

Lucent Technologies
Bell Labs Innovations



SLC[®] Series 5 Carrier System

Applications and Planning Guide

363-205-010
Issue 4.0
March 1997

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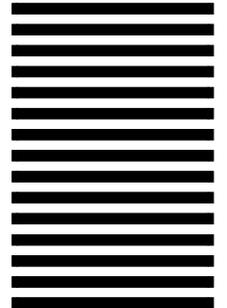
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Appearance					////////////////////
Examples					
Illustrations					
Overall Satisfaction					////////////////////

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| <input type="checkbox"/> Improve the organization | <input type="checkbox"/> Add more troubleshooting information |
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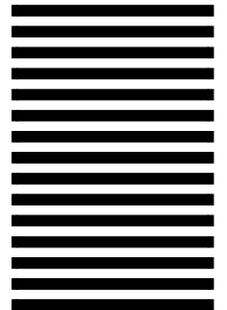
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About This Applications and Planning Guide

Overview

Objectives

This applications and planning guide provides guidelines for the *SLC*[®] Series 5 Carrier System. It contains specific information to assist network planners and engineers in planning for current and future access (loop) applications. These applications and planning guidelines are designed to meet the following objectives:

- provide an introduction to digital loop carrier
- provide an overview of the Series 5 system and its place in the network
- introduce some of the future developments in the network
- provide a single reference for most Series 5 system applications and interfaces
- provide a comprehensive description of services provided by the Series 5 system
- provide information to help estimate equipment needs and coordinate implementation of the Series 5 system.

(Continued on next page)

Overview (Continued)

Pricing information

See your Account Executive for prices of Series 5 system equipment. Personal computer (PC) configurators may be available to make it easier to compare the cost of different system arrangements.

Ordering information

363-205-000 (Series 5 ordering guide) contains equipment identification for ordering. 363-205-000 Appendix A, *Quick Reference Ordering Guide*, provides tables that summarize the basic Series 5 system ordering information.

Scope

To assist telephone companies in planning the access (loop) network for current and future service needs, this document may be used in presales planning and postsale implementation of the Series 5 system. This applications and planning guide is both marketing oriented and technically comprehensive. The access network evolution plan (Chapter 1) shows the current architecture and explains what to expect in the coming year and beyond. The Series 5 system is evolving to meet changing needs by providing maximum use of existing and future investments while taking advantage of the growth in new technology. These features are highlighted in the access network overview (Chapter 2). The channel bank applications and services (Chapter 3) show how the Series 5 system provides a solid base for the access network. The rest of the chapters concentrate on the technical aspects of the system (equipment, engineering, etc.). Refer to the section How to Use This Guide for the contents of the other chapters.

(Continued on next page)

Overview (Continued)

Intended audience These applications and planning guidelines are for people who participate in the planning and implementation of digital loop carrier systems, including the following:

- customers
 - telephone company personnel - staffers, planners, salespeople, and managers [including independent companies and the Regional Holding Companies (RHCs)]
 - marketing personnel
 - account executives.
-

Prerequisite This document is based on a background in telephony and an understanding of basic digital transmission principles. Knowledge of digital loop carrier systems may be assumed in some chapters of this guide.

Reasons for reissue This applications and planning guide is being reissued for the following reason:

- To add information for Common Management Information Protocol (CMIP-91) changes to FP303.

How to Use This Guide

Guide organization

This guide is organized as follows:

- About This Applications and Planning Guide

This section defines the purpose, scope, and intended audience for this document and tells how to obtain technical support on the Series 5 system.

- Chapter 1, Access Network Evolution

This chapter describes the role of the Series 5 system in the current trends in the access market and describes some of the future products and services.

- Chapter 2, Access Network Overview

This chapter describes the elements of Service Net-2000 and highlights the features of the Series 5 system.

- Chapter 3, System Applications and Services

This chapter describes the current applications of the Series 5 system and how it interfaces with the network. Also, it describes the customer services available with the Series 5 system.

- Chapter 4, Equipment Description

This chapter describes the equipment, apparatus, shelves, and enclosures associated with the Series 5 system.

- Chapter 5, Remote Terminal Cabinets and Enclosures

This chapter describes the cabinets and enclosures associated with the Series 5 system remote terminal.

- Chapter 6, Channel Units

This chapter describes the channel units and services available with the system.

- Chapter 7, Engineering and Planning

This chapter describes the engineering and planning considerations for implementing the Series 5 system.

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How to Use This Guide (Continued)

Guide organization (continued)

- Chapter 8, System Alarms and Maintenance
This chapter describes the system maintenance scheme and alarms provided for trouble clearing.
 - Chapter 9, Circuit Maintenance
This chapter describes circuit maintenance, test systems, and test equipment.
 - Appendix A, Quick Reference Ordering Guide, 363-205-000
This appendix provides experienced users of the Series 5 Ordering Guide with a means of finding basic equipment ordering information quickly. It contains several tables covering channel units, common units, central office terminal (COT) frames and equipment, remote terminal (RT) frames and equipment, and RT cabinets. It also includes ordering information for the extended test controller (XTC) and a list of discontinued circuit packs.
 - Appendix B, System Documentation
This appendix provides a comprehensive description of Network Systems documentation and practices. It lists various types of documentation on Series 5 and related systems and equipment.
 - Appendix C, Training
This appendix describes the courses available for the Series 5 system.
 - Glossary
This section lists the abbreviations and acronyms and spells them out.
-

Conventions Used In This Document

Product names

Feature Package B (FPB) has had several names that referred to different upgrades of the common unit (bank control unit) used to add features to the system. In spite of the confusion, this guide refers to **enhanced FPB** only (a Series 5 system equipped with the MC97776A1() bank control unit. The other codes of the bank control unit used in other versions of an FPB system are not described. The MC97776A1() bank control unit provides almost all applications of an FPB system. The official naming conventions for Series 5 Feature Package B are given in Chapter 3, System Applications and Services.

