated with the copper loop.

- Enhanced potential for new revenue
  - If service is provided more quickly, revenue is generated more quickly.
- Future service offerings capable
  - New features are designed to be compatible with existing technology. This saves the expense of replacing equipment.
- Existing revenue guard; counter bypass
  - Existing revenue can be guarded by not having to take a revenue-generating system out of service while adding new features.

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## A SONET Overview

# B

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### Introduction

This Appendix briefly describes the synchronous optical network (SONET).

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### History

In the early 1980s, the American National Standards Institute recognized the need for an optical signal standard for future broadband transmission. The *ANSI T1X1* subcommittee began working on optical signal and interface standards in 1984. In 1985, Bellcore proposed a network approach to fiber system standardization to T1X1. The proposal suggested a hierarchical family of signals whose rates would be *integer multiples* of a basic modular signal. The proposal further suggested a synchronous multiplexing technique, leading to the coining of the term *synchronous optical network* (SONET).

The International Telephone and Telegraph Consultative Committee (CCITT) first showed interest in 1986. Conferences held through 1987 and 1988 resulted in coordinated specifications for both the American National Standard (SONET) and the CCITT-International Standard, synchronous digital hierarchy (SDH). CCITT is now called International Telecommunications Union (ITU). Approval of both sets of standards occurred in late 1988.

## Basic Purpose

---

The basic purpose of SONET is to provide a standard synchronous optical hierarchy with sufficient flexibility to accommodate digital signals that currently exist in today's network, as well as those planned for the future.

SONET currently defines standard rates and formats and optical interfaces. These and other related issues continue to evolve through the *ANSI* committees. SONET ultimately permits an optical midspan meet in a multivendor environment.

The following standards are defined in the American National Standard:

- Optical parameters
- Multiplexing schemes to map existing digital signals (that is, DS1 and DS3) into SONET payload signals
- Overhead channels to support standard operations, administration, maintenance, and provisioning (OAM&P) functions
- Criteria for optical line automatic protection switch (APS).

## Technical Overview

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### SONET Signal Hierarchy

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The SONET signal hierarchy is based on a basic *building block* frame called the synchronous transport signal level 1 (STS-1) (Figure B-1). The STS-1 frame has a recurring rate of 8,000 frames a second. Each frame is 125 microseconds.

The following items compose the STS-1 frame:

- 90 columns (each column is an 8-bit byte)
- 9 rows.

The STS-1 frame is transmitted serially starting from the left with row 1 column 1 through column 90, then row 2 column 1 through 90, continuing on, row-by-row, until all 810 bytes (9×90) of the STS-1 frame have been transmitted.

Since each STS-1 frame consists of 810 bytes and each byte has 8 bits, the frame contains 6,480 bits a frame. There are 8,000 STS-1 frames a second, at the STS-1 signal rate of 51,840,000 (6,480×8,000) bits a second.

The first three columns in each of the first three rows carry the SECTION and LINE overhead bytes. Collectively, these 27 bytes are referred to as transport overhead.

The remainder of the frame, columns 4 through 90, is reserved for payload signals (for example, DS1 and DS3) and is referred to as the STS-1 synchronous payload envelope (SPE). The optical counterpart of the STS-1 is the optical carrier level 1 signal (OC-1), which is the result of a direct optical conversion.

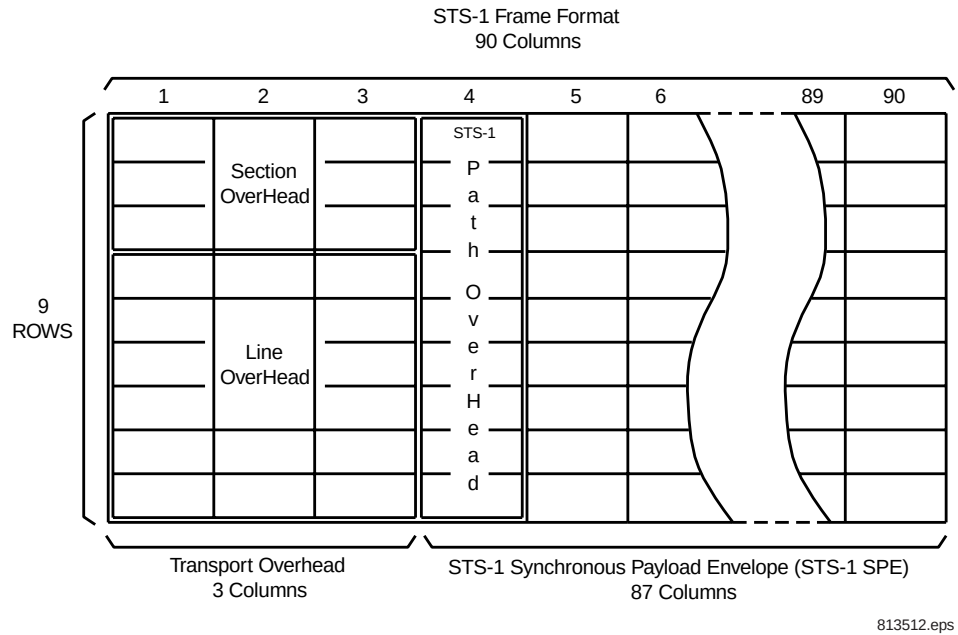


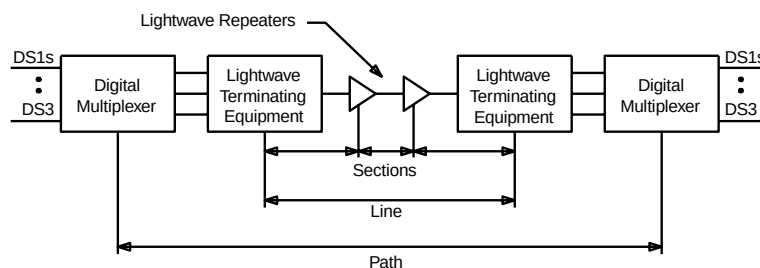
**Figure B-1. SONET STS-1 Frame Simplified Version**

## SONET Layers

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SONET divides its processing functions into three layers. These three layers are associated with equipment that reflects the natural divisions in network spans. The following are the three layers of processing functions (Figure B-2 shows these defined layers in a signal path).

- a. *SECTION* and *Section Terminating Equipment* — The transmission spans between lightwave terminating equipment and the regenerators. The spans between the regenerators are also considered sections. Section terminating equipment provides regenerator functions, terminates the section overhead to provide single-ended operations and section performance monitoring.
- b. *LINE* and *Line Terminating Equipment* — The transmission span between terminating equipment (STS-1 cross-connects) that provides line performance monitoring.
- c. *STS-1* and *VT Paths Terminating Equipment* — The transmission span for an end-to-end tributary (DS1 or DS3) signal that provides functions including signal labeling and path performance monitoring for signals as they are transported through a SONET network. The STS-1 path terminating equipment can also provide cross-connections for lower-rate, (that is, DS1) signals. A virtual tributary (VT) is a sub-DS3 payload and is described later in more detail.



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**Figure B-2. Section, Line, and Path Definitions**

Each SONET layer has a set of overhead bytes as shown in Figure B-3. These bytes carry information used by various network elements.

- *SECTION* layer overhead contains information that is used by all SONET equipment including repeaters.
- *LINE* layer overhead is used by all SONET equipment except repeaters.

- *PATH* overhead is carried within the payload envelope.
  - *STS-1* remains with the STS-1 SPE until its payload is demultiplexed.
  - *VTN* ( $N= 1.5, 2, 3, \text{ or } 6$ ) remains with the VTN until it is demultiplexed to its asynchronous signal.

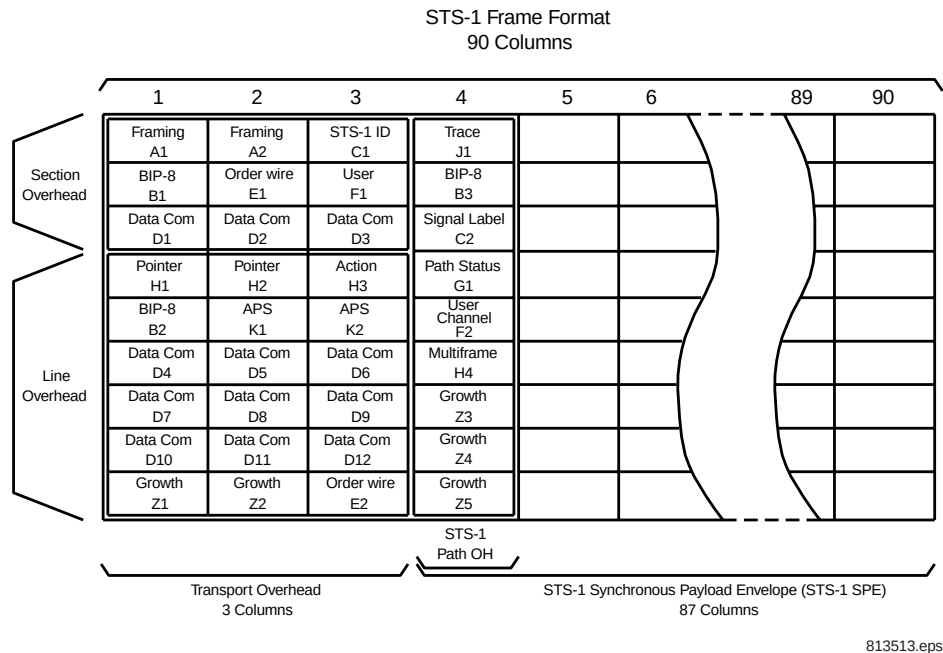


**Figure B-3. SONET Frame Format**

## SONET Frame Structure

The following pages provide more detailed information on the function of various overhead bytes for each SONET layer.

### Section Overhead

#### Framing (A1 & A2)

Provides framing for each STS-1.

#### STS-1 ID (C1)

Provides the order of appearance in a byte-interleaved STS-N frame. For example, STS-1 #1, STS-1 #2.....STS-1 #48. Section Bit Interleaved Parity (BIP-

8) (B1). Provides SECTION performance monitoring and is calculated over all bits of the previous STS-N frame. Defined only for STS-1 #1 of an STS-N signal.

### **Section Order Wire (E1)**

Provides a local order wire for voice communication channel between regenerators. Defined only for STS-1 #1 of an STS-N signal.

### **Section User Channel (F1)**

Set aside for the user's purpose. Defined only for STS-1 #1 of an STS-N signal.

### **Section Data Communications Channel (D1, D2, D3)**

A 192 kbps message-based channel. Used for alarms, maintenance, control, monitoring, and other communication needs between section terminating equipment. Defined only for STS-1 #1 of an STS-N signal.

## **Line Overhead**

### **Line Pointer (H1, H2)**

Two bytes indicate the offset in bytes between the pointer action byte (H3) and the first byte (J1) of the STS-1 synchronous payload envelope (SPE).

### **Pointer Action (H3)**

One byte is allocated for frequency justification.

### **Line Bit Interleaved Parity (BIP-8) (B2)**

This byte is for line performance monitoring and is provided in all STS-1 signals within an STS-N signal.

### **Line Automatic Protection Switch (APS) (K1, K2)**

Two bytes used for APS signaling between line level entities. In addition, bits 6, 7, and 8 of K2 are used for line alarm indication signal (AIS) and line far-end receive failure (FERF). Defined only for STS-1 #1 of an STS-N signal.

### **Line Data Communications Channel (D4 - D12)**

This is a 576 kbps message-based channel.

### **Line Growth (Z1, Z2)**

Two bytes are set aside for future functions.

### **Line Order Wire (E2)**

Defined only for STS-1 #1 of an STS-N signal. One byte is allocated to be used as an express order wire between line entities.

### **Path Overhead**

STS-1 and VT are the two types of path overheads.

#### **STS-1 Path Overhead**

The STS-1 path overhead is assigned to and remains with the STS-1 SPE until the payload is demultiplexed and is used for functions that are necessary to transport all synchronous payload envelopes.

**STS-1 Path Trace (J1).** Repetitively transmits a 64 byte, fixed length string so that an STS-1 path receiving terminal can verify its continued connection to the intended transmitter.

**STS-1 Path Bit Interleaved Parity (BIP-8) (B3).** Provides each STS-1 path performance monitoring. This byte is calculated over all bits of the previous STS-1 SPE before scrambling.

**STS-1 Path Signal Labels (C2).** Indicates the construction of the STS-1 SPE. Currently, only two values are valid, 00000000 indicates STS-1 SPE unequipped and 00000001 indicates STS-1 SPE equipped.

**STS-1 Path Status (G1).** Conveys the STS-1 path terminating status, performance, and yellow signal conditions back to an originating STS-1 path terminating equipment.

**STS-1 Path User Channel (F2).** Reserved for user communication.

**VT Multiframe Indicator (H4).** Provides a general multiframe indicator for VT-structured payloads.

**Growth (Z3 - Z5).** Reserved for future functions.

#### **VT Path Overhead**

There is one byte of VT path overhead called V5. It occurs on every fourth frame (2,000 times a second).

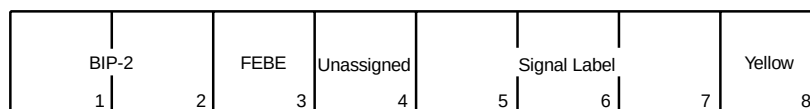
The following functions (the same functions that B3, C2, and G1 provide for STS paths) are provided by this byte for VT paths:

- Error checking
- Signal label
- Path status.



The bit assignments of the VT path overhead are specified in the following list and are illustrated in Figure B-4.

- Bits 1 and 2 are used for error performance monitoring (BIP-2).
- Bit 3 is a VT path far-end-block-error (FEBE) indication that is sent back toward an originating VT PTE when errors are detected by the BIP-2.
- Bit 4 is unassigned (×).
- Bits 5 through 7 provide a VT signal label.
- Bit 8 is a VT path yellow indication.



VT Path Signal Label Coding:

|       |                      |
|-------|----------------------|
| 0 0 0 | Unequipped           |
| 0 0 1 | Equipped-Nonspecific |

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**Figure B-4. VT Path Overhead Byte**

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## SONET Digital Multiplexing Schemes

### Asynchronous Multiplexing

Currently, fiber optic facilities are primarily used to carry DS3 signals. The following payload signals combined make up the DS3 signal:

- 28 DS1s
- 14 DS1Cs
- 7 DS2s.

Typically, 28 DS1 signals are multiplexed into a DS3 signal, using an M13 format (Figure B-5). The M13 format is a process that includes bit interleaving four DS1 signals into a DS2 signal and then bit interleaving seven DS2 signals into a DS3. In addition, the DS3 rate is not a direct multiple of the DS1 or the DS2 rates due to the bit-stuffing synchronization technique used in asynchronous multiplexing.

Identification of DS0s contained in any DS-N signal, except DS1, is complex and DS0s cannot be directly extracted. Thus, an asynchronous DS3 signal must be demultiplexed down to the DS1 level to access and cross-connect DS0 and DS1 signals.

Another disadvantage of the M13 format is no end-to-end overhead channel for use by OAM&P groups.

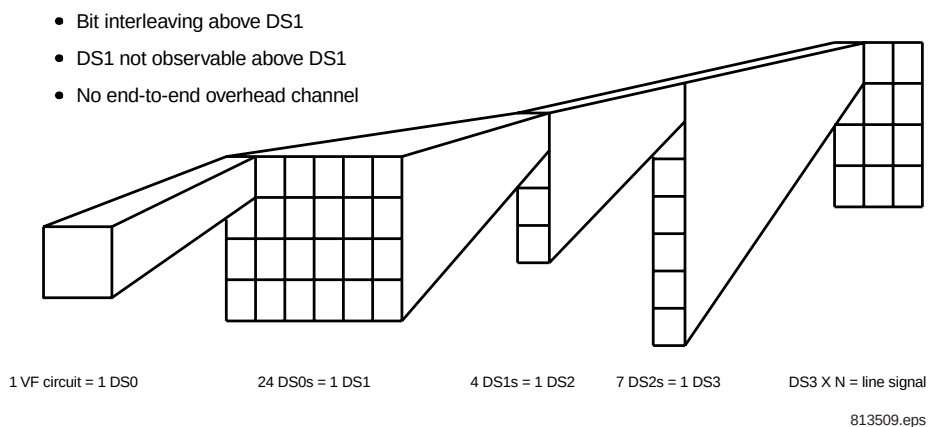
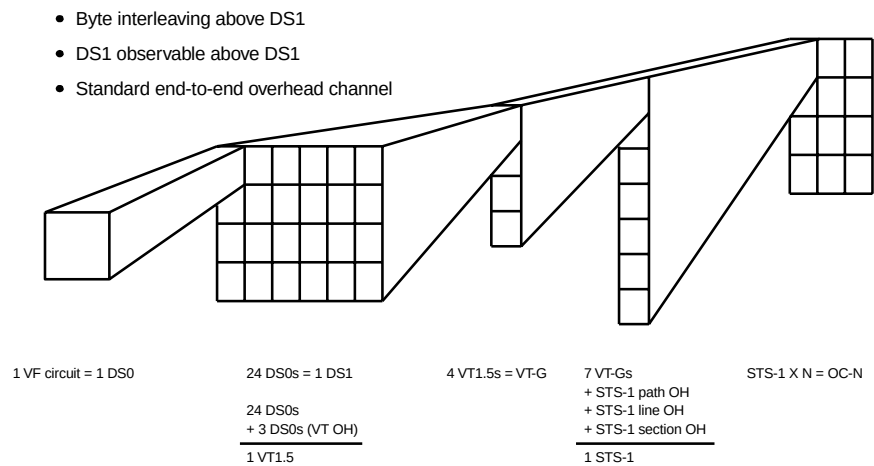


**Figure B-5. Asynchronous Multiplexing**

## Synchronous Multiplexing

SONET's method of *byte interleaving* DS1s to a higher signal rate permits economical extraction of a single DS1 without the need to demultiplex the entire STS-1 SPE. In addition, SONET provides overhead channels for use by OAM&P groups.