Fiber to the Customer applications in this guide are structured as follows:

- Fiber in the Loop — SLC-2000 Multi-Services Distant Terminal (MSDT)
 - Fiber to the Business
 - Business Remote Terminal (BRT)-2000 (large businesses)
 - SLC-2000 MSDT (small businesses)
-

Trademarks

The trademarks used in this guide are identified on the back of the title page. Trademarks are used as follows: they stand out from the rest of the text by using a different font or capital letters, and they modify a noun. For example, with the trademark, the system name is *SLC Series 5 Carrier System*. Without the trademark, it is referred to as the Series 5 system. The trademark is never used by itself; it always modifies a noun (for example, *SPOTS*[®] channel units). Trademarks are identified on first use in *each chapter* (in text and headings) with the register mark ([®]) or with a footnote. Also, they will be identified in each table and figure on first occurrence.

Terms used

In this applications and planning guide, the term *access* may be used instead of loop to refer to the part of the network between the service node (central office) and the customer. Access is a broader term that includes the customer loop and the systems that connect it to the service node.

Product Safety, UL Listing, and EMC Compatibility

Admonishments

This guide contains admonishments as caution statements. These statements indicate the following:

- **Caution** indicates the presence of a hazard that *will* or *can* cause minor personal injury or property damage if the hazard is not avoided. For example,



CAUTION:

An electrostatic discharge wrist strap with a minimum resistance of 250K Ohms should be worn when handling Series 5 circuit packs to prevent possible damage to the circuit packs. Before using the wrist strap, check it for opens, shorts, and minimum resistance value. If the strap does not pass these checks it should not be used. To avoid possible personal injury while using the wrist strap at the COT, connect the wrist strap to the ESD WRIST STRAP GROUNDING POINT on the right-hand side of the COT frame. If no grounding point is present, connect the wrist strap to a bare-metal section of COT frame. At the RT, to avoid possible personal injury while using the wrist strap, do not connect it to the power shelf or adjacent portions of the RT frame. Connect the wrist strap only to ESD GRD jack on the fan unit, if present. If grounding jack is not present, connect wrist strap to bare-metal section of the frame well away from the power shelf.

UL listed RT

The Series 5 system is available in a *UL* Listed RT. The *UL* Listed RT is designed to help customers comply with The National Electric Code, state, and local code requirements. The *UL* Listed RT is a 7-foot frame equipped with any combination of *UL* Recognized equipment and apparatus. Nearly all RT equipment and apparatus is *UL* Recognized, and Lucent Technologies plans to obtain *UL* Recognition for all new RT equipment introduced in the future. For a list of *UL* Recognized equipment and apparatus, refer to 363-205-011 (*UL* Listed remote terminal installation) or 363-205-000 (Series 5 ordering guide).

EMC compatibility

The Series 5 system meets requirements for electromagnetic compliance (EMC) as defined in Federal Communications Commission (FCC) Part 15A and/or 15B.

System Features Supported

Feature packages supported in this guide

This guide supports all features that can be ordered for a Series 5 system equipped with enhanced Feature Package B, Feature Package C, Feature Package F, or Feature Package 303.

Feature package not supported in this guide

Feature Package D is not included in this guide because of its similarity to enhanced Feature Package B Mode 2, which is a more flexible system (see Chapter 1).

Customer Assistance and Technical Support

Types of customer assistance

Lucent Technologies will provide customer assistance on the Series 5 system including, but not limited to:

- troubleshooting assistance
- technical consultation
- operational problem consultation
- procedural advice
- emergency recovery assistance from a qualified system support professional from the Regional Technical Assistance Center (RTAC).

Getting assistance

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

References, documents, and training sources

Appendix B provides a list of Series 5 system documents and references on related systems and equipment. Appendix C describes the training courses available on the Series 5 system.

Documentation plans for the Series 5 system

In this section, the headings that follow present an overview of Series 5 documentation based on various features and system arrangements defined in Chapter 2. These documentation plans attempt to guide a user to the documents that may be needed for each stage in implementing a system. The documentation plans list the minimum documentation needed; see Appendix B for a list of complete titles and document numbers. Also, for acronyms and abbreviations used in the documentation plans, see the Glossary chapter.

In the plans, most categories list more than one document. In some categories, the documents contain the same information with different levels of detail. For these categories, the user's experience should determine the appropriate document. In other categories, the documents contain information on different equipment; one or more documents may be needed depending on the equipment being installed or used.

Documentation plan for integrated arrangements

System Planning — Integrated Interface

- 363-200-010 Digital Carrier Line Unit (DCLU) General Information Manual
- 363-205-010 Series 5 System Applications and Planning Guide
- 363-205-100 Series 5 System General Description

System Engineering and Circuit Design

- 363-005-101 Series 5 System Data Sheets
thru -302
 - 363-200-010 DCLU General Information Manual
 - 915-710-115 Series 5 System Engineering
 - 915-710-116 Series 5 System Channel Unit Applications
-

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Related Documentation/Training (Continued)

Documentation plan for integrated arrangements (continued)

Series 5 System Ordering

- 363-205-000 Series 5 System Ordering Guide
- 363-205-000, Appendix A Series 5 System Quick Reference Ordering Guide
- 363-205-020 Series 5 System PC Configurator

Series 5 System Remote Terminal (RT) Installation and Splicing

- 631-600-240 80-Type Cabinets
- 631-600-241 80-Type Cabinet Feeder Distribution Interface (FDI)
- 640-250-217 Outside Plant Documentation
thru -327