In SONET, a single asynchronous DS3 signal is mapped into an STS-1 SPE (Figure B-6).



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**Figure B-6. Synchronous Multiplexing**

Sub-DS3 asynchronous signals (DS1, DS1C, DS2 and E1) are *byte interleaved* into a digital signal called a virtual tributary (VT). The VT is a structure designed for the transport and switching of sub-DS3 payloads. There are four sizes of virtual tributaries. Table B-1 shows the digital signals that can be transported as SONET payloads.

**Table B-1. SONET Payloads**

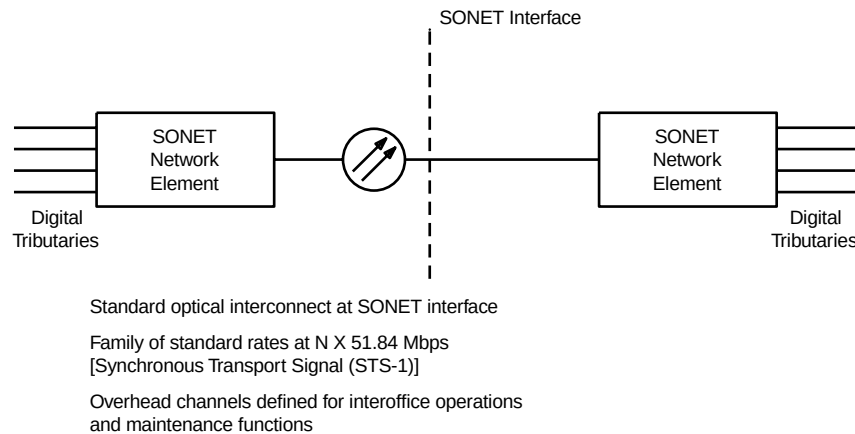
| <b>Voice Channels (DS0s)</b> | <b>Asynchronous Input</b> | <b>Rate</b>    | <b>SONET Signal</b> | <b>Rate</b> |
|------------------------------|---------------------------|----------------|---------------------|-------------|
| 24 DS0s                      | DS1                       | 1.544 Mb/s     | VT1.5               | 1.728 Mb/s  |
| 32 DS0s                      | E1 (CEPT)                 | 2.048 Mb/s     | VT2                 | 2.304 Mb/s  |
| 48 DS0s                      | DS1C                      | 3.152 Mb/s     | VT3                 | 3.456 Mb/s  |
| 96 DS0s                      | DS2                       | 6.312 Mb/s     | VT6                 | 6.912 Mb/s  |
| 672 DS0s                     | DS3                       | 44.736 Mb/s    | STS-1               | 51.840Mb/s  |
| Future payloads              |                           | up to 150 Mb/s |                     |             |
| Future broadband payloads    |                           |                |                     |             |

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DS1 and DS3 digital signals are the most important of these as are future broadband payloads with rates of 150 Mb/s and higher.

## SONET Interface

The SONET interface (Figure B-7) provides the optical midspan meet between SONET network elements. A SONET network element is the hardware and software that affects the termination or repeating of a SONET standard signal.



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**Figure B-7. SONET Interface**

## SONET Multiplexing Procedure

SONET has provisions for multiplexing asynchronous DS1s, synchronous DS1s, and asynchronous DS3s (Figure B-8 and Figure B-9).

The first stage in multiplexing is mapping the input DS1 or DS3 tributary. In the case of DS1 inputs, three time slots (DS0s) are added to the incoming signal thus becoming a VT1.5. An asynchronous DS1 that fully meets the specified rate is mapped into the VT1.5 SPE as clear channel input since no framing is needed.

- Each VT1.5 carries a single DS1 payload.
- Four VT1.5s are bundled into a VT group (VT-G).
- Seven VT-Gs are byte interleaved into an STS-1 frame.

The VT-G to-STS-1 multiplex is a simple byte interleaving process, so individual VT signals are easily observable within the STS-1. Thus, cross-connections and add/drop can be accomplished without the back-to-back mux/demux steps required by asynchronous signal formats. The structured VTs are now multiplexed into the STS-1 SPE, and the path, line, and section overhead is added. The final multiplexing, as shown in Figure B-8, provides the scrambled STS- $N$  signal to the optical conversion stage.

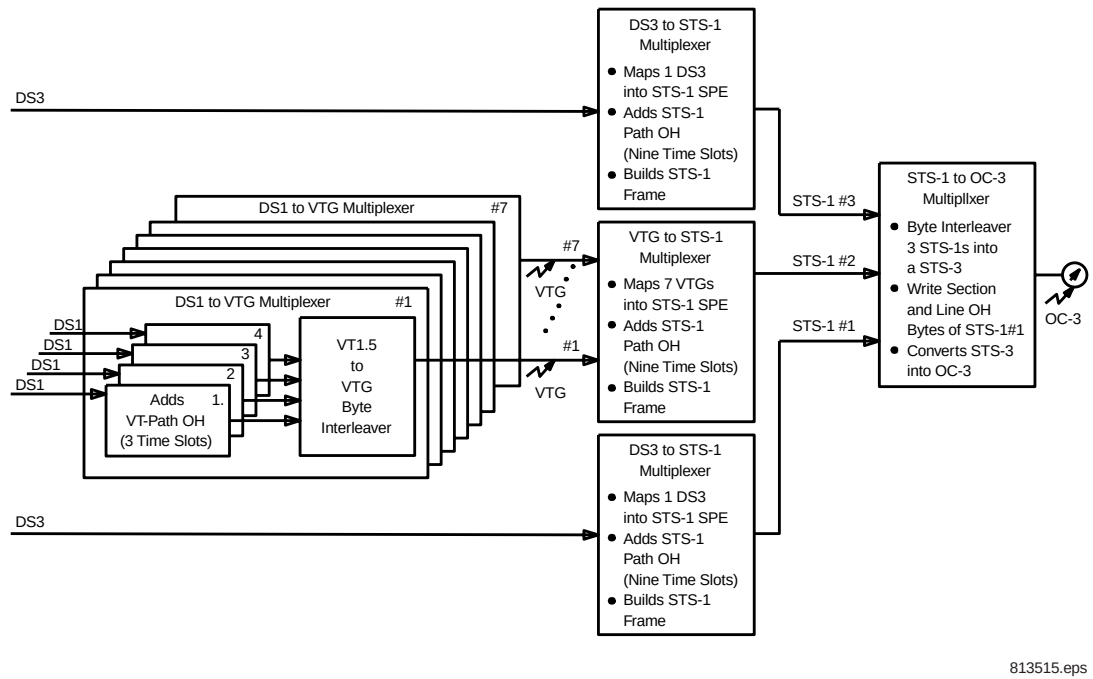
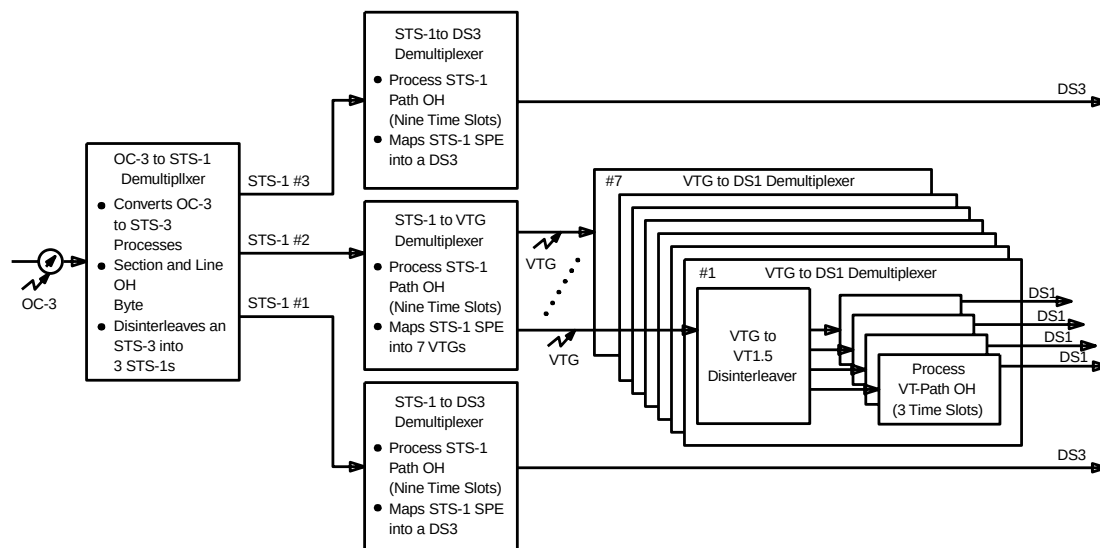


**Figure B-8. SONET Multiplex Procedure**

## SONET Demultiplexing Procedure

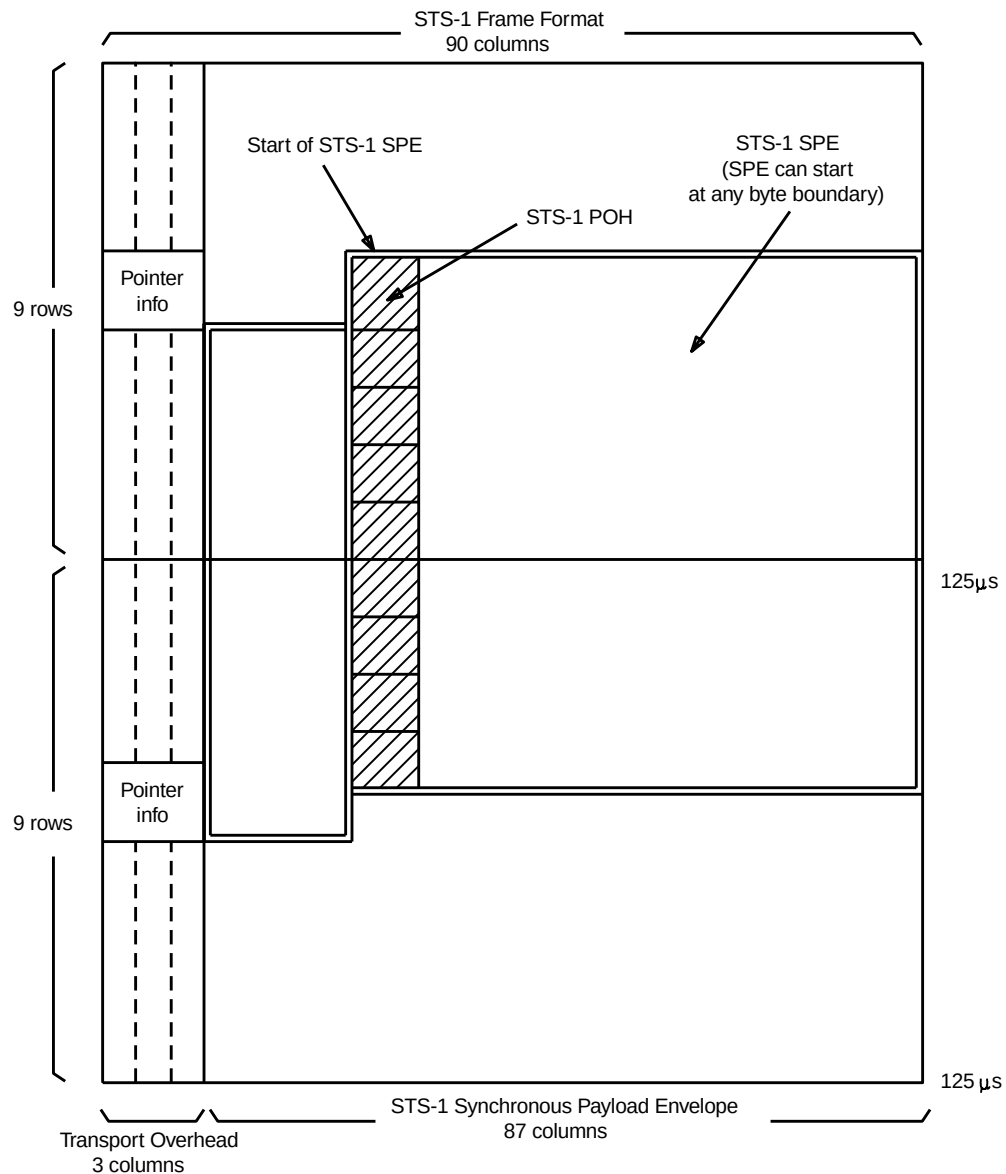
As shown in Figure B-9, demultiplexing is the inverse of multiplexing. The unscrambled STS-1 signal from the optical conversion stages is processed to extract the section and line overhead and accurately locate the SPE. The next stage processes the path overhead and demultiplexes the VTs. The individual DS1 VTs are then processed to extract VT overhead and, using the VT pointer, to accurately locate the DS1 SPE. Finally, desynchronization of the DS1 SPE provides a standard DS1 signal to the asynchronous network.



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**Figure B-9. SONET Demultiplex Procedure**

Two key points should be understood at this time. First, the SONET frame is a fixed time (125  $\mu$ s) and no bit-stuffing is used. Second, as shown in Figure B-10, the synchronous payload envelope can *float* within the frame. This is to permit compensation for small variations in frequency between the clocks of the two systems that may occur if the systems are independently timed (plesiochronous timing). The SPE can also drift across the 125- $\mu$ s frame boundary.



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**Figure B-10. STS-1 Synchronous Payload Envelope in Interior of STS-1 Frame**

### SONET Higher Rate Transport

Higher rate SONET signals are created by byte-interleaving STS-1 *N* to form an STS-*N* signal. The desired STS-*N* is created by adjusting all payload pointers and regenerating the section and line overhead bytes to be in phase with each other



and the outgoing multiplexed signal. The STS- $N$  is then scrambled and converted to an optical carrier level  $N$  (OC- $N$ ) signal. The OC- $N$  has a line rate of exactly  $N$  times the OC-1 signal (Table B-2).

**Table B-2. SONET Transport Rates**

| OC Level | Line Rate (Mb/s) | Capacity             |
|----------|------------------|----------------------|
| OC-1     | 51.84            | 28 DS1s or 1 DS3     |
| OC-3     | 155.52           | 84 DS1s or 3 DS3s    |
| OC-9     | 466.56           | 252 DS1s or 9 DS3s   |
| OC-12    | 622.08           | 336 DS1s or 12 DS3s  |
| OC-18    | 933.122          | 504 DS1s or 18 DS3s  |
| OC-24    | 1244.16          | 672 DS1s or 24 DS3s  |
| OC-36    | 1866.24          | 1008 DS1s or 36 DS3s |
| OC-48    | 2488.32          | 1344 DS1s or 48 DS3s |

The intent of this Appendix is to present a short overview of SONET. More detailed expositions can be found in various literature. An excellent description can be found in Reference 3.

## References

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The following references were used to present this overview of SONET.

1. ANSI T1.106-1988 *American National Standard for Telecommunications - Digital Hierarchy Optical Interface Specifications, Single Mode*, and ANSI T1.105-1988 *American National Standard for Telecommunications - Digital Hierarchy Optical Rates and Formats Specification*.
2. CCITT Recommendations G.707, G.708, G.709.
3. R. Ballert and Y. C. Ching, *SONET: Now It's the Standard Optical Network*, *IEEE Communications Magazine*, Vol. 27, No. 3 (March 1989): 8-15.

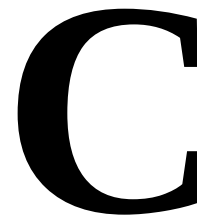
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# System Documentation



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## Introduction

This appendix lists the system documentation for the *SLC*<sup>®</sup>-2000 Access System. Documentation for Lucent Technologies Network Systems products may include some or all the following types of documents:

- Sales/marketing brochures (presale)
- Product announcement package
- Nine-digit numbered Lucent Technologies documents (postsale)
- Equipment/apparatus drawings.

The 9-digit numbered Lucent Technologies documents include: Lucent Technologies Practices, manuals, handbooks, quick-reference guides, input/output (I/O) manuals, application guides, administrative documents, engineering documents, descriptive documents, data sheets, recent change/verify (RC/V) documents, user guides/manuals, reference guides/manuals, document indexes, customer information releases (CIRs), procedural documents, task-oriented practices (TOPs), installation documents, maintenance documents, ordering guides, etc.

Lucent Technologies Practice refers to a document style that uses numbered paragraphs and marked text headings (similar to the original Bell System Practices) and says *Practice* in the document header. Many of the current Lucent Technologies documents are practices, but the practice style is not suited to documents like manuals and applications guides. Several different styles have been used for nine-digit numbered documents that were not suitable for the practice format. In an effort to consolidate and reconcile the different formats that currently exist and to produce consistent documentation, a new multiweight format

has been developed. This format is part of the corporate standard that specifies the content and format for all Lucent Technologies documentation. Most new documents are done with the multiweight format; documents to be reissued are evaluated for conversion. This appendix has been produced using the multiweight format.

## **SLC®-2000 Access System Documentation**

The following categories of nine-digit numbered documents provide most of the *SLC-2000 Access System* documentation.

- Indexes
- Applications, planning, and ordering guide
- Data sheets
- Task-oriented practices (TOPs)
- User guides/manuals
- Descriptive documents.

See information under *Outside Plant Documentation* and under *Drawings* for additional documentation on the *SLC-2000 Access System* and related equipment.

## **SLC-2000 Access System Documentation Plan**

The following documents provide additional information about the *SLC-2000 Access System*:

- 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service and Ordering Manual*.

Audience — Engineers, installers, administrators, operation and maintenance personnel, and technical support.

Content — Applications, physical and functional description, administration, powering, technical specifications, construction and installation, and operation and maintenance [in task-oriented practice (TOP) format]. This document also contains ordering information for the MSDT.

- 363-208-001, *SLC-2000 Access System, User/Service Manual*.

Audience — Installers, technicians, engineers, and troubleshooters.

Content — System overview, system description, introduction to each system interface, administration and provisioning, operations and maintenance procedures (in TOP format), and maintenance support information (alarm tables, etc.).

- 363-208-003, *SLC-2000 Access System, Commands and Messages*.

Audience — Installers, technicians, engineers, and troubleshooters.

Content — A tutorial on system commands and messages, also detailed information about the system commands in manual-page format. The document pages are organized by user interface panel (UIP) commands and craft interface terminal (CIT) commands.

- 363-208-010, *SLC-2000 Access System, Customer Assembly Manual for RT Frames*.

Audience — Customers that plan to install the equipment.

Content — Configuration drawings and detailed instructions for ordering, installing, assembling, and connecting the equipment in an remote terminal (RT) frame arrangement. This document includes installation procedures, cabling and wiring diagrams, the application schematic diagrams (SDs), a parts list, and supporting information. Shelf assembly, cable routing, and frame installation are provided.

- 363-208-011, *SLC-2000 Access System, Customer Assembly Manual for COT Frames*.

Audience — Customers that plan to install the equipment.

Content — Configuration drawings and detailed instructions for ordering, installing, assembling, and connecting the equipment in a central office terminal (COT) frame arrangement. This document includes installation procedures, cabling and wiring diagrams, the application schematic diagrams (SDs), a parts list, and supporting information. Shelf assembly, cable routing, and frame installation are provided.

- 363-208-013, *SLC-2000 Access System Customer Conversion Procedures From a COT Frame to an RT Frame*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Procedures for converting a COT frame to an RT Frame.

- 363-208-020, *SLC-2000 Access System, Software Release Description — Release 3.01.02, Issue 3*.

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-022, *SLC-2000 Access System, Software Release Description — Release 3.02.01.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-022, *SLC-2000 Access System, Software Release Description — Release 3.03.00; Issue 5.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-023, *SLC-2000 Access System, Software Release Description — Release 4.00.02.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-024, *SLC-2000 Access System, Software Release Description — Release 4.01.00; Issue 2.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-024, *SLC-2000 Access System, Software Release Description — Release 4.02.00; Issue 3*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-025, *SLC-2000 Access System, Software Release Description — Release 4.03.00; Issue 1.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-208-026, *SLC-2000 Access System, Software Release Description — Release 4.04.00; Issue 1.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-200, *DDM-2000 OC-3 and OC-12 Multiplexer, Applications, Planning, and Ordering Guide*

Audience — Network planners, engineers, product evaluators, standardization groups, and ordering personnel.

Content — Provides specific information about the features, applications, operation, engineering, and ordering of the DDM-2000 OC-3 and OC-12 Multiplexers.

- 363-206-202, *DDM-2000 OC-3 Multiplexer, User/Service Manual — Releases 2, 3, 4, 5, 6, and 7.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — System overview, system description, introduction to each system interface, administration and provisioning, operations and maintenance procedures (in TOP format), and maintenance support information (alarm tables, etc.).

- 363-206-218, *DDM-2000 OC-3 Multiplexer, Software Release Description — Release 7.0.2.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-242, *DDM-2000 OC-3 Multiplexer, Software Release Description — Release 6.2.2.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-243, *DDM-2000 OC-3 Multiplexer, Software Release Description — Release 7.1.2.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-253, *DDM-2000 OC-3 Multiplexer, Software Release Description — Release 7.2.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-245, *DDM-2000 OC-3 Multiplexer, Software Release Description — Release 9.0.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-246, *DDM-2000 OC-12 Multiplexer, Software Release Description — Release 2.2.1.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.



- 363-206-247, *DDM-2000 OC-12 Multiplexer, Software Release Description — Release 3.1.1.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides information about the software release and procedures for implementation. Describes the features and capabilities provided in the release. Lists operating issues from the previous release that have been resolved, the operating issues in this release, and any work-arounds.

- 363-206-280, *DDM-2000 OC-3 Multiplexer — Releases 8 and Higher— User/Service Manual.*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — System overview, system description, introduction to each system interface, administration and provisioning, operations and maintenance procedures (in TOP format), and maintenance support information (alarm tables, etc.).

- 363-206-300 *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide*

Audience — Network planners, engineers, product evaluators, standardization groups, and ordering personnel.

Content — Provides specific information about the features, applications, operation, engineering, and ordering of the DDM-2000 OC-3 and OC-12 Multiplexers.

- 363-206-301 *DDM-2000 FiberReach Multiplexer, User/Service Manual*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — System overview, system description, introduction to each system interface, administration and provisioning, operations and maintenance procedures (in TOP format), and maintenance support information (alarm tables, etc.).

- 824-102-148, *2000 Family of Products, Operations Systems Engineering Guide*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides detailed information about the operations system (OS) interface to the systems in the 2000 Product Family for engineering an OS.

- 824-102-149, *SLC-2000 Access System, Operations Systems Engineering Guide*

Audience — Installers, technicians, engineers, and troubleshooters.

Content — Provides detailed information about the OS interface to the SLC-2000 Access System (how the systems communicate with each other) for engineering an OS.

The documents listed in the documentation plan support the following tasks:

- Planning
  - 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*
  - 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service, and Ordering Guide*
  - 824-102-148, *2000 Family of Products, Operations Systems Engineering Guide*
  - 363-206-300 *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide.*
- System engineering
  - 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*
  - 363-208-010, *SLC-2000 Access System, Customer Assembly Manual for RT Frames* (equipment required for RT frame arrangements)
  - 363-208-011, *SLC-2000 Access System, Customer Assembly Manual for COT Frames* (equipment required for COT frame arrangements)
  - 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service, and Ordering Guide*
  - 363-206-300 *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide.*
- Ordering
  - 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide* (parts list)
  - 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service, and Ordering Manual*
  - 363-206-300 *DDM-2000 FiberReach Multiplexer, Applications, Planning, and Ordering Guide.*
- Circuit order and channel unit applications
  - 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*
  - 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting.*

- System Installation
  - 363-208-010, *SLC-2000 Access System, Customer Assembly Manual for RTs*
  - 363-208-011, *SLC-2000 Access System, Customer Assembly Manual for COT Frames.*
- Acceptance, turn-up, maintenance, and system provisioning
  - 363-208-001, *SLC-2000 Access System, User/Service Manual* (TOP procedures and Lucent Technologies Data Sheets)
  - 363-208-003, *SLC-2000 Access System, Command and Message Manual* (command pages)
  - 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service and Ordering Manual.*
  - 363-206-301 *DDM-2000 FiberReach Multiplexer, User/Service Manual*
- Cabling/wiring maintenance
  - 363-208-010, *SLC-2000 Access System, Customer Assembly Manual for RT Frames*
  - 363-208-011, *SLC-2000 Access System, Customer Assembly Manual for COT Frames.*
- Channel unit installation
  - 363-208-001, *SLC-2000 Access System, User/Service Manual* (TOP procedures)
  - 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting.*
- Administration
  - 363-208-001, *SLC-2000 Access System, User/Service Manual.*
- Remote Operations
  - 824-102-148, *2000 Family of Products Operations System Engineering Guide*
  - 363-208-003, *SLC-2000 Access System, Command and Message Manual.*

## **Division 363 Document Index**

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The numerical index for each division (first three digits of the nine-digit number) lists the current issue of the available Lucent Technologies documents in that division. The index also lists appendixes and addenda to the current issue. Currently, active indexes are being updated about four times a year. Document 363-000-000, *Numerical Index — Division 363, Loop Transmission Systems*, lists all nine-digit numbered documents (that start with 363) for *SLC-2000 Access*

System and other loop transmission systems. The Division 363 Index layers (second three digits) include Lucent Technologies Data Sheets (363-005-zzz), "CIRs" (363-099-zzz), *SLC 96 Carrier System* documents (363-202-zzz), *SLC Series 5 Carrier System* documents (363-205-zzz), and *SLC-2000 Access System* documents (363-208-zzz).

The following documents are included in the division for the *SLC-2000 Access System*.

- 363-005-350 through -401, *SLC-2000 Data Sheets*
- 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*
- 363-208-001, *SLC-2000 Access System, User/Service Manual*
- 363-208-003, *SLC-2000 Access System, Commands and Messages*
- 363-208-006, *SLC-2000 Access System, Release 2.0 Software Release Description (Mode 1)*
- 363-208-007, *SLC-2000 Access System, Software Release Description (Mixed Mode)*
- 363-208-008, *SLC-2000 Access System, Software Release Description (Mode 2)*
- 363-208-010, *SLC-2000 Access System, Customer Assembly Manual for RT Frames*
- 363-208-011, *SLC-2000 Access System, Customer Assembly Manual for COT Frames*

The following documents are included in the division for the *SLC Series 5 Carrier System*.

- 363-205-000, *SLC Series 5 Carrier System, Ordering Guide*
- 363-205-010, *SLC Series 5 Carrier System, Applications and Planning Guide*
- 363-205-004, *SLC-2000 Multi-Services Distant Terminal (MSDT) Feature, User/Service and Ordering Manual*
- 363-205-100, *SLC Series 5 Carrier System, General Description*
- 363-205-101, *Craft Interface Unit, Description*
- 363-205-103, *SLC Series 5 Carrier System, Centralized Operations and Provisioning, Installation, Test, and Maintenance*
- 363-205-104, *SLC Series 5 Carrier System, Integrated Network Access — Remote Terminal (INA-RT) User's Manual*
- 363-205-106, *SLC Series 5 Carrier System, AUA90 T-BRITE Channel Unit for ISDN, Installation and Maintenance*
- 363-205-107, *SLC Series 5 Carrier System, AUA93 BRITE II Channel Unit for ISDN, Installation and Maintenance*

- 363-205-300, *SLC Series 5 Carrier System, Extended Test Controller, Description, Installation, and Maintenance*
- 363-205-400, *SLC Series 5 Carrier System, COT Acceptance and Turnup (TOP)*
- 363-205-402, *SLC Series 5 Carrier System, Channel Unit Installation (TOP)*
- 363-205-406, *SLC Series 5 Carrier System, End-to-End Tests (TOP)*
- 363-205-500, *SLC Series 5 Carrier System, Trouble Clearing (TOP)*

### **Applications, Planning, and Ordering Guides**

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These documents provide guidelines for network planners and engineers for system applications and engineering. The guide provides a high-level description of system features, arrangements, interfaces, components/equipment, and operations, administration, maintenance, provisioning (OAM&P), and ordering information. Applications typically are presented as block diagrams showing various system arrangements, equipment interfaces, and how the system fits into the network. Some engineering information may be given, and training may be covered. Appendixes provide details on special features of the system. 363-208-000, *SLC-2000 Access System, — Applications, Planning, and Ordering Guide*, contains a network overview, system applications, equipment description, channel unit information, OAM&P, references, ordering, and training.

The engineering information specifies requirements for engineering a system. The requirements may include equipment constraints, customer considerations, circuit or facility design information, physical design constraints, etc. The ordering section includes information on how many of each unit, shelf, bank, and/or bay is required for each system arrangement. Also listed are miscellaneous units and special test equipment.

### **Lucent Technologies Data Sheets**

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The Lucent Technologies Data Sheets provide detailed information for plug-in units (usually just circuit packs, not shelves). The data sheet gives a detailed description of the unit's operation, controls, and indicators, and provides a figure showing a line drawing of the faceplate.

The *SLC-2000 Access System* data sheets (Lucent Technologies Data Sheets 363-005-350 through 363-005-401) cover the common units, the *SLC-2000* channel units, and the integral test head (ITH) units. Each Lucent Technologies data sheet is assigned a unique nine-digit number within the range of numbers for the system. (*SLC-2000 Access System* data sheets are within the range Lucent Technologies Data Sheets 363-005-311 to 363-005-401.)

## **Task-Oriented Practices (TOPs)**

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Procedures for acceptance or installation testing and maintenance are given in a highly structured format in task-oriented practices. These documents exist in two different formats. The older task-oriented practices (TOPs) were done in a flowchart style turned sideways on each page (flowchart TOP). A newer, text style format (vertical page TOP) was developed later that uses numbered steps in a list format with if-then questions replacing the decision blocks used in the flowchart style. The TOP uses layered procedures with the different layers coded for identification. Recent issues of some TOPs feature tabs for each section in the TOP to separate and make it easier to find tasks such as powering, turn-up, conversion, etc.

The TOP procedures for the *SLC-2000 Access System* are contained in a chapter of the user/service manual ( 363-208-001). The first part of the chapter contains general TOP user information including an explanation of the TOP coding system and how to use it.

## **User Guides/Manuals**

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The *SLC-2000 Access System, User/Service Manual* ( 363-208-001) provides a single document containing the information needed to use the product or feature. It explains when, why, and how to use the system, briefly describes the product's hardware, software, and features, and provides detailed step-by-step instructions in TOP format for installation, operation, and maintenance. The *SLC-2000 User/Service Manual* is part of the documentation set and may require the command and message manual or the data sheets for detailed information.

## **Software Release Descriptions**

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You can only obtain software release descriptions (SRDs) when you order the digital loop carrier (DLC) subsystem software from Lucent Technologies. You *cannot* order these documents separately from Lucent Technologies Customer Information Center (CIC).

## **Outside Plant Documentation**

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Outside plant documentation on transmission apparatus, cables, and enclosures spans several divisions. Division 622 covers conduit, manholes, and cable vaults, including the concrete hut and controlled environment vaults used for *SLC Carrier Systems*. Division 626 (cables, wire, and apparatus — general) documents the different kinds of cables and provides ordering information and lettering guidelines for the 80-type outside plant cabinets. Division 631 (cable terminals) documents exchange cable identification, different types of connector blocks, and splicing information for pedestals and cabinets. Division 640 (outside plant — carrier apparatus) covers carrier apparatus cases (which house repeaters for digital

lines), *SLC Carrier System* splicing in various cabinets and enclosures, and lightguide cable systems. Refer to 000-000-002, *Lucent Technologies 9-Digit Numbered Documents Master Index*, for other divisions of outside plant documentation.

The following is a partial list of outside plant documentation.