Turnup Procedures — Integrated System

<u>Maintenance System</u>	<u>DCLU or IDCU</u>	<u>RT</u>	<u>T1 Metallic Facility</u>
235-105-500 Maintenance Handbook (includes IDCU)	363-200-005 DCLU Recent Change	363-205-401 Series 5 RT	363-200-001 T1 Preservice Tests
	235-118-242 Recent Change (includes IDCU)		

End-to-End System Tests — Integrated Interface

- 363-205-406 Series 5 System End-to-End Tests

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Related Documentation/Training (Continued)

Documentation plan for integrated arrangements (continued)

RT Channel Unit Installation

363-205-402	Series 5 System Channel Unit Installation Tests
363-205-113	Series 5 System AUA94 U-DSL Channel Unit Installation and Maintenance

System Maintenance

363-200-010	DCLU General Information Manual
363-205-500	Series 5 System Maintenance

Documentation plan for universal arrangements

Series 5 System Planning

363-205-010	Series 5 System Applications and Planning Guide
363-205-100	Series 5 System General Description

Series 5 System Engineering and Circuit Design

363-005-101 thru -302	Series 5 System Data Sheets
915-710-115	Series 5 System Engineering
915-710-116	Series 5 System Channel Unit Applications
FPD 801-450- 106-x	Series 5 System Floor Plan Data Sheets

(Continued on next page)

Related Documentation/Training (Continued)

Documentation plan for universal arrangements (continued)

Series 5 System Ordering

363-205-000	Series 5 System Ordering Guide
363-205-000, Appendix A	Series 5 System Quick Reference Ordering Guide
363-205-020	Series 5 System PC Configurator

Series 5 System Remote Terminal (RT) Installation and Splicing

631-600-240	80-Type Cabinets
631-600-241	80-Type Cabinet Feeder Distribution Interface (FDI)
640-250-217 thru -327	Outside Plant Documentation

Turnup Procedures — Universal System

<u>Maintenance System</u>	<u>COT</u>	<u>RT</u>	<u>T1 Metallic Facility</u>
363-202-300 Pair Gain Test Controller	363-205-400 Series 5 COT	363-205-401 Series 5 RT	363-200-001 T1 Preservice Tests
363-205-300 Extended Test Controller			

(Continued on next page)

Related Documentation/Training (Continued)

**Documentation
plan for universal
arrangements
(continued)**

End-to-End System Tests

363-205-406 Series 5 System End-to-End Tests

Channel Unit Installation

363-205-402 Series 5 System Channel Unit Installation Tests

363-205-106 Series 5 System AUA90 T-BRITE Channel Unit
Installation and Maintenance

363-205-107 Series 5 System AUA93 BRITE II Channel Unit
Installation and Maintenance

363-205-116 Series 5 System FPC BRITE II Channel Unit
Installation and Maintenance

System Maintenance

363-205-500 Series 5 System Maintenance

(Continued on next page)

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Documentation plan for the integrated network access - remote terminal

Integrated Network Access - Remote Terminal (INA-RT) Planning

363-205-104 INA-RT User's Manual

INA-RT Engineering and Circuit Design

363-005-101 Series 5 System Data Sheets
thru -302

363-205-104 INA-RT User's Manual

915-710-116 Series 5 System Channel Unit Applications

INA-RT Ordering

363-205-000 Series 5 System Ordering Guide

INA-RT Installation and Splicing

631-600-240 80-Type Cabinets

363-205-402 Series 5 System Channel Unit Installation Tests

631-600-241 80-Type Cabinet Feeder Distribution Interface (FDI)

640-250-217 Outside Plant Documentation
thru -327

Turnup Procedures —

363-205-104 INA-RT User's Manual

Channel Unit Installation

363-205-402 Series 5 System Channel Unit Installation Tests

INA-RT Maintenance

363-205-104 INA-RT User's Manual

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Introduction

Evolution history

The subscriber loop environment has changed radically since the introduction of electronics into the loop plant. Traditionally, the subscriber was connected with a pair of wires directly to the switched network (at the telephone office). When the wire was too long, special equipment was required to provide service. If all the pairs in the cable were used, the telephone company had to run new cable. In the search for alternatives, pair gain systems were developed to handle long rural routes and to add channels in areas with limited pair availability, low demand, or uncertain growth. As the network evolved, pair gain became loop carrier, which, with the announcement of Service Net 2000 (Chapter 2), is now called (network) access. Digital loop carrier is a key element in the network, bridging the gap between the phone company and the subscriber. This chapter describes the evolution of digital loop carrier and the *SLC*[®] Series 5 Carrier System current and future developments.

Digital Loop Carrier Development

***SLC* product family history**

The first digital pair gain system, the subscriber loop multiplexer (SLM), was introduced in 1972. This system was superseded by the *SLC* 40 Carrier System, a digital system accommodating up to 40 subscribers. About the same time, the *SLC* 1 and *SLC* 8 Carrier Systems were introduced. Both of these were analog systems for urban and rural applications (at this time, the choice of systems was a trade-off between needed capacity and the latest technology). Services ranged from single party (the *SLC* 1 Carrier System) to 2-party (automatic number identification and operator number identification), 4-party with fully selective ringing, 8-party with semi-selective ringing (the *SLC* 8 Carrier System) or fully-selective ringing and coin service (with the *SLC* 40 Carrier System). The *SLC* 1, *SLC* 8, and *SLC* 40 Carrier Systems use the central office terminal to remote terminal arrangement that is typical of current digital loop carrier systems.