- 622-506-052, *KS-23038 Controlled Environment Vault Description*
- 622-506-235, *Concrete Hut ED-7C285-30, Description and Installation*
- 622-506-236, *KS-23038 Controlled Environment Vault Installation*
- 622-506-237, *KS-23038 Controlled Environment Vault Operation and Maintenance*
- 626-500-105, *80-Type Cabinet, Coding Scheme, Ordering Information, and Lettering Guidelines*
- 631-600-240, *80 B, C, and D Size Cabinets, Installation*
- 631-600-241, *80 B, C, and D Size Cabinet, Splicing Information*
- 640-250-223, *80-Type Cabinet Remote Terminal, Installation and Splicing (Metallic Systems)*
- 640-250-224, *Remote Terminal Splicing, Precabled Structures Using Bulk Protection*
- 640-250-237, *51A RT Cabinet (ED-7C601-30) Placement, SLC Series 5 Carrier System*
- 640-250-247, *SLC Series 5 Carrier System, Dual Channel Banks (Metallic), Field Installation of SLC Series 5 Carrier System Remote Terminal Into 80-Type Cabinets Precabled for the SLC Series 5 Carrier System*
- 640-250-248, *Precabled Structure Using Bulk Protection Metallic Remote Terminal Splicing SLC Series 5 Carrier System*
- 640-250-250, *Precabled Structures Using Bulk Power and Protection, Splicing, and Cabling Arrangements (Metallic and Fiber SLC Carrier Systems)*
- 640-250-251, *16- and 24-Foot Platforms Description SLC Series 5 Carrier System*
- 640-250-252, *80D Cabinet (Fiber) Group 80 Description, Installation, and Splicing, SLC Series 5 Carrier System*
- 640-250-255, *80D Cabinet (Fiber) Group 90, 91, 92 Description, Installation, and Splicing, SLC Series 5 Carrier System*
- 640-250-256, *80E Cabinet (Fiber) Group 90 and 91, Description, Installation, and Splicing, SLC Series 5 Carrier System and SXSS Repeater Shelf*
- 640-250-273, *80A (Bulk Power) Cabinet (Fiber: Group 490) Splicing and Equipment Installation (Combined SLC Series 5 and SLC-2000 Systems)*

- 640-250-290, *80D-BP (Bulk Power) Cabinet (Fiber: Group 490) Splicing and Equipment Installation (Combined SLC Series 5 and SLC-2000 Systems)*
- 640-250-325, *80D Cabinet Description, Installation, and Splicing SLC Series 5 Carrier System*
- 640-250-327, *80E Cabinet Remote Terminal, Description, Installation, and Splicing*
- 640-252-310, *Concrete Hut (ED-7C285-30) Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems*
- 640-252-311, *C Equipment Platform Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems*
- 640-252-312, *80-Type Cabinets, Description, Installation, and Splicing, Combined SLC 96 and SLC Series 5 Carrier Systems*
- 644-203-155, *80-Type Cabinet, Repair and Replacement Part .*

## Drawings

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Equipment drawings (J drawings), apparatus drawings (A drawings), schematic drawings (SDs), and circuit descriptions (CDs) provide detailed wiring, cabling, schematic, and physical information. Circuit descriptions (when available) use the same number as the schematic drawing. There may be limited availability on some drawings. Refer to Division 801 for J drawings and other equipment specifications.

The following drawings contain detailed information on SLC-2000 equipment and related systems.

- *Writing Shelf, ED-30335-70*
- *Floor Plan Data Sheet, SLC-2000 Remote Terminal, 7-foot 0-inch Frame (With 1 ARM and 4 MDS Banks), FPD 801-450-108-1*
- *Extended Test Controller Control Shelf, SD-ICD-7C127-01*
- *Pair Gain Test Controller Control Shelf, SD-ICD-97760-01.*



## **Related Documentation**

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The following documents contain information on systems and equipment related to the SLC Series 5 Carrier System. The numerical index for each division (for example, 363-000-000, *Numerical Index — Division 363, Loop Transmission Systems*) lists the current issue of the Lucent Technologies documents in that division. Refer to the numerical index for availability of the following Lucent Technologies documents.

- 235-019-102, *General Growth Procedures*
- 235-190-029, *Pair Gain Interface to Nonintegrated SLC Carrier System*
- 235-190-036, *Integrated SLC Carrier System*
- 363-005-zzz, *SLC-2000 Data Sheets*
- 363-200-005, *Integrated SLC Carrier System, Recent Change*
- 363-200-010, *DCLU Integrated SLC Carrier System, General Information Manual*
- 363-201-216, *Active Fault-Locating System, ED-2C374 Active Fault-Locating Panel Turnup, Active Filter (1114/1115-Type) Preinstallation Tests, and Initial Fault-Locating Line and System Tests*
- 363-202-300, *Pair Gain Test Controller, Description and Installation*
- 363-202-602, *Bulk Protected Remote Terminals Installation of Shelves, SLC Series 5 Carrier and SLC 96 Carrier Systems*
- 363-205-002, *SLC Series 5 Carrier System, Fiber-To-The-Home Feature, User's Manual*
- 363-205-003, *SLC-2000 Multi-Services Distant Terminal Feature, Applications, Planning, and Ordering Guide*
- 363-206-100, *DDM-1000 Multiplexer User's Manual*
- 363-206-200, *DDM-2000 Network Multiplexer, Applications and Planning Guide*
- 363-206-202, *DDM-2000 OC-3 Multiplexer, User/Service Manual*
- 363-206-280, *DDM-2000 OC-3 Multiplexer, User/Service Manual, Release 8 and Higher*
- 363-206-300, *DDM-2000 FiberReach Terminal, Applications and Planning Guide*
- 363-206-300, *DDM-2000 FiberReach Terminal, User/Service Manual*
- 662-400-500, *Testing Customer Lines, Operation and Test Procedures*
- 662-505-507, *Test Desk Procedures*
- 801-440-001, *JPCP42 Specifications, Pair Gain Test Controller*
- 855-350-106, *DSX-1 and DSX-1C Retrofit*

- 855-351-101, *Transmission and Outside Plant Design Procedures, T1 Digital Line Carrier Engineering System Application*
- 902-200-110, *Digital Line Design and Pair Selection Rules, Subscriber Carrier Systems*
- 902-200-115, *Digital Line Engineering Program (DILEP)*
- 915-710-110, *SLC 96 Carrier System Application Engineering, Facility Design Systems*
- 919-240-302, *16-Foot Controlled Environment Vault Engineering Considerations.*

## **Bellcore Documents**

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- Bellcore Technical Reference TR-TSY-000008 Issue 2, August 1987, *Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch.*
- Bellcore Technical Reference TR-NWT-000057 Issue 2, January 1991, *Functional Criteria for Digital Loop Carrier Systems.*
- Bellcore Technical Reference TR-NWT-000303, Issue 2 (December 1992) and all Revisions and Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface.*
- BR-680-203-023, *Assignment Procedures for the SLC Series 5 Carrier System*
- BR-902-200-120, *Outside Plant Engineering, Digital Line Engineering Program II (DILEP II) .*

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## Fiber Service Module (FSM)

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### Introduction

This appendix provides an overview of the Fiber Service Module (FSM) for the *SLC*<sup>®</sup>-2000 Access System. It includes the following sections:

- Functional description
- Physical description.

For a detailed description of the installation and end-to-end acceptance procedures when installing the FSM in an Multi-Services Distant Terminal (MSDT) configuration, see 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service and Ordering Manual*.

For a detailed description of the installation and end-to-end acceptance procedures when installing the FSM in a DDM-2000 FiberReach Narrowband shelf (NBS) configuration, contact your regional technical assistance center (RTAC) on 1-800-225-RTAC.

## Functional Description

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The FSM provides expanded fiber-in-the-loop (FITL) distribution capability for Multi-Services Distant Terminals (MSDTs) or DDM-2000 FiberReach Terminal Narrowband Shelves (NBSs) using DSX-1 transmission extensions (no protection switching). Located at both the *SLC-2000* host digital terminal (HDT) site and at the optical network unit (ONU) locations, the FSM multiplexes up to 12 DSX-1s into a single 51.84-Mb/s digital bit stream for optical fiber transport. The optical loss budget is 10 dB from the HDT to the ONU site. Figure D-1 shows a block diagram of the FSM in an HDT-to-MSDT arrangement. Figure D-2 shows a block diagram of the FSM in an HDT-to-NBS arrangement.

The FSM meets customer needs to increase deployment of FITL ONUs and DSX-1 extensions in various installation configurations.

- **At the HDT site**, the FSMs will take up to 12 DSX-1 signals at the rate of 1.544-Mb/s from both the existing MSDT or DT Servers and from other equipment and multiplex them into a single 51.84-Mb/s optical signal. DSX-1 signals from other equipment can include signals from the *SLC-2000* function group C. The FSM then transmits the optical signal to the ONU site. In the opposite direction, the FSM receives the 51.84-Mb/s optical signal from the ONU site and demultiplexes it back into DSX-1 signals for use by the *SLC-2000* HDT. All DSX-1 signals are functionally interchangeable.

When using the FSM with the *SLC-2000* MSDT (Figure D-1), you replace the high density optics shelf (HDOS) optical unit (OU) with a specially designed *cut-through board (CTB)*. As shown in Figure D-1, this board interfaces between the MSDT or DT Server (*SPQ*®808, *SPQ*809, or *SPQ*810 circuit pack) and the FSM. The FSM does not affect existing link requirements between the Server and the MSDT.

Figure D-1 also shows a configuration that does not use the HDOS shelf. In this case, the MDS is wired directly to a DSX patch panel. However, when using this configuration, all MSDT or DT Servers on that specific MDS shelf *must* go through the FSM. This configuration is not as flexible as using the HDOS/CTB configuration.

When using the FSM with the DDM-2000 FiberReach Narrowband Shelf, the DSX-1 signal from the Server is wired to the FSM through the patch panel (Figure D-2).

- **At the *ONU site***, the FSM receives the 51.84-Mb/s optical signal from the HDT site and demultiplexes it back into DSX-1 signals for use with the ONU or other customer equipment. When used with other customer equipment, the FSM sends the DSX-1 signal to an AEK-type repeater that transmits the signal to the customer equipment. In the opposite direction, the FSM will take DSX-1 signals from the ONU and from other equipment and multiplex them into a 51.84-Mb/s optical signal. It then transmits the optical signal to the HDT site.

When the FSM is the digital pipe to the HDT from the *SLC-2000* MSDTs, you replace the MSDT OU with a *digital signal translator* (DST) circuit pack. As shown in Figure D-1, this board interfaces between the backplane interface unit (BIU) of the MSDT and the FSM.

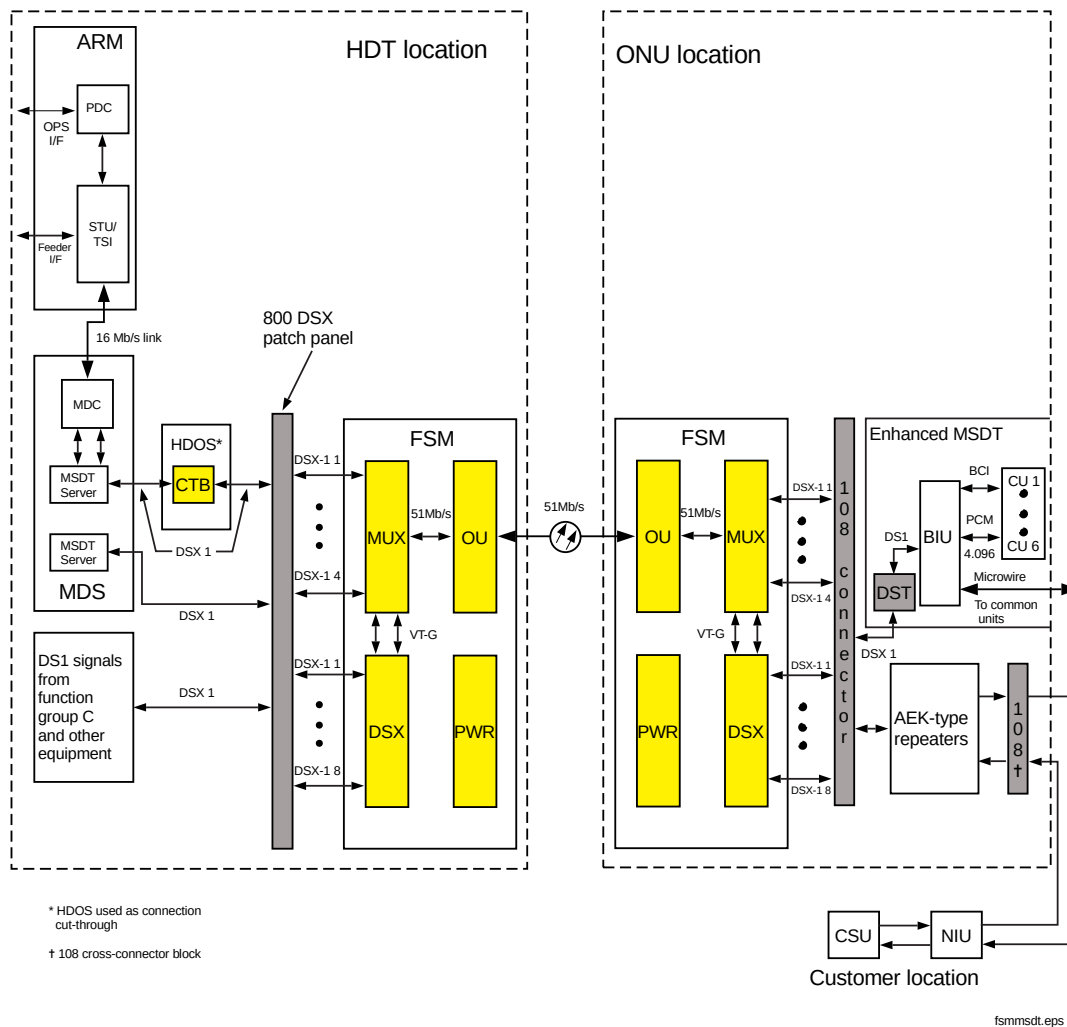


**Figure D-1. Block Diagram of the Fiber Service Module (FSM) in a Typical HDT-to-MSDT Arrangement**

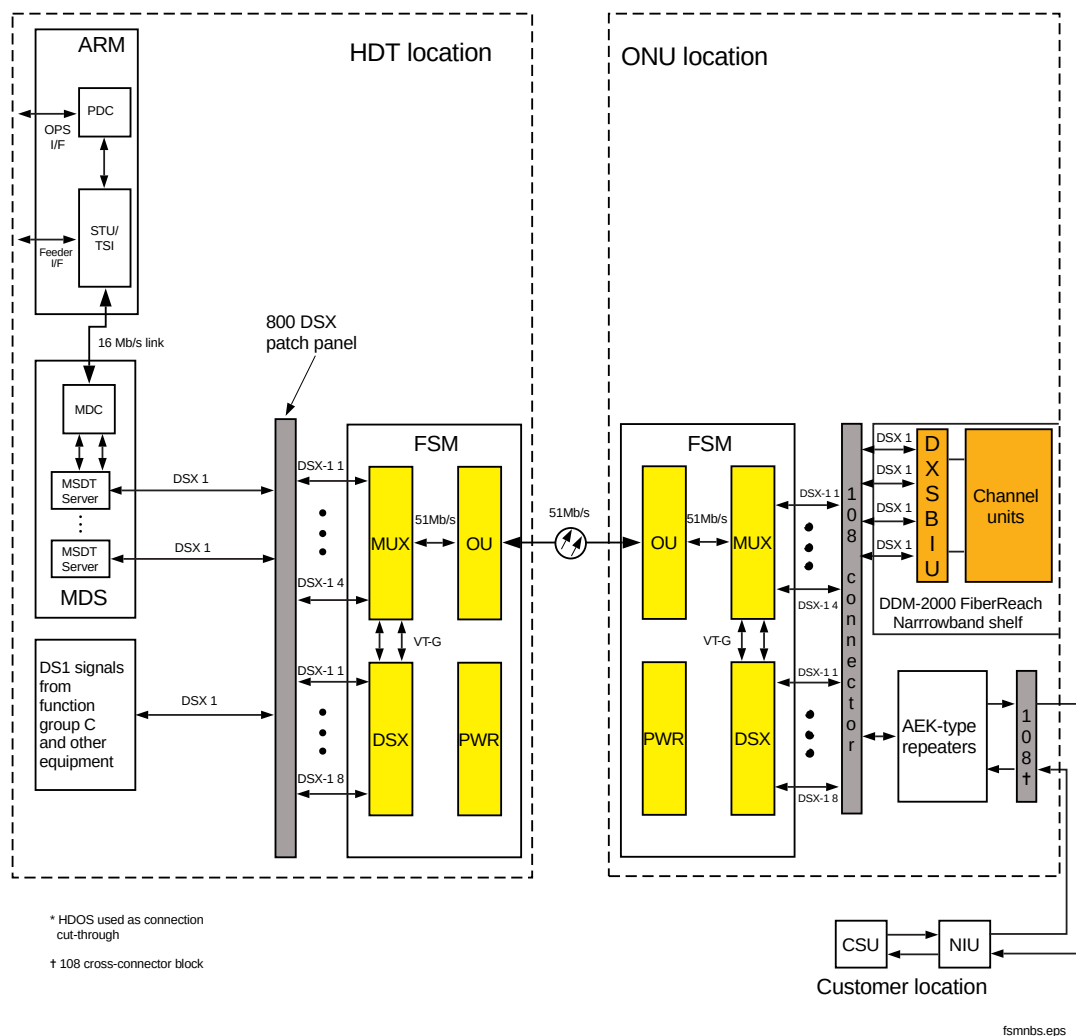


**Figure D-2. Block Diagram of the Fiber Service Module (FSM) in a Typical HDT-to-NBS Arrangement**



## Physical Description

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### FSM Assembly

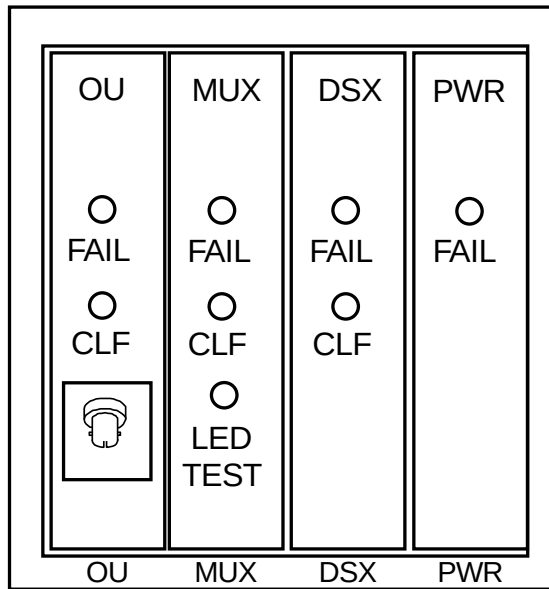
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The FSM (Figure D-3) is made up of the following circuit packs:

- **PWR circuit pack (BDJ<sup>®</sup> 241).** This circuit pack supplies the FSM with  $\pm 5$  volts of power.
- **MUX circuit pack (BDJ243).** This circuit pack multiplexes four DSX-1 signals and two VT-G groups into a 51.84-Mb/s bit stream. At the HDT site, the MUX circuit pack can either interface DSX-1 signals from the MSDT or DT Servers in the SLC-2000 MDS assembly or DSX-1 signals from other equipment such as function group C to the OU circuit pack. At the ONU site, it interfaces between the OU circuit pack and the following:
  - **SLC-2000 MSDT:** DST circuit pack
  - **DDM-2000 FiberReach Narrowband Shelf:** DSXBIU circuit pack
  - **T1 Facility to Customer Equipment:** AEK-type repeater.
- **DSX circuit pack (BDJ242).** This circuit pack multiplexes eight DSX-1 signals into two VT-G DS1 groups. The VT-G groups are then sent to the MUX circuit pack to be multiplexed into a 51.84-Mb/s bit stream.
- **OU circuit pack (BDJ244).** This circuit pack performs the electrical-to-optical and optical-to-electrical conversions. It provides a single-fiber bidirectional optical interface between the FSM at the HDT site and the FSM at the ONU site.

The FSM also provides the following options and features:

- **Fault and Alarm Indications.** The FSM provides local LED fault indication and a summary alarm contact closure.
- **DSX-1 Line Failure.** The FSM transmits AIS (alarm indication signal) alarm indication when receive DSX-1 line failure is detected.
- **FSM Without the DSX Circuit Pack.** You can install the FSM without the DSX circuit pack (that interfaces eight DSX-1s) and still provide four DSX-1 fiber link transmission.
- **DSX-1 Repeater Shelf at ONU Site.** At the ONU site, the FSM also works with a DSX-1 repeater shelf for spans up to 1.5 kft (22 AWG PIC cable).
- **Cabling Options.** Cabling options are provided for new or retrofit installations of multiple FSMs at the RT/HDT.



*fsm packs.eps*

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**Figure D-3. FSM with Circuit Packs**

## FSM Arrangement in the HDT

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Figure D-4 shows the recommended arrangement of the FSM at the HDT. The following equipment at the HDT is associated with the FSM:

- **Fiber Service Shelf (FSS).** The FSM is located in the *fiber service shelf*. The fiber service shelf is located in the *SLC-2000* HDT bay and contains up to six FSMs. Since each FSM can support up to 12 DSX-1 signals, the fiber service shelf can support up to 72 DSX-1 signals. These DSX-1 signals can be a mix of VF circuits from the *SLC-2000* function group A and DS1s either from function group C or from other equipment (like an add/drop multiplexer and/or a digital cross-connect system).
- **HDOS AYB7 Cut-through Board (CTB).** The FSM functionally replaces the OU in the HDOS assembly when the HDT is hosting a *SLC-2000* MSDT ONU. When the FSM receives a DSX-1 signal from a Server in the MDS assembly, the signal must pass through a *cut-through board* in the HDOS assembly when the HDOS is used. The cut-through board passes the signal between the Server and the FSM without changing its characteristics. You must physically wire the connections between the AYB7 CTB and the DSX-1 patch panel block.



**NOTE:**

The CTB is not used when the MDS shelf connects directly to the DSX-1 panel.

- **Auxiliary Fuse Panel.** The FSMs at the HDT require an *auxiliary fuse panel* to provide a –48 volt feeder to power the FSMs. Lucent Technologies recommends a 1 amp fuse for each card cage.
- **DSX-1 Patch Panel.** This panel interfaces between the FSM and the source of the DSX-1 signal — usually either the MSDT or DT Server or function group C.

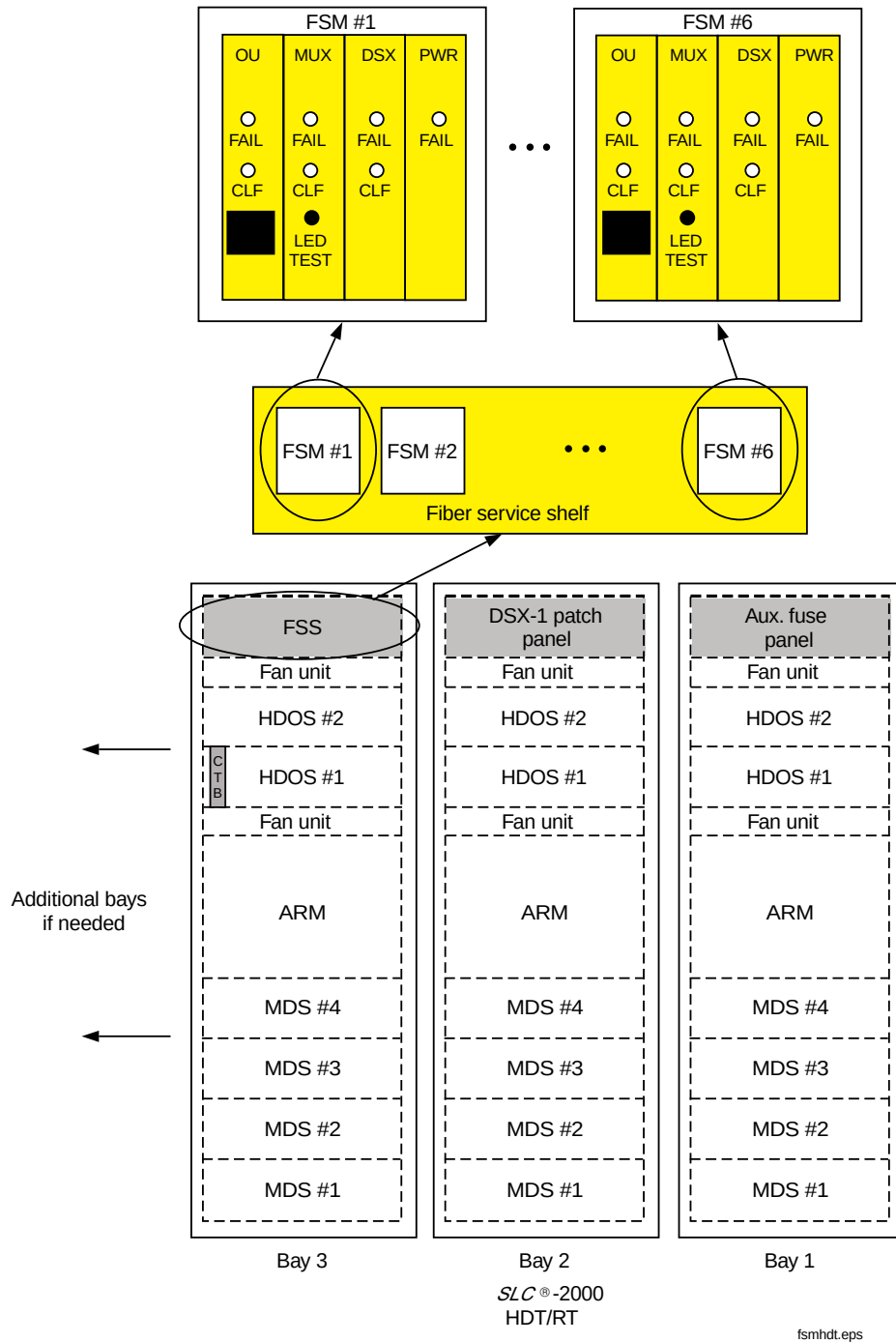
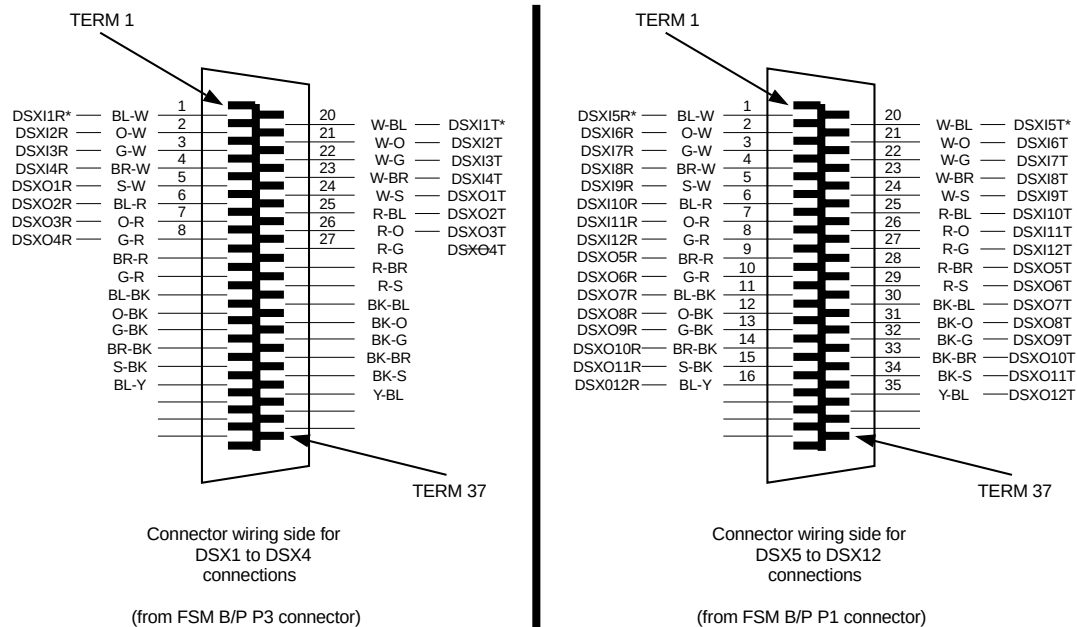


**Figure D-4. Recommended FSM Arrangement in the HDT**

Figure D-5 shows the color code and DSX-1 designation of each of the 12 DSX-1 circuits from the FSM to a DSX-1 patch panel for cables J6 and J7.



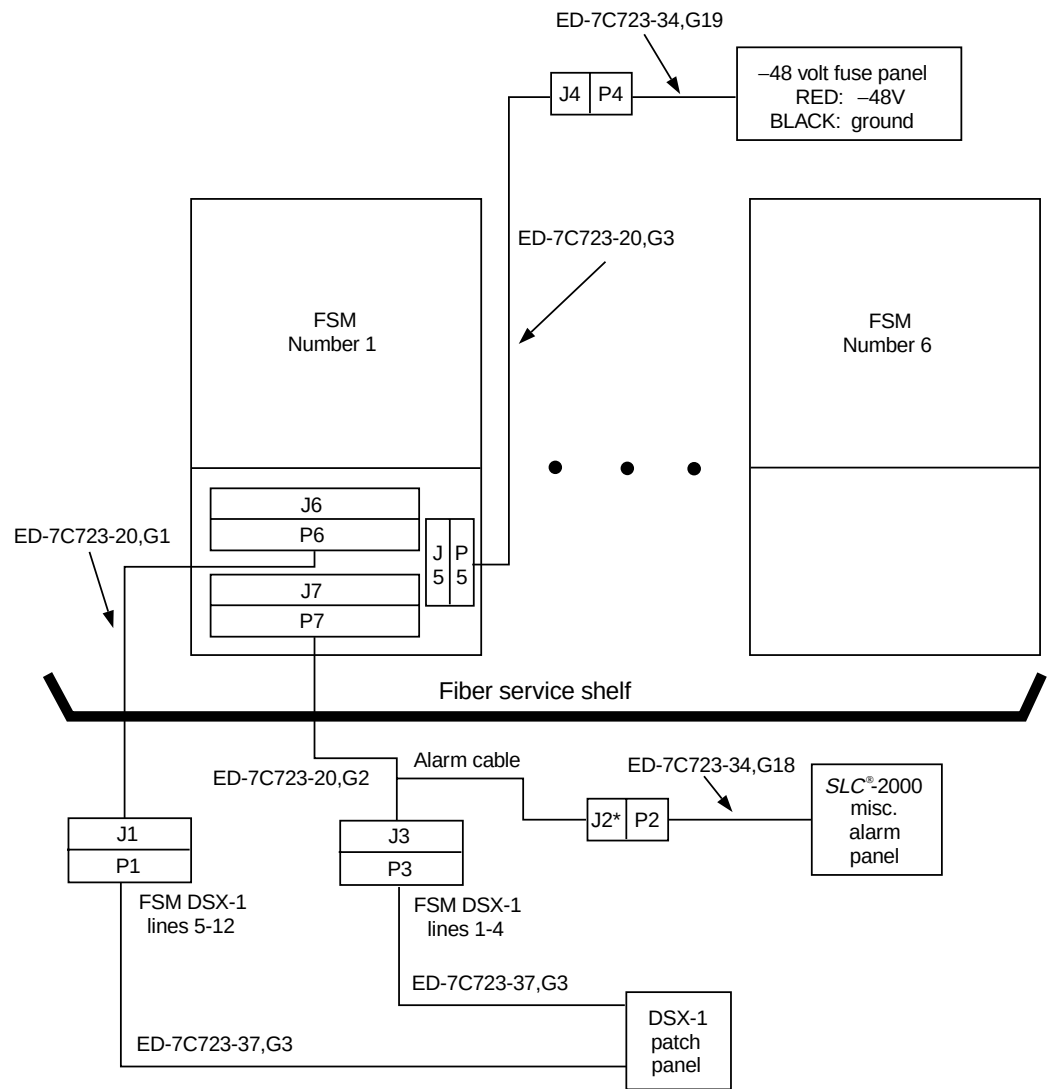
\* Use the following pin designation examples:

- DSXI1R is DSX1 input 1 Ring
- DSXI1T is DSX1 input 1 Tip
- DSXI1R is DSX1 output 1 Ring
- DSXI1T is DSX1 output 1 Tip
- etc.

fmdtcon.eps

**Figure D-5. FSM DSX-1 Wiring Diagram at HDT**

Figure D-6 shows the wiring diagram of the FSM at the HDT.