***SLC* 96 product description**

Among the most popular digital loop carrier systems, and the forerunner for the Series 5 system, is the *SLC* 96 Carrier System. This system serves up to 96 subscribers via T1 digital lines and uses many of the D4 channel units for special services. Applications of *SLC* 96 Carrier System include accommodating unexpected growth and providing feeder relief for suburban areas. The compact equipment also provides a solution to temporary demand from short-term events such as conventions, telethons, fairs, and governmental visits. The *SLC* 24 Carrier System is a smaller version of the *SLC* 96 Carrier System and was designed for applications where customers were widely distributed.

Series 5 product description

The Series 5 system was introduced in 1985 as a double-density, microprocessor-based alternative to the *SLC* 96 Carrier System. The circuit packs are half the size of the *SLC* 96 units, so, for the same amount of space, the Series 5 system capacity is 192 channels versus only 96 channels for the *SLC* 96 Carrier System. The other major difference is the microprocessor, which allows such improvements as electronic channel unit provisioning (option setting) and more detailed system status and alarms.

The SLC[®] Series 5 Carrier System

System architecture

The Series 5 digital loop carrier (DLC) system combines the functions of a channel bank and an office repeater bay in one compact system.

There are two types of Series 5 system architectures:

- The *universal* system architecture has two terminals, one at the central office (central office terminal) and one in the field (the remote terminal).
- In the *integrated* system architecture, the remote terminal interfaces directly with a digital switch instead of with a central office terminal.

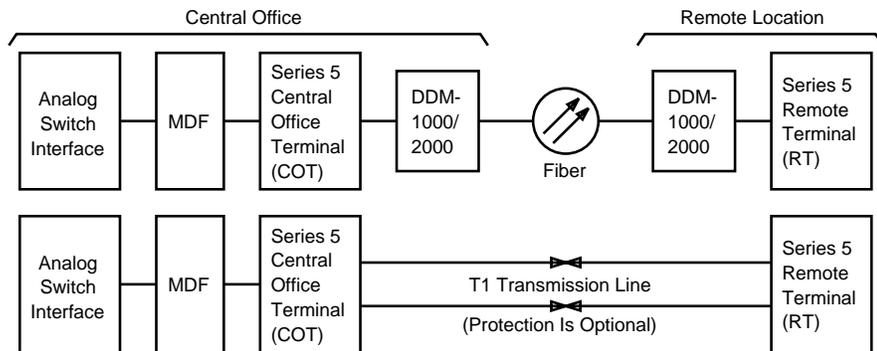
In both of these arrangements the remote terminal may be connected to the central office equipment through T1 carrier digital lines or a fiber facility using a multiplexer such as the DDM-2000 or DDM-1000 multiplexer.

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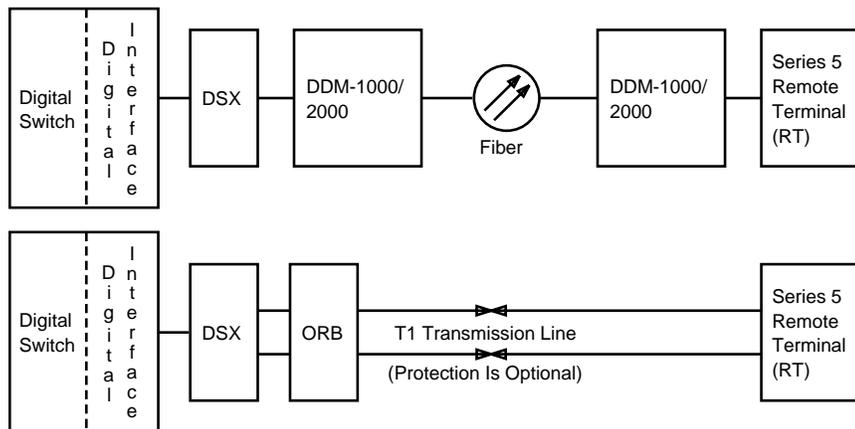
The SLC® Series 5 Carrier System (Continued)

Universal and integrated system architectures illustrated

The universal system architecture is shown in the top portion of the following figure. The integrated system architecture is shown in the bottom portion.



a. Universal System Architecture



b. Integrated System Architecture

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The SLC[®] Series 5 Carrier System (Continued)