\* For the alarm leads:  
- TLM0C is on lead number 1  
- TLM0 is on lead number 6.

fsmhdtwr.eps

**Figure D-6. FSM Wiring Diagram at HDT**

## FSM Arrangement at the ONU Site

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### Equipment Arrangement for a SLC-2000 MSDT ONU

Figure D-7 shows the FSM equipment at the MSDT site. The following equipment at the MSDT is associated with the FSM:

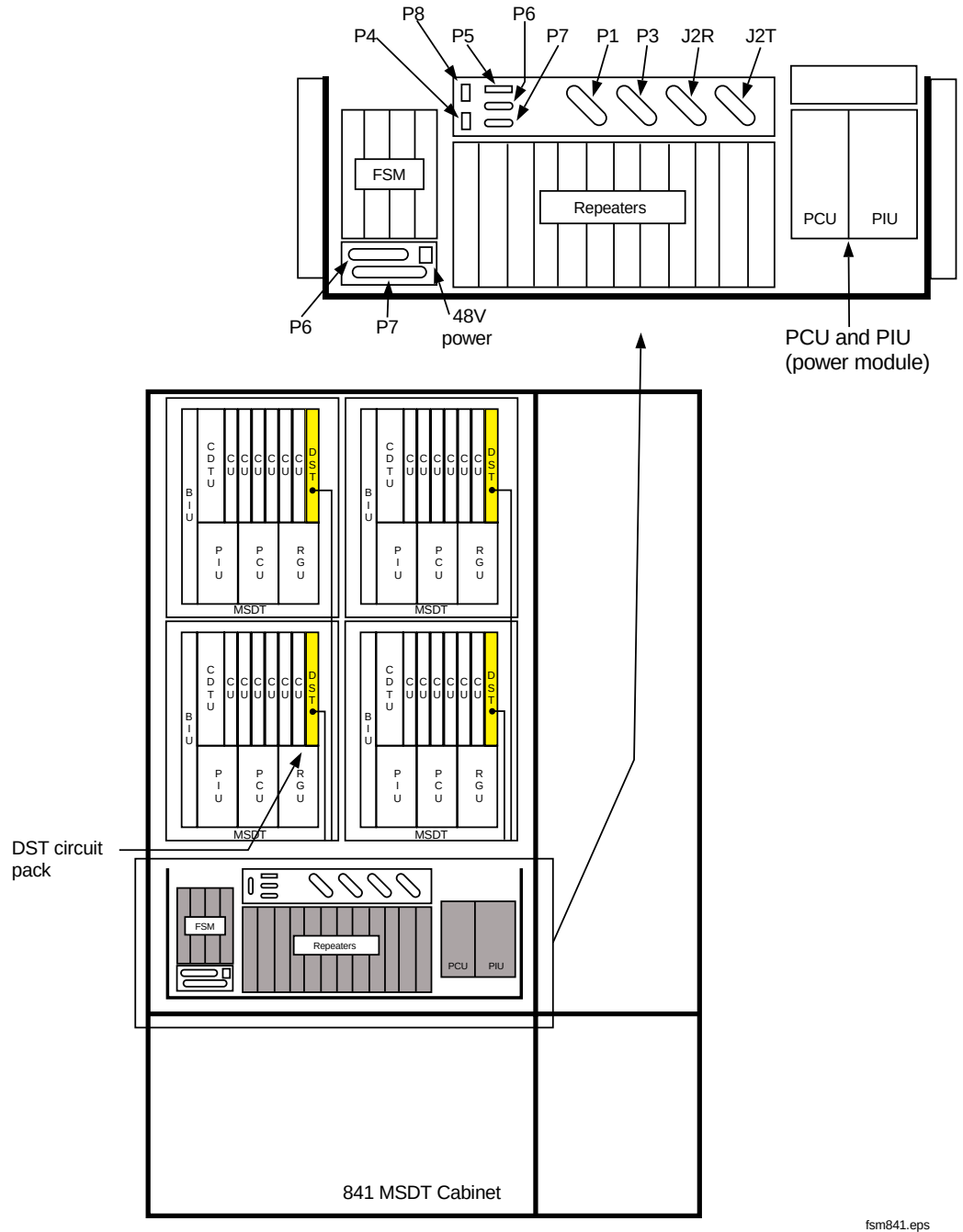
- **841 Cabinet.** The 841 cabinet is an above-ground cabinet that can house up to four MSDTs, the FSM, and repeater equipment.
- **FSM/Repeater/Power Shelf (COMCODE 847367596).** This shelf at the MSDT site houses the following equipment:
  - **FSM Assembly.** This shelf houses the FSM assembly and its four circuit packs.
  - **Repeater Cage containing the AEK-type Repeaters.** Up to 12 AEK-type repeaters allow the FSM to interface DSX-1 signal cable for spans up to 1.5 kft (22 AWG PIC cable).
  - **Power Cage containing the Power Converter Unit (PCU) and Power Interface Unit (PIU).** The PCU (AUA422) and PIU (AUA424 or AUA434) provide –48 volts of power to the FSM and the repeaters.



**NOTE:**

Although the AUA434 PIU can be used, Lucent Technologies recommends using the AUA424 PIU when possible.

- **DST Circuit Pack.** The digital signal translator (DST) circuit pack replaces the OU in the MSDT when an FSM is used. It interfaces the DS1 rate signal from the MSDT's BIU with the DSX-1 line from the FSM. The circuit pack descrambles the DS1 signal from the BIU and sends it to the FSM. In the opposite direction, it scrambles the DSX-1 signal from the FSM and sends it to the BIU. It also provides signal level translation.



fsm841.eps

**Figure D-7. FSM Equipment in the 841 MSDT Cabinet**



Figure D-8 shows the T1 lightning protector field, FSM DSX-1 wiring block, repeater DSX-1 wiring block, repeater T1 wiring block, and the feeder distribution panel.

**CAUTION:**

*Lucent Technologies recommends that the wiring of the DSX-1 and T1 blocks be done with twisted pair wire to minimize signal interference.*

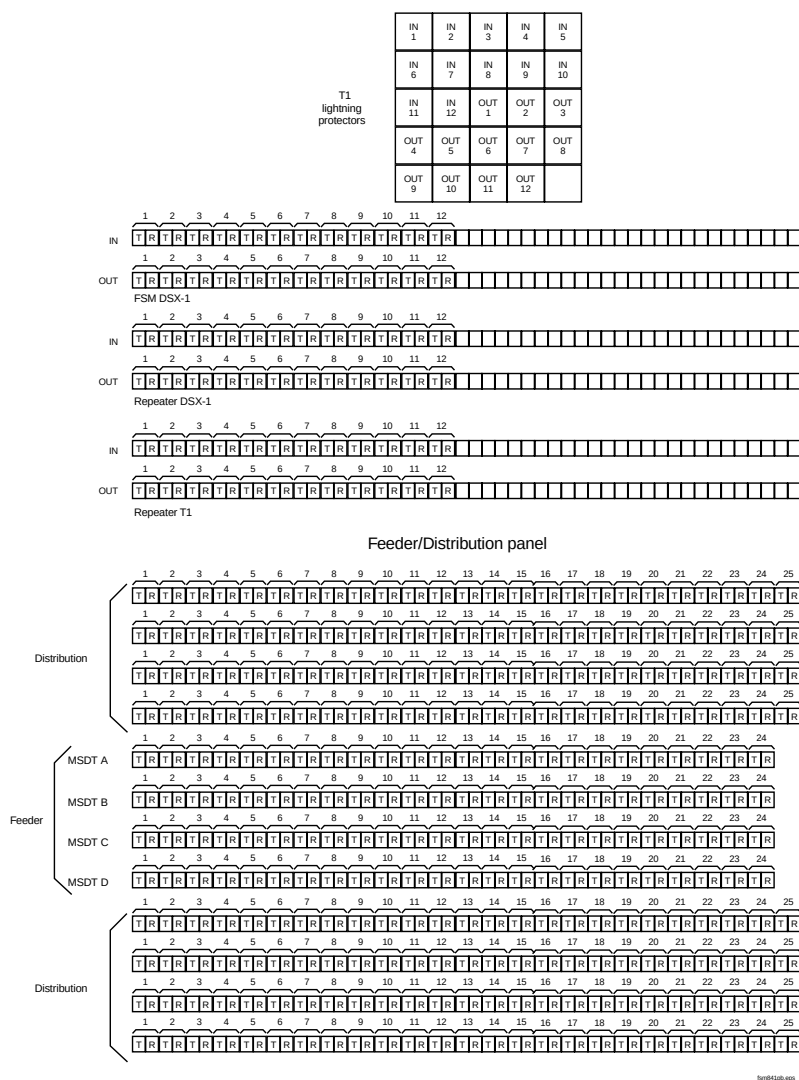
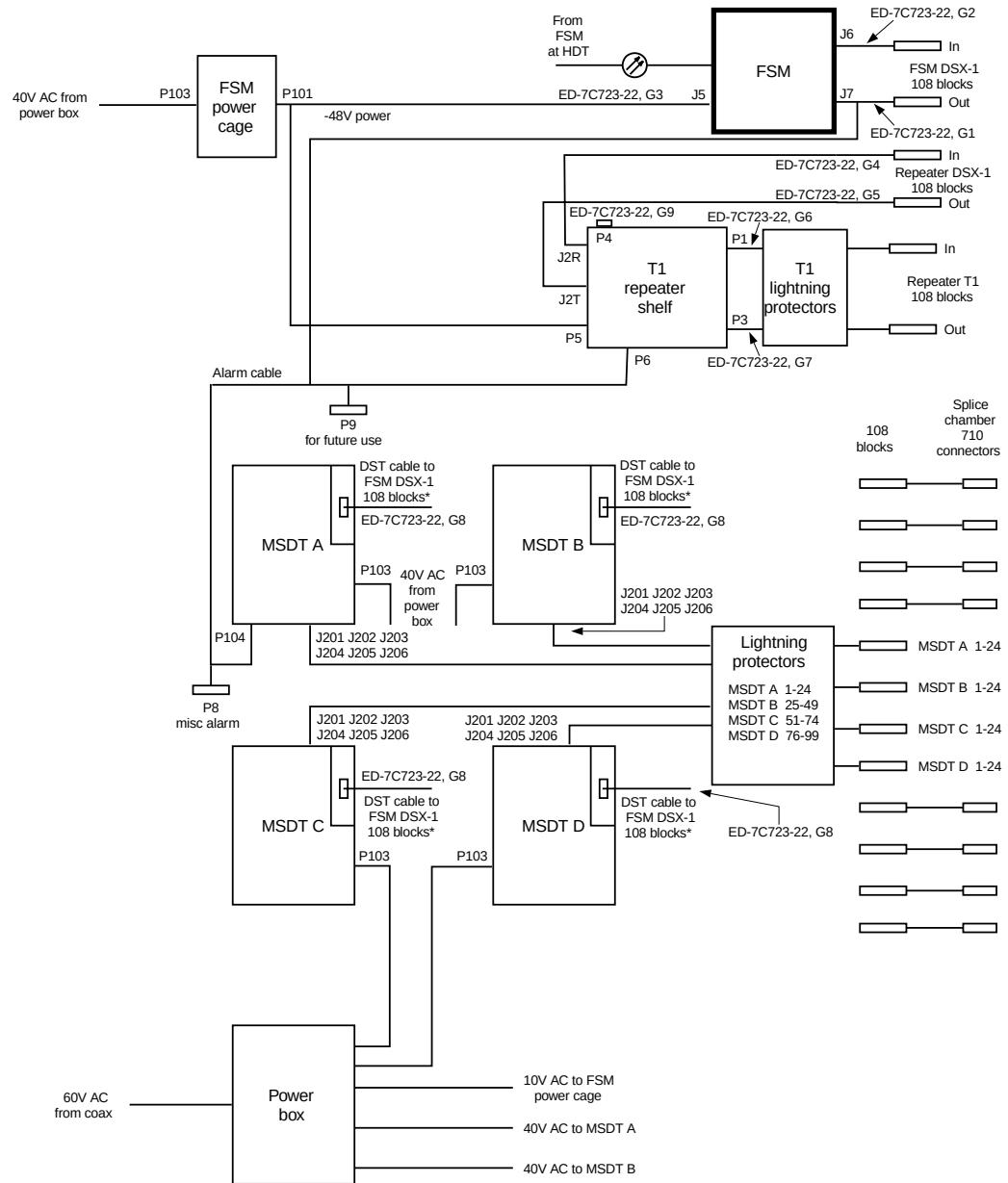


**Figure D-8. FSM Protectors, Wiring Blocks, and Feeder/Distribution Panel in the 841 Cabinet**

Figure D-9 shows the 841/MSDT/FSM cabinet wiring diagram.



fsm841wr.eps

\* See Figure B-9.1 for the connections between the DST circuit pack and the 108 connector.

**Figure D-9. 841/MSDT/FSM Cabinet Wiring Diagram**

Figure D-10 shows the 841/MSDT/FSM repeater shelf assembly wiring diagram.

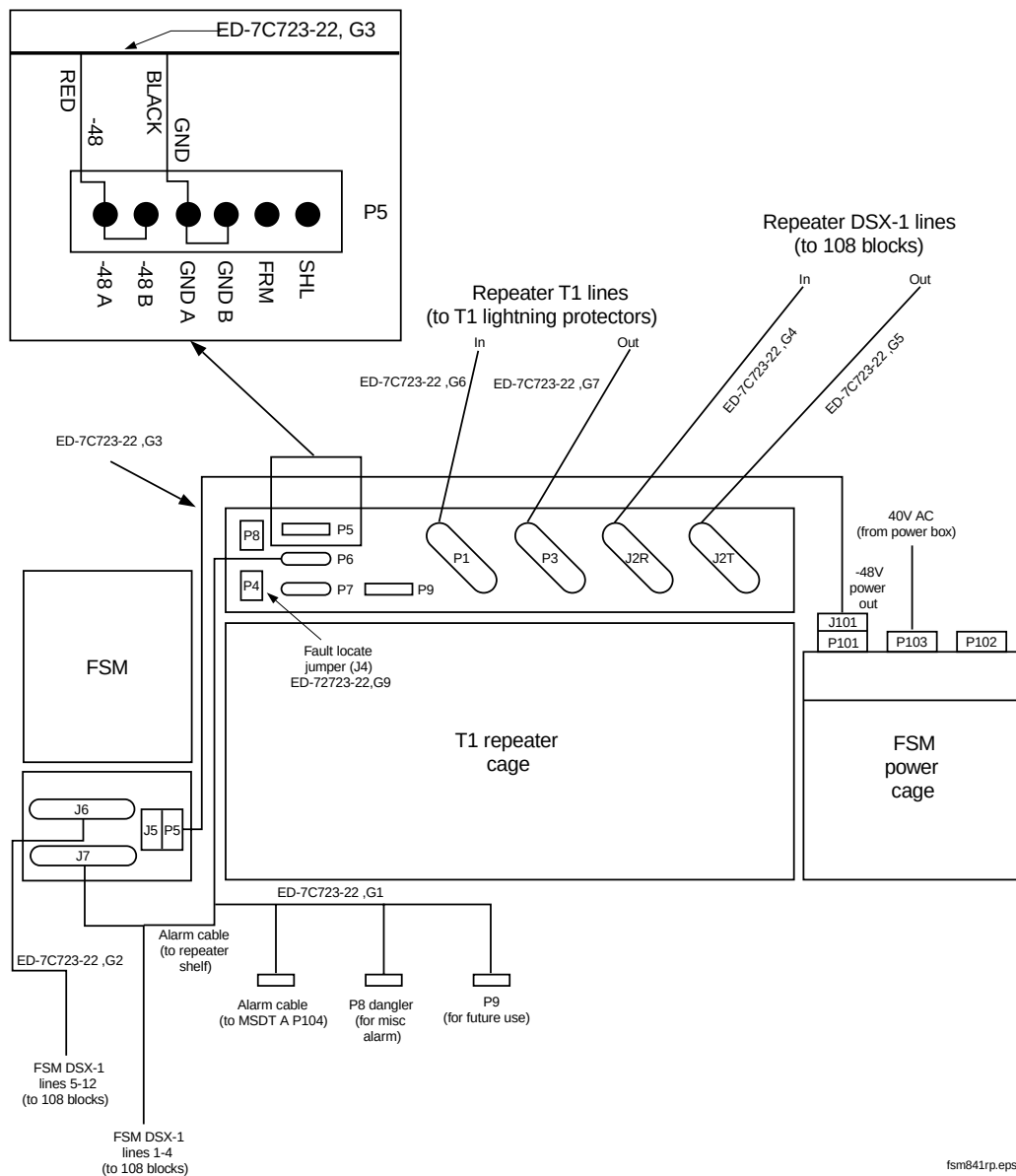


**Figure D-10. 841/MSDT/FSM Repeater Shelf Assembly Wiring Diagram**

### **Equipment Arrangement for a DDM-2000 FiberReach Narrowband Shelf ONU**

For the equipment arrangement when using the FSM to feed a DDM-2000 FiberReach Narrowband Shelf ONU, contact your regional technical assistance center (RTAC) by dialing 1-800-225-RTAC or your Lucent Technologies Account Executive.

### **Alarms**

#### **SLC-2000 MSDT**

In the 841/MSDT/FSM cabinet arrangement, the T1 repeater shelf and the FSM alarms are sent to the HDT by MSDT (A). At the HDT, they can be accessed with the UIP or CIT. This alarm and the door alarm are on the P8 connector that is connected to P104 of MSDT (A). On P104, pins 3 and 4 are for the miscellaneous alarms and pins 1 and 2 are for the door alarm.

#### **DDM-2000 FiberReach Narrowband Shelf**

In the cabinet arrangement containing the NBS, the FSM alarms are sent to the HDT by DSXBIU in the NBS. At the HDT, they can be accessed with the UIP or CIT.

### **FSM COMMON LANGUAGE CLEI\* Codes**

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Table D-1 lists the new FSM *CLEI* codes (and changes to the FITL *CLEI* codes) for the RT/HDT and MSDT shelves, modules, and plug-ins.

For equipment at the DDM-2000 FiberReach Narrowband Shelf ONU, contact your regional technical assistance center (RTAC) by dialing 1-800-225-RTAC or your Lucent Technologies Account Executive.



#### **NOTE:**

When using the SLC-2000 DLC to supply DSX-1 lines from the "C" function group to the FSM, you must order the MXRVO, the BBF1B DS1 low-speed interface card, and the cabling (ED-7C723-37, G1 or G2) that goes from the "C" function group to the DSX-1 patch panel. In addition, you need two cables (ED-7C723-37, G1 or G1) that connect the DSX-1 lines from the FSM to the DSX-1 patch panel.

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\*

COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

**Table D-1. CLEI Codes for FSM Applications**

| Equipment                                                                                                                                 | Description (Note)                      | CLEI* Code     | COMCODE or Drawing Number                      |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------|------------------------------------------------|
| <b><i>In the RT/HDT:</i></b>                                                                                                              |                                         |                |                                                |
| SPQ <sup>®</sup> -808                                                                                                                     | MSDT or DT Server in MDS assy.          | SAIUMBFBAA     | 107063992                                      |
| AUA408 Ser. 2                                                                                                                             | MSDT Server in MDS assy.                | SAIUMB0        | 106275662                                      |
| SPQ809                                                                                                                                    | MSDT or DT Server in MDS assy. (TR-303) | 5SCF40JCAA     | 107345100                                      |
| SPQ810                                                                                                                                    | MSDT or DT Server in MDS assy. (TR-303) | LFMAEKOAMA     | J1C265AC-1L3                                   |
| HDOS                                                                                                                                      | HDOS assembly                           | SAIUN90BAA     | 107287435                                      |
| AYB7                                                                                                                                      | HDOS cut-through board (CTB)            | SAMYABABAA     | 847528403                                      |
| FSS                                                                                                                                       | Fiber service shelf                     | —              | ED-7C723-37, G2 (150 feet)                     |
| Cabling                                                                                                                                   | FSM DSX-1 cable to DSX                  | SAMA290AMA     | 601783343                                      |
| FSM (with cables)                                                                                                                         | Fiber service module (with cable)       | —              | ED-7C723-37, G1 (75 feet)                      |
| Cabling                                                                                                                                   | FSM DSX-1 cable to DSX                  | SNCM4A2AAA     | 106439409                                      |
| BBG2                                                                                                                                      | MXRV0                                   | SNCLA70AAA     | 106543606                                      |
| BBF1B                                                                                                                                     | Low-speed DS1 interface                 |                |                                                |
| <b><i>841 Cabinet:</i></b>                                                                                                                |                                         |                |                                                |
| 4 MSDTs, 4 Fiber jumper cables (No FSM)                                                                                                   |                                         | F04OH0255      | 107276412                                      |
| 4 MSDTs, 5 Fiber jumper cables (with FSM)                                                                                                 |                                         | F95OH0012      | 107500811                                      |
| 4 MSDTs, 1 Fiber jumper cable (with FSM)                                                                                                  |                                         | F94OH0013      | 107500829                                      |
| FSM/Repeater/Power Shelf                                                                                                                  |                                         | —              | 847367596                                      |
| <b><i>In the MSDT:</i></b>                                                                                                                |                                         |                |                                                |
| FSM (without cables)                                                                                                                      | Fiber service module                    | —              | ED-7C723-21, G1                                |
| MSDT                                                                                                                                      | Enhanced MSDT assembly                  | To be provided | To be provided                                 |
| BYB7                                                                                                                                      | MSDT DST pack (for the FSM)             | SAIUNH0BAA     | 107287401                                      |
| MC97780A1 I3:3                                                                                                                            | MSDT BIU                                | 5SCT42BAAA     | 107129363                                      |
| FHA2 MC97793A1                                                                                                                            | MSDT BIU (downloadable, TR303)          | 5SPQACAAAA     | 107255382                                      |
| FHA1 MC97789A1                                                                                                                            | MSDT BIU                                | To be provided | 107163859                                      |
| AUA411 S1:1                                                                                                                               | MSDT CDTU                               | 5SPQAA3AAA     | 106275696                                      |
| AUA411B                                                                                                                                   | MSDT CDTU (TR-303)                      | To be provided | 107431579                                      |
| AUA413 S1:2                                                                                                                               | MSDT RGU                                | 5SPQ10SAAB     | 106275977                                      |
| AUA424                                                                                                                                    | MSDT PIU                                | 5SPQABX        | 107086407                                      |
| AUA434                                                                                                                                    | MSDT PIU (60V)                          | 5SPQACBAAA     | 107248965                                      |
| AUA417 S1:1                                                                                                                               | MSDT PCU                                | 5SPQAA1AAA     | 106436504                                      |
| AUA422 S1:1                                                                                                                               | MSDT PCU                                | 5SPQABWAAA     | 107086399                                      |
| AUA423 S1:1                                                                                                                               | MSDT RGU                                | 5SPQABLAAA     | 106835598                                      |
| —                                                                                                                                         | Repeater shelf                          | T1M1KC0ARA     | ED-8C730-31, G2<br>(Part number 007-00504-000) |
| <b><i>FSM circuit packs (in the RT/HDT and MSDT):</i></b>                                                                                 |                                         |                |                                                |
| BDJ241 S1:1                                                                                                                               | FSM PWR pack                            | SAIUNJ0BAA     | 107287351                                      |
| BDJ242 S1:1                                                                                                                               | FSM DSX pack                            | SAIUNK0BAA     | 107287369                                      |
| BDJ243 S1:1                                                                                                                               | FSM MUX pack                            | SAIUNL0BAA     | 107287377                                      |
| BDJ244 S1:1                                                                                                                               | FSM OU pack                             | SAIUNM0BAA     | 107287385                                      |
| <b>Note:</b> Some plug-ins have switch settings that may be set by Operations Systems; data sheets for those plug-ins are to be provided. |                                         |                |                                                |
| * COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.           |                                         |                |                                                |

## **FSM Installation and Acceptance**

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Refer to 363-205-004, *SLC-2000 Multi-Services Distant Terminal Feature, User/Service and Ordering Manual*, for detailed information on turn-up and end-to-end acceptance when using the FSM to feed a *SLC-2000* MSDT ONU.

For detailed information on turn-up and end-to-end acceptance when using the FSM to feed a *DDM-2000* FiberReach Narrowband Shelf ONU, contact your regional technical assistance center (RTAC) by dialing 1-800-225-RTAC or your Lucent Technologies Account Executive.

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# Glossary

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## A

|                 |                                                                                                           |
|-----------------|-----------------------------------------------------------------------------------------------------------|
| <b>ABN</b>      | <b>abnormal</b>                                                                                           |
| <b>ACD</b>      | <b>automatic call distribution</b>                                                                        |
| <b>ACO</b>      | <b>alarm cutoff</b>                                                                                       |
| <b>ADM</b>      | <b>add-drop multiplex</b>                                                                                 |
| <b>AID</b>      | <b>access identifiers</b>                                                                                 |
| <b>AIS</b>      | <b>alarm indication signal</b>                                                                            |
| <b>AIU</b>      | <b>access interface unit</b>                                                                              |
| <b>ALC</b>      | <b>automatic loss compensation</b>                                                                        |
| <b>ALIC5</b>    | <b>analog line cutover to integrated <i>SLC</i><sup>®</sup> carrier at <i>5ESS</i><sup>®</sup> switch</b> |
| <b>ALIT</b>     | <b>automatic line insulation testing</b>                                                                  |
| <b>AMI</b>      | <b>alternate mark inversion</b>                                                                           |
| <b>AMU</b>      | <b>analog measurement unit</b>                                                                            |
| <b>ANI</b>      | <b>automatic number identification</b>                                                                    |
| <b>APOG</b>     | <b>applications, planning, and ordering guide</b>                                                         |
| <b>APS</b>      | <b>automatic protection switch</b>                                                                        |
| <b>ARM</b>      | <b>access resource manager</b>                                                                            |
| <b>AS&amp;C</b> | <b>alarm, status, and control</b>                                                                         |
| <b>ASCII</b>    | <b>American standard code for information interchange</b>                                                 |
| <b>ASK</b>      | <b>amplitude shift keyed</b>                                                                              |
| <b>ATU</b>      | <b>alarm and test unit</b>                                                                                |
| <b>AUTO</b>     | <b>automatic</b>                                                                                          |

---

## **B**

|              |                                                    |
|--------------|----------------------------------------------------|
| <b>BER</b>   | <b>bit error rate</b>                              |
| <b>BIP</b>   | <b>bit interleaved parity</b>                      |
| <b>BITS</b>  | <b>building integrated timing supply</b>           |
| <b>BIU</b>   | <b>bank interface unit</b>                         |
| <b>BMC</b>   | <b>bandwidth management complex</b>                |
| <b>BMP</b>   | <b>bandwidth management processor</b>              |
| <b>BP</b>    | <b>bulk power</b>                                  |
| <b>BPP</b>   | <b>bypass pair</b>                                 |
| <b>BRCS</b>  | <b>business and residence customer services</b>    |
| <b>BRI</b>   | <b>basic rate interface</b>                        |
| <b>BRITE</b> | <b>basic rate interface transmission extension</b> |
| <b>BRT</b>   | <b>business remote terminal</b>                    |
| <b>BWM</b>   | <b>broadcast warning message</b>                   |

---

## **C**

|               |                                                                     |
|---------------|---------------------------------------------------------------------|
| <b>CATV</b>   | <b>cable television</b>                                             |
| <b>CATV</b>   | <b>community antenna television</b>                                 |
| <b>CAU</b>    | <b>craft access unit</b>                                            |
| <b>CC</b>     | <b>clear channel</b>                                                |
| <b>CCITT</b>  | <b>International Telephone and Telegraph Consultative Committee</b> |
| <b>CD-ROM</b> | <b>compact disk — read only memory</b>                              |
| <b>CDTU</b>   | <b>channel and drop test unit</b>                                   |
| <b>CEV</b>    | <b>controlled environment vault</b>                                 |
| <b>CF</b>     | <b>current feed</b>                                                 |
| <b>CIR</b>    | <b>customer information release</b>                                 |



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|                 |                                                         |
|-----------------|---------------------------------------------------------|
| <b>CIT</b>      | <b>craft interface terminal</b>                         |
| <b>CIU</b>      | <b>craft interface unit</b>                             |
| <b>CLF</b>      | <b>clear line failure</b>                               |
| <b>CM</b>       | <b>communication module</b>                             |
| <b>CMI</b>      | <b>control mode idle</b>                                |
| <b>CMISE</b>    | <b>common management information service element</b>    |
| <b>CMOS</b>     | <b>complementary-symmetry metal oxide semiconductor</b> |
| <b>CNAM</b>     | <b>calling name delivery</b>                            |
| <b>CND</b>      | <b>calling number delivery</b>                          |
| <b>CO</b>       | <b>central office</b>                                   |
| <b>COACH</b>    | <b>customized on-line aid for customer help</b>         |
| <b>COFA</b>     | <b>change of frame alignment</b>                        |
| <b>COMCATS</b>  | <b>computerized catalog system</b>                      |
| <b>COMPCLK</b>  | <b>composite clock</b>                                  |
| <b>COSMOS</b>   | <b>computer system for main frame operations system</b> |
| <b>COT</b>      | <b>central office terminal</b>                          |
| <b>CPC</b>      | <b>circuit provisioning center</b>                      |
| <b>CPE</b>      | <b>customer premises equipment</b>                      |
| <b>CPI</b>      | <b>calling party identification</b>                     |
| <b>CR</b>       | <b>critical</b>                                         |
| <b>CRC</b>      | <b>cyclic redundancy code</b>                           |
| <b>CRV</b>      | <b>call reference value</b>                             |
| <b>CS</b>       | <b>current sink</b>                                     |
| <b>CSA</b>      | <b>carrier serving area</b>                             |
| <b>CSC</b>      | <b>common signaling channel</b>                         |
| <b>CS&amp;O</b> | <b>customer support and operations</b>                  |
| <b>CSS</b>      | <b>controlled slip seconds</b>                          |
| <b>CTU</b>      | <b>channel test unit</b>                                |

---

|             |                                  |
|-------------|----------------------------------|
| <b>CU</b>   | <b>channel unit</b>              |
| <b>CUR</b>  | <b>catalog update release</b>    |
| <b>CV</b>   | <b>coding violation</b>          |
| <b>CVFE</b> | <b>coding violations far end</b> |

---

## **D**

|             |                                            |
|-------------|--------------------------------------------|
| <b>DA</b>   | <b>discontinued availability</b>           |
| <b>DACS</b> | <b>Digital Access Cross-Connect System</b> |
| <b>DCB</b>  | <b>dual channel bank</b>                   |
| <b>DCC</b>  | <b>data communications channel</b>         |
| <b>DCE</b>  | <b>data circuit-terminating equipment</b>  |
| <b>DCLU</b> | <b>digital carrier line unit</b>           |
| <b>DDS</b>  | <b>Digital Data System</b>                 |
| <b>DID</b>  | <b>direct inward dial</b>                  |
| <b>DLC</b>  | <b>digital loop carrier</b>                |
| <b>DLTU</b> | <b>digital line trunk unit</b>             |
| <b>DM</b>   | <b>degraded minutes</b>                    |
| <b>DNO</b>  | <b>dynamic network operations</b>          |
| <b>DP</b>   | <b>dataport or dial pulse</b>              |
| <b>DPLL</b> | <b>digital phase-locked loop</b>           |
| <b>DPO</b>  | <b>dial pulse originating</b>              |
| <b>DPT</b>  | <b>dial pulse terminate</b>                |
| <b>DS0</b>  | <b>digital signal level zero</b>           |
| <b>DSL</b>  | <b>digital subscriber line</b>             |
| <b>DST</b>  | <b>digital signal translator</b>           |
| <b>DSU</b>  | <b>data services unit</b>                  |
| <b>DT</b>   | <b>distant terminal</b>                    |
| <b>DTE</b>  | <b>data terminal equipment</b>             |
| <b>DX</b>   | <b>duplex signaling</b>                    |

---

## **E**

|                |                                               |
|----------------|-----------------------------------------------|
| <b>EBS</b>     | <b>enhanced business services</b>             |
| <b>EC-1</b>    | <b>electrical carrier level 1</b>             |
| <b>EC-3</b>    | <b>electrical carrier level 3</b>             |
| <b>ECCR</b>    | <b>exchange customer cable record</b>         |
| <b>ECI</b>     | <b>equipment catalog item</b>                 |
| <b>EHG</b>     | <b>equipment hierarchy generator</b>          |
| <b>EIA</b>     | <b>electronic industries association</b>      |
| <b>EMC</b>     | <b>electromagnetic compliance</b>             |
| <b>EML</b>     | <b>element manager layer</b>                  |
| <b>EOC</b>     | <b>embedded operations channel</b>            |
| <b>EPROM</b>   | <b>erasable programmable read-only memory</b> |
| <b>ES</b>      | <b>errored seconds</b>                        |
| <b>ESA</b>     | <b>errored seconds type A</b>                 |
| <b>ESB</b>     | <b>errored seconds type B</b>                 |
| <b>ESD</b>     | <b>electrostatic discharge</b>                |
| <b>ESF</b>     | <b>extended super frame</b>                   |
| <b>ESF/ndl</b> | <b>extended super frame/new data link</b>     |
| <b>ETO</b>     | <b>equalized transmission only</b>            |
| <b>EXR</b>     | <b>extended range</b>                         |

---

## **F**

|             |                                               |
|-------------|-----------------------------------------------|
| <b>FACS</b> | <b>facility assignment and control system</b> |
| <b>FAX</b>  | <b>facsimile</b>                              |
| <b>FCC</b>  | <b>Federal Communications Commission</b>      |
| <b>FDI</b>  | <b>feeder distribution interface</b>          |

---

|             |                                       |
|-------------|---------------------------------------|
| <b>FE</b>   | <b>far end</b>                        |
| <b>FEBE</b> | <b>far-end-block-error</b>            |
| <b>FELP</b> | <b>far-end loopback</b>               |
| <b>FERF</b> | <b>far-end receive failure</b>        |
| <b>FITL</b> | <b>Fiber-in-the-Loop</b>              |
| <b>FLT</b>  | <b>fault</b>                          |
| <b>FPD</b>  | <b>floor plan data</b>                |
| <b>FSK</b>  | <b>frequency shift keying</b>         |
| <b>FSM</b>  | <b>fiber service module</b>           |
| <b>FSR</b>  | <b>frequency selective ringing</b>    |
| <b>FSS</b>  | <b>fiber service shelf</b>            |
| <b>FWHM</b> | <b>full width at half maximum</b>     |
| <b>FX</b>   | <b>foreign exchange</b>               |
| <b>FXO</b>  | <b>foreign exchange — office end</b>  |
| <b>FXS</b>  | <b>foreign exchange — station end</b> |

---

## **G**

|            |                                |
|------------|--------------------------------|
| <b>GNE</b> | <b>gateway network element</b> |
| <b>GS</b>  | <b>ground start</b>            |

---

## **H**

|             |                                  |
|-------------|----------------------------------|
| <b>HDBH</b> | <b>high day busy hour</b>        |
| <b>HDOS</b> | <b>high density optics shelf</b> |
| <b>HDT</b>  | <b>host digital terminal</b>     |
| <b>HX</b>   | <b>heat exchange</b>             |