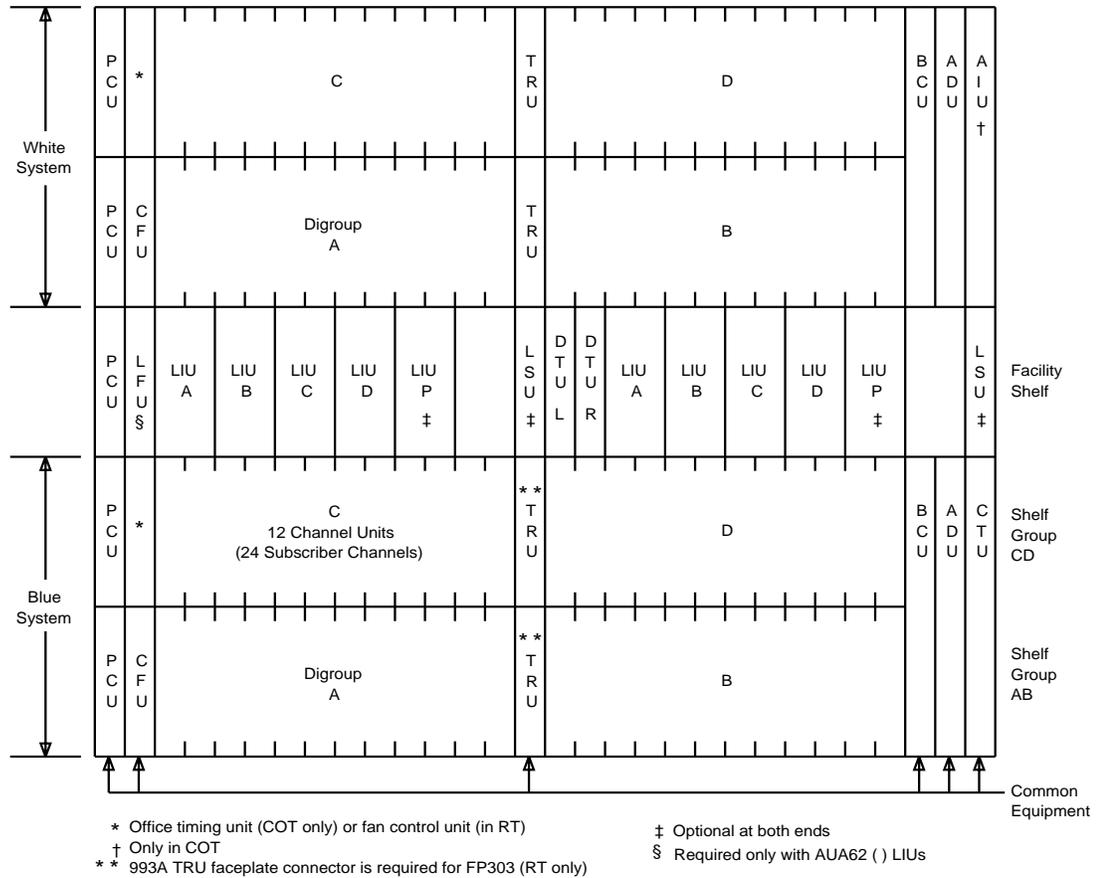
Series 5 system terminal equipment

The Series 5 system central office and remote terminals each contain two banks (systems) split across five plug-in shelves. Each bank has two shelves of channel units divided into four digroups (24 lines each). The middle shelf contains common equipment split between banks: half of the units are used by the lower bank (blue system), the rest of the units are used by the upper bank (white system). Other common units are installed in slots at the ends of the shelves. The remote terminal may have auxiliary shelves associated with it that contain common units or batteries.

(Continued on next page)

The SLC® Series 5 Carrier System (Continued)

Dual channel bank illustrated This figure shows the shelf arrangement of the Series 5 system dual channel bank.



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The SLC[®] Series 5 Carrier System (Continued)

Terminal equipment functions

On the office side, the central office terminal interfaces with the switch or transmission equipment at the central office. On the metallic side, the remote terminal interfaces with the distribution cable containing the subscriber pairs. The common equipment may include powering, bank and data link control, alarm interface, transmission line or DS1 interface and protection, transmit/receive signal control, test interface, and fusing.

At the remote terminal, a separate power shelf rectifies the AC supply and provides power control and ringing. Separate battery shelves may be provided for battery backup. Some remote terminal arrangements use or provide bulk power; this is a centralized -48V supply with battery backup/reserve that serves all systems at the remote location. Bulk ringing can be provided for some arrangements. The bulk power and ringing arrangements eliminate the need for separate power and battery shelves for each remote terminal.

Channel units typically provide analog-to-digital (A/D) and digital-to-analog (D/A) conversion for subscriber signals, transmission and signaling circuits, bank interface, test relays, and/or interfaces for digital or special services. The output from the bank is one to four digital signals at the DS1 rate (1.544 Mb/s) with optional protection. The signals are suitable for transmission on a metallic facility such as a T1 metallic repeater transmission line or a fiber facility such as the DDM-2000 or DDM-1000 multiplexer.

SLC[®] Series 5 Carrier System Feature Package Development

Feature Package A The first release of the Series 5 system was named Feature Package A (FPA). The FPA system was a universal arrangement using a Series 5 central office terminal and a Series 5 remote terminal over metallic T1 digital lines. FPA included basic (POTS) telephone service, coin service, and locally-switched special services. FPA has been superseded by FPC (see below).

Feature Package B Feature Package B (FPB), the second release of the Series 5 system, offered universal and integrated arrangements. This universal FPB (Mode 96) system used a SLC 96 central office terminal and a Series 5 remote terminal. The integrated arrangement used a Series 5 remote terminal interfaced directly to the digital carrier line unit (DCLU) of a 5ESS[®] switch. Initially, FPB services were the same as FPA: POTS, coin, and locally-switched special services. Later, new channel units were introduced that added multiparty, frequency-selective ringing (FSR), and direct inward dial (DID) services.

Feature Package C The third release of the Series 5 system was Feature Package C. Feature Package C (FPC) supports all FPA and FPB services, plus a wide range of nonlocally switched special services, including 2- and 4-wire voice-frequency (VF) and Digital Data System (DDS) services. Feature Package C also provides enhanced test capabilities and single-ended installation and maintenance test procedures (see Chapter 2). FPC supersedes and replaces FPA, which has been discontinued.

Feature Package D Following FPC came Feature Package D (FPD) which uses low bit-rate voice.

(Continued on next page)

SLC[®] Series 5 Carrier System Feature Package Development (Continued)

Enhanced Feature Package B

Next came enhanced FPB which includes all the capabilities and services of FPB (Mode 96) plus many new features. Enhancements include provisionable special services, integrated services digital network (ISDN), and Mode 2 concentration. FPF is a further enhancement to FPB and FPC that supports the Fiber in the Loop feature, using the Multi Services Distant Terminal (MSDT).

A Feature Package C with AutoCut (FPC/AC) System allows a conversion from FPC to an enhanced FPB without dispatching craft to the RT.

The Integrated Network Access (INA) remote terminal provides integrated access based on a subset of D4 channel bank features.