---

## **I**

|                |                                                              |
|----------------|--------------------------------------------------------------|
| <b>IAO-LAN</b> | <b>Intra-Office Local Area Network</b>                       |
| <b>IC</b>      | <b>internal clock</b>                                        |
| <b>ICA</b>     | <b>initial customer application</b>                          |
| <b>ICLID</b>   | <b>incoming call line identification</b>                     |
| <b>IDCU</b>    | <b>integrated digital carrier unit</b>                       |
| <b>IDT</b>     | <b>integrated digital terminal</b>                           |
| <b>IMF</b>     | <b>infant mortality factor</b>                               |
| <b>INA</b>     | <b>integrated network access</b>                             |
| <b>INAP</b>    | <b>individual network access password</b>                    |
| <b>IO</b>      | <b>input/output</b>                                          |
| <b>ISO</b>     | <b>international organization for standardization</b>        |
| <b>IR</b>      | <b>information release</b>                                   |
| <b>IS</b>      | <b>in-service</b>                                            |
| <b>IS-3</b>    | <b>interconnect signal-level 3</b>                           |
| <b>ISDN</b>    | <b>integrated services digital network</b>                   |
| <b>ITH</b>     | <b>integral test head</b>                                    |
| <b>ITM SNC</b> | <b>integrated transport management subnetwork controller</b> |
| <b>ITS</b>     | <b>integrated test system</b>                                |
| <b>ITU</b>     | <b>international telecommunications union</b>                |
| <b>IXC</b>     | <b>interexchange carrier</b>                                 |

---

## **L**

|             |                                               |
|-------------|-----------------------------------------------|
| <b>LAC</b>  | <b>loop assignment center</b>                 |
| <b>LAN</b>  | <b>link to alarms and network</b>             |
| <b>LAPD</b> | <b>link access protocol for the D-channel</b> |

---

|              |                                                |
|--------------|------------------------------------------------|
| <b>LASS</b>  | <b>local area signaling services</b>           |
| <b>LDS</b>   | <b>local digital switch</b>                    |
| <b>LEC</b>   | <b>local exchange carrier</b>                  |
| <b>LED</b>   | <b>light-emitting diode</b>                    |
| <b>LEIM</b>  | <b>loop electronics inventory module</b>       |
| <b>LFACS</b> | <b>loop facility assignment control system</b> |
| <b>LIC</b>   | <b>lightguide interconnection cable</b>        |
| <b>LIU</b>   | <b>line interface unit</b>                     |
| <b>LOF</b>   | <b>loss of frame</b>                           |
| <b>LOP</b>   | <b>loss of pointer</b>                         |
| <b>LOS</b>   | <b>loss of signal</b>                          |
| <b>LS</b>    | <b>loop start</b>                              |
| <b>LSAS</b>  | <b>line-side answer supervision</b>            |
| <b>LT</b>    | <b>line termination</b>                        |
| <b>LTF</b>   | <b>line test fanout</b>                        |
| <b>LTS</b>   | <b>line terminal status</b>                    |

---

## **M**

|              |                                                     |
|--------------|-----------------------------------------------------|
| <b>MAN</b>   | <b>metropolitan area network</b>                    |
| <b>MCC</b>   | <b>master control center</b>                        |
| <b>MCC</b>   | <b>master control center (terminal)</b>             |
| <b>MDC</b>   | <b>material distribution center</b>                 |
| <b>MDC</b>   | <b>metallic distribution controller</b>             |
| <b>MDS</b>   | <b>metallic distribution shelf</b>                  |
| <b>MEA</b>   | <b>mismatch of equipment and attributes (state)</b> |
| <b>MJ</b>    | <b>major</b>                                        |
| <b>ML</b>    | <b>marketing information letter</b>                 |
| <b>MLT</b>   | <b>mechanized loop testing</b>                      |
| <b>MN</b>    | <b>minor</b>                                        |
| <b>MOR</b>   | <b>maintenance/operations release</b>               |
| <b>MPP</b>   | <b>miscellaneous pair panel</b>                     |
| <b>MR</b>    | <b>modification request</b>                         |
| <b>MSDT</b>  | <b>multi-services distant terminal</b>              |
| <b>MTAU</b>  | <b>metallic test access unit</b>                    |
| <b>MTBF</b>  | <b>mean time between failure</b>                    |
| <b>MTIE</b>  | <b>maximum time interval error</b>                  |
| <b>MWI</b>   | <b>message waiting indication</b>                   |
| <b>MXRVO</b> | <b>VT to STS-1 multiplexer</b>                      |

---

## **N**

|            |                                  |
|------------|----------------------------------|
| <b>NBS</b> | <b>narrowband shelf</b>          |
| <b>NCI</b> | <b>network channel interface</b> |
| <b>NE</b>  | <b>near end</b>                  |



---

|             |                                            |
|-------------|--------------------------------------------|
| <b>NE</b>   | <b>network element</b>                     |
| <b>NEBS</b> | <b>network equipment building services</b> |
| <b>NEC</b>  | <b>national electric code</b>              |
| <b>NLS</b>  | <b>non-locally-switched</b>                |
| <b>NMON</b> | <b>not monitored</b>                       |
| <b>NP</b>   | <b>network planning letter</b>             |
| <b>NS</b>   | <b>nonswitched</b>                         |
| <b>NSDB</b> | <b>network services database</b>           |
| <b>NT</b>   | <b>network termination</b>                 |
| <b>NT1</b>  | <b>network termination - layer 1</b>       |

---

## **O**

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| <b>OAM&amp;P</b>   | <b>operations, administration, maintenance, and provisioning</b> |
| <b>OC-1</b>        | <b>optical carrier level 1</b>                                   |
| <b>OC-3</b>        | <b>optical carrier level 3</b>                                   |
| <b>OC-12</b>       | <b>optical carrier level 12</b>                                  |
| <b>OCU</b>         | <b>office channel unit</b>                                       |
| <b>OE</b>          | <b>office equipment</b>                                          |
| <b>OHCTL</b>       | <b>overhead controller</b>                                       |
| <b>O+T</b>         | <b>originating plus terminating</b>                              |
| <b>OHT</b>         | <b>on-hook transmission</b>                                      |
| <b>OIM</b>         | <b>operations interface module</b>                               |
| <b>OLIU</b>        | <b>optical line interface unit</b>                               |
| <b>ONU</b>         | <b>optical network unit</b>                                      |
| <b>OOS</b>         | <b>out-of-service</b>                                            |
| <b>OOS-MA-AS</b>   | <b>out-of-service, memory administration, assigned</b>           |
| <b>OOS-MT-AUTO</b> | <b>out-of-service maintenance automatic</b>                      |
| <b>OPS</b>         | <b>off premises station</b>                                      |
| <b>OOS-MA-UAS</b>  | <b>out-of-service, memory administration, unassigned</b>         |
| <b>OOS-MT</b>      | <b>out-of-service, maintenance (state)</b>                       |
| <b>OPX</b>         | <b>off premises extension</b>                                    |
| <b>ORB</b>         | <b>office repeater bay</b>                                       |
| <b>OS</b>          | <b>operations system</b>                                         |
| <b>OSEG</b>        | <b>operations systems engineering guide</b>                      |
| <b>OSI</b>         | <b>open systems interconnect</b>                                 |
| <b>OSIA</b>        | <b>operations system impact assessment</b>                       |
| <b>OSIP</b>        | <b>open switching interval protection</b>                        |
| <b>OSP</b>         | <b>outside plant</b>                                             |

---

|             |                                                   |
|-------------|---------------------------------------------------|
| <b>OSPE</b> | <b>outside plant engineering</b>                  |
| <b>OSS</b>  | <b>operations support system</b>                  |
| <b>OTGR</b> | <b>operations technology generic requirements</b> |
| <b>OU</b>   | <b>optical unit</b>                               |

---

## **P**

|               |                                                            |
|---------------|------------------------------------------------------------|
| <b>PAU</b>    | <b>power amplifier unit</b>                                |
| <b>PBX</b>    | <b>private branch exchange</b>                             |
| <b>PC</b>     | <b>personal computer</b>                                   |
| <b>PCLI</b>   | <b>peripheral control link interface</b>                   |
| <b>PCM</b>    | <b>pulse code modulation</b>                               |
| <b>PCU</b>    | <b>power converter unit</b>                                |
| <b>PDC</b>    | <b>provisioning and display controller</b>                 |
| <b>PG</b>     | <b>pair gain</b>                                           |
| <b>PGTC</b>   | <b>pair gain test controller</b>                           |
| <b>PID</b>    | <b>program identification</b>                              |
| <b>PIN</b>    | <b>positive-intrinsic-negative</b>                         |
| <b>PINFET</b> | <b>positive intrinsic negative field effect transistor</b> |
| <b>PIU</b>    | <b>power interface unit</b>                                |
| <b>PLAR</b>   | <b>private line auto ring</b>                              |
| <b>PLR</b>    | <b>pulse link repeater</b>                                 |
| <b>PM</b>     | <b>performance monitoring</b>                              |
| <b>PMN</b>    | <b>power minor</b>                                         |
| <b>POTS</b>   | <b>plain old telephone service</b>                         |
| <b>PRI</b>    | <b>primary rate interface</b>                              |
| <b>PROSE</b>  | <b>product offerings expertise</b>                         |
| <b>PRS</b>    | <b>primary reference source</b>                            |
| <b>PS</b>     | <b>product sheet</b>                                       |
| <b>PSC-L</b>  | <b>protection switch counts—line</b>                       |
| <b>PTS</b>    | <b>Product Training Services</b>                           |
| <b>PTU</b>    | <b>power and test unit</b>                                 |

---

## **Q**

|             |                           |
|-------------|---------------------------|
| <b>QLS</b>  | <b>quad low speed</b>     |
| <b>QMON</b> | <b>quality monitoring</b> |

---

## **R**

|              |                                                   |
|--------------|---------------------------------------------------|
| <b>RAM</b>   | <b>random access memory</b>                       |
| <b>RC/V</b>  | <b>recent change/verify</b>                       |
| <b>RCMAS</b> | <b>recent change memory administration system</b> |
| <b>RDT</b>   | <b>remote digital terminal</b>                    |
| <b>RMU</b>   | <b>remote measurement unit</b>                    |
| <b>ROP</b>   | <b>read only printer</b>                          |
| <b>ROSE</b>  | <b>remote operations service element</b>          |
| <b>RPP</b>   | <b>reliability prediction procedure</b>           |
| <b>RSM</b>   | <b>remote switch module</b>                       |
| <b>RT</b>    | <b>remote terminal</b>                            |
| <b>RTAC</b>  | <b>Regional Technical Assistance Center</b>       |
| <b>RTU</b>   | <b>remote test unit</b>                           |
| <b>RZ</b>    | <b>return-to-zero</b>                             |

---

## **S**

|              |                                              |
|--------------|----------------------------------------------|
| <b>SAC</b>   | <b>service area computer</b>                 |
| <b>SAI</b>   | <b>serving area interface</b>                |
| <b>SARTS</b> | <b>Switched Access Remote Testing System</b> |
| <b>SCCS</b>  | <b>switching control center systems</b>      |
| <b>SCEC</b>  | <b>second channel error correction</b>       |

---

|               |                                                        |
|---------------|--------------------------------------------------------|
| <b>SD</b>     | <b>schematic drawing</b>                               |
| <b>SDE</b>    | <b>synchronization distribution expander</b>           |
| <b>SDH</b>    | <b>synchronous digital hierarchy</b>                   |
| <b>SEFS</b>   | <b>severely errored frame seconds</b>                  |
| <b>SEOs</b>   | <b>single-ended operations</b>                         |
| <b>SES</b>    | <b>severely errored second</b>                         |
| <b>SF</b>     | <b>superframe</b>                                      |
| <b>SM</b>     | <b>switching module</b>                                |
| <b>SMDS</b>   | <b>switched multi-megabit data service</b>             |
| <b>SMU</b>    | <b>system memory unit</b>                              |
| <b>SNC</b>    | <b>subnetwork controller</b>                           |
| <b>SOAC</b>   | <b>service order analysis and control</b>              |
| <b>SONET</b>  | <b>synchronous optical network</b>                     |
| <b>SPE</b>    | <b>synchronous payload envelope</b>                    |
| <b>SQU</b>    | <b>sync quality unknown</b>                            |
| <b>SS</b>     | <b>supervisory system</b>                              |
| <b>STS-1</b>  | <b>synchronous transport signal level 1</b>            |
| <b>STS-1E</b> | <b>synchronous transport signal level 1 electrical</b> |
| <b>STU</b>    | <b>system timing unit</b>                              |
| <b>SYSCtl</b> | <b>system controller</b>                               |

---

## **T**

|               |                                                                      |
|---------------|----------------------------------------------------------------------|
| <b>T8U</b>    | <b>TR-08 unit</b>                                                    |
| <b>TA</b>     | <b>technical advisory</b>                                            |
| <b>TAP</b>    | <b>test access path</b>                                              |
| <b>TASC</b>   | <b>telecommunication alarm surveillance and control system</b>       |
| <b>TBCU</b>   | <b>test bus control unit</b>                                         |
| <b>TBOS</b>   | <b>telemetry byte-oriented serial (interface)</b>                    |
| <b>TC</b>     | <b>technical consultant</b>                                          |
| <b>TCA</b>    | <b>threshold-crossing alert</b>                                      |
| <b>TCVCXO</b> | <b>temperature-compensated voltage-controlled crystal oscillator</b> |
| <b>TD</b>     | <b>technical description</b>                                         |
| <b>TD</b>     | <b>toll diversion</b>                                                |
| <b>TDM</b>    | <b>time division multiplexing</b>                                    |
| <b>TE1</b>    | <b>terminal equipment 1</b>                                          |
| <b>TEO</b>    | <b>telephone equipment order</b>                                     |
| <b>TGS</b>    | <b>synchronous timing generator</b>                                  |
| <b>THC</b>    | <b>test head controller</b>                                          |
| <b>TID</b>    | <b>target identifier</b>                                             |
| <b>TL1</b>    | <b>transaction language 1</b>                                        |
| <b>TLB</b>    | <b>timing looped back</b>                                            |
| <b>TLWS</b>   | <b>trunk line work station</b>                                       |
| <b>TMC</b>    | <b>time slot management channel</b>                                  |
| <b>TMN</b>    | <b>telecommunications management network</b>                         |
| <b>TO</b>     | <b>transmission only</b>                                             |
| <b>TOP</b>    | <b>task-oriented practice</b>                                        |
| <b>TOS</b>    | <b>testing operations system</b>                                     |
| <b>TR</b>     | <b>technical reference</b>                                           |

---

|             |                                                  |
|-------------|--------------------------------------------------|
| <b>TRC</b>  | <b>test response circuit</b>                     |
| <b>TS</b>   | <b>technical specification</b>                   |
| <b>TSC</b>  | <b>test system controller</b>                    |
| <b>TSGR</b> | <b>transmission systems generic requirements</b> |
| <b>TSI</b>  | <b>time slot interchange</b>                     |
| <b>TSIU</b> | <b>time slot interchange unit</b>                |
| <b>TSO</b>  | <b>Technical Support Organization</b>            |
| <b>TSU</b>  | <b>transmission and signaling unit</b>           |



---

## **U**

|              |                                            |
|--------------|--------------------------------------------|
| <b>U-DSL</b> | <b>U-interface digital subscriber line</b> |
| <b>UAS</b>   | <b>unavailable seconds</b>                 |
| <b>UEQ</b>   | <b>unequipped (state)</b>                  |
| <b>UIP</b>   | <b>user interface panel</b>                |
| <b>UPD</b>   | <b>update</b>                              |
| <b>UVG</b>   | <b>universal voice grade</b>               |

---

## **V**

|               |                                                |
|---------------|------------------------------------------------|
| <b>VCOT</b>   | <b>virtual central office terminal</b>         |
| <b>V-DT</b>   | <b>virtual - distant terminal</b>              |
| <b>VF</b>     | <b>voice frequency</b>                         |
| <b>VFDE</b>   | <b>voice frequency data enhancement</b>        |
| <b>V-MSDT</b> | <b>virtual multi-services distant terminal</b> |
| <b>VRT</b>    | <b>virtual remote terminal</b>                 |
| <b>VT</b>     | <b>virtual tributary</b>                       |
| <b>VT-G</b>   | <b>virtual tributary groups</b>                |
| <b>VTU</b>    | <b>virtual tributary unit</b>                  |

---

## **W**

|             |                                    |
|-------------|------------------------------------|
| <b>WATS</b> | <b>wide area telephone service</b> |
| <b>WBS</b>  | <b>wideband shelf</b>              |
| <b>WORD</b> | <b>work order record detail</b>    |

---

---

## **X**

**XTC**      **extended test controller**

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---

## **Z**

**ZCS**      **zero code suppression**

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