Feature Package 303

The latest release of the Series 5 system is Feature Package 303 (FP303) Release 3.0. FP303 supports a direct interface to a local digital switch compliant with Bellcore's specification TR-303* such as the 5ESS Switch equipped with an Integrated Digital Carrier Unit (IDCU). This new integrated configuration provides a cost effective solution for ISDN, variable concentration, and leads the way to improved operations and maintenance capabilities. Chapters 2 and 3 contain more detail on enhanced FPB, FPC, FPF, and the current system features.

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

SLC[®] Series 5 Carrier System Summary

Current picture The Series 5 system will continue to be enhanced, driven by the need to lower costs and increase revenues and to provide standard interfaces such as TR-08* and TR-303. Its architecture reflects Lucent Technologies' commitment to the graceful evolution of the network.

Looking forward The access evolution plan is designed to enable telephone companies to maximize their current and future investment by using existing Series 5 channel units and remote terminals that can be upgraded (without backplane changes) to include integrated ISDN, Mode 2, video, and TR-303 options. Also, the experience of telephone company personnel and the investment in operations support systems and procedures deserve a graceful evolution forward. This evolution plan does so in a realistic and economic fashion. By introducing new technologies and features where they make sense while protecting the investments and embedded base, the Series 5 system provides a solid building block for access evolution.

* 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*.

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Introduction

Series 5 as a building block

The *SLC*[®] Series 5 Carrier System, as part of the access node, is a building block in Lucent Technologies' Service Net-2000. The Series 5 system is a full service vehicle that supports both residential and business applications. The full service capability of the Series 5 system allows a telephone company to respond quickly to the changing service needs of the customer simply by reprovisioning or changing channel units. Also, these same channel units can be used in the new *SLC-2000* Access System or the *SLC-2000* Multi-Services Distant Terminal (MSDT). This enhances the ability to upgrade present systems while maximizing the value of current and future investments.

The Series 5 system continues to be enhanced, driven by the need to lower costs and increase revenues and to provide standard interfaces such as TR-08, TR-303, and the synchronous optical network (SONET) (via the DDM-2000 multiplexer or the *SLC-2000* Access System) for use in a multivendor environment. Its architecture reflects Lucent Technologies' commitment to the graceful evolution of your network.

Service Net-2000 is an architecture that blends switching, access, transport, and operational functions into a single entity to simplify service delivery. The Service Net-2000 architecture uses familiar systems in new ways: remote terminals become access nodes, and central offices become service nodes. These are the building blocks of Service Net-2000.

(Continued on next page)

Introduction (Continued)

Node types

There are two types of access nodes: the business remote terminal 2000 (BRT-2000) access node and the remote terminal 2000 (RT-2000) access node. The BRT-2000 access node is packaged for use in medium-to-large business customer locations using the same equipment modules as the RT-2000 access node, which is designed for residential and business customers.

The service node will evolve from the traditional central office to a single, unified node, consolidating wire center operations and integrating today's switching, transmission, and operations capabilities.

The nodes are connected using fiber optic transmission media in a topology that emphasizes availability. Service Net-2000 supports a SONET fiber network with fiber (SONET standard) or metallic feeder to provide fiber and metallic distribution. Intelligence is distributed among all network elements. Operations can then be streamlined using this distributed self-awareness.

The network elements in each access node are designed to work together as a unified logical element using the advanced operations, administration, maintenance, and provisioning capabilities provided by SONET. Automated testing and service provisioning of customer circuits can be done from the central office or work center, allowing telephone companies to respond quickly to ever-changing service needs and minimizing service calls.

Access network benefits

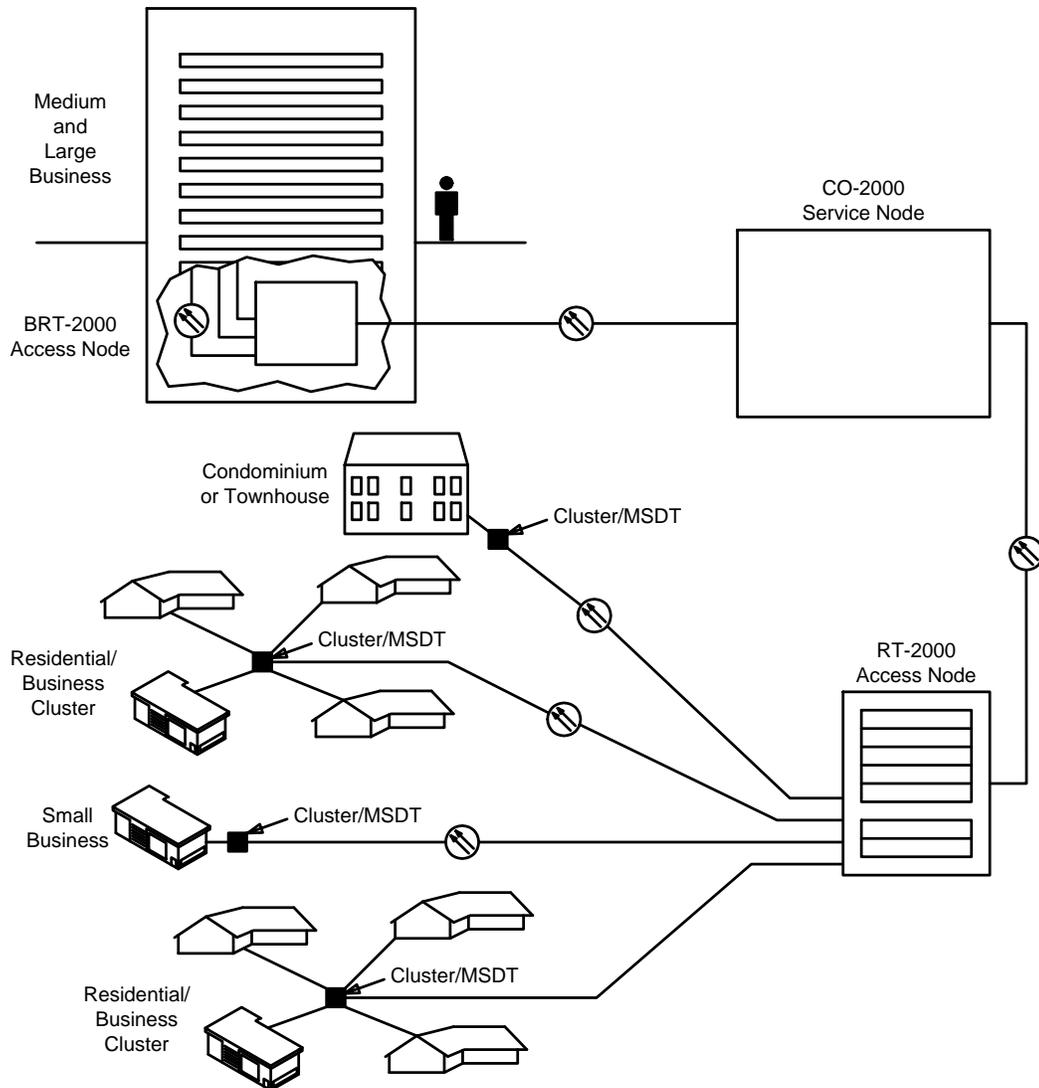
The access network is designed to improve two key aspects of your business as follows:

- enhances your service offerings which allows you to generate more revenue
 - helps control your network costs.
-

Service Net-2000

Architecture

Service Net-2000 architecture involves placing intelligence in all network elements and allows greater control by customers. The offering consists of two major components (node types), the access node and the service node, as shown in the figure below.



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Service Net-2000 (Continued)

Access node description

The access node provides customers with a rich set of service interfaces, including plain old telephone service (POTS), integrated services digital network (ISDN), *CENTREX*, data, special services, DS1, DS3, and video. The access node can be configured in a flexible and modular fashion to meet residential and business customer service needs. The RT-2000 access node, configured for residential and small-to-medium business applications, is deployed in cabinets or racks at the customer location to support quick service provisioning and bandwidth on demand.

The access node is designed to easily accommodate customer growth and to incorporate new narrowband, wideband, and broadband capabilities. This enables telephone companies to create a stable and manageable SONET-based network for transport of customer information to a service node over robust, high-bandwidth fiber paths. The access nodes can be connected to the service node using SONET standard optical facilities in hub, taper (add/drop), and ring configurations (shown on the following pages), providing protection against fiber cuts and equipment failures. From the access node, customer services can be delivered directly to the residence or business using metallic or fiber distribution.

Service node description

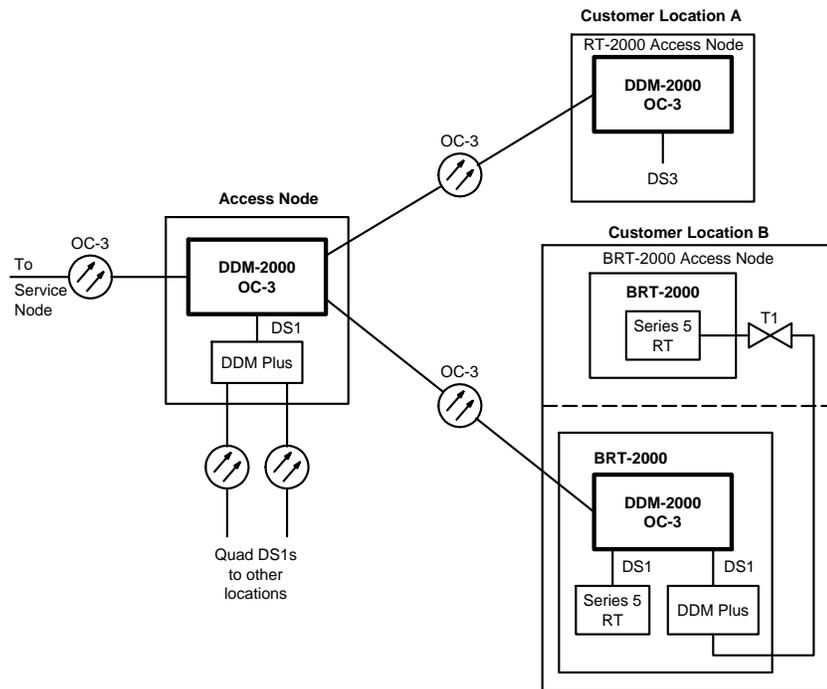
Optical fiber from the access node is fed to the service node. The service node consolidates wire center operations and integrates today's switching, transmission, and operations capabilities. The CO-2000 service node consists of products from switching, transmission, and the operations systems (OS) product lines.

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Service Net-2000 (Continued)

OC-3 hub application illustration

This figure shows how the access nodes can be connected to the service node using the SONET OC-3 standard optical facility in a hub configuration.

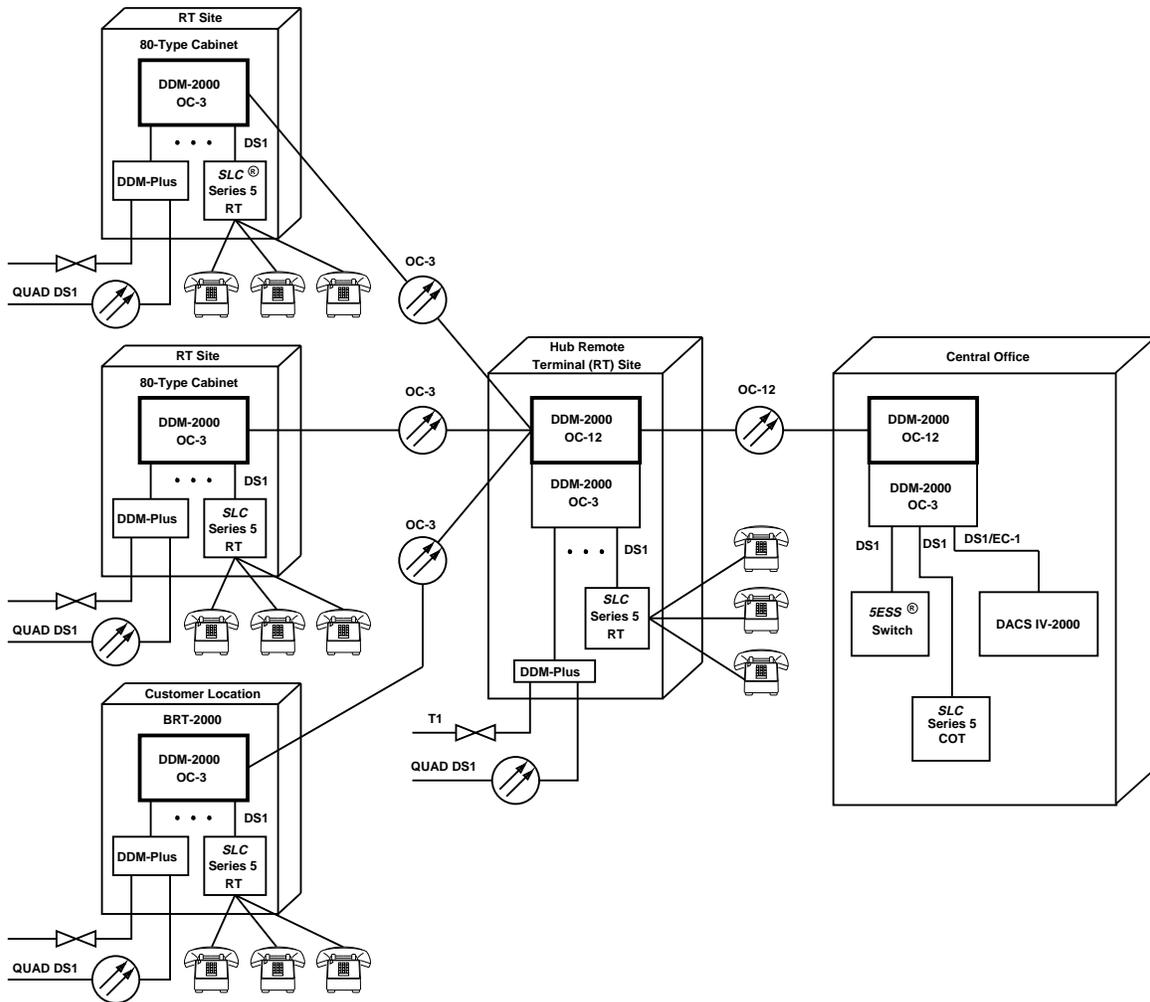


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Service Net-2000 (Continued)

OC-12 hub application illustration

This figure shows how the access nodes can be connected to the service node using the SONET OC-12 standard optical facility in a hub configuration.

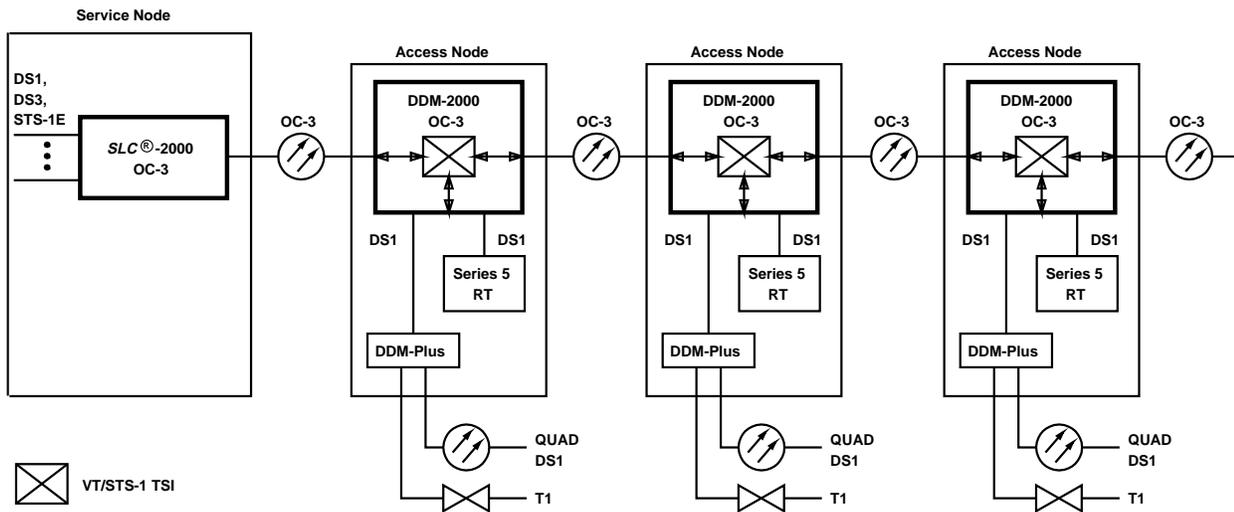


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Service Net-2000 (Continued)

OC-3 linear application illustration

This figure shows how the access nodes can be connected to the service node using the SONET standard optical facility in a DS1 Add/Drop OC-3 linear configuration.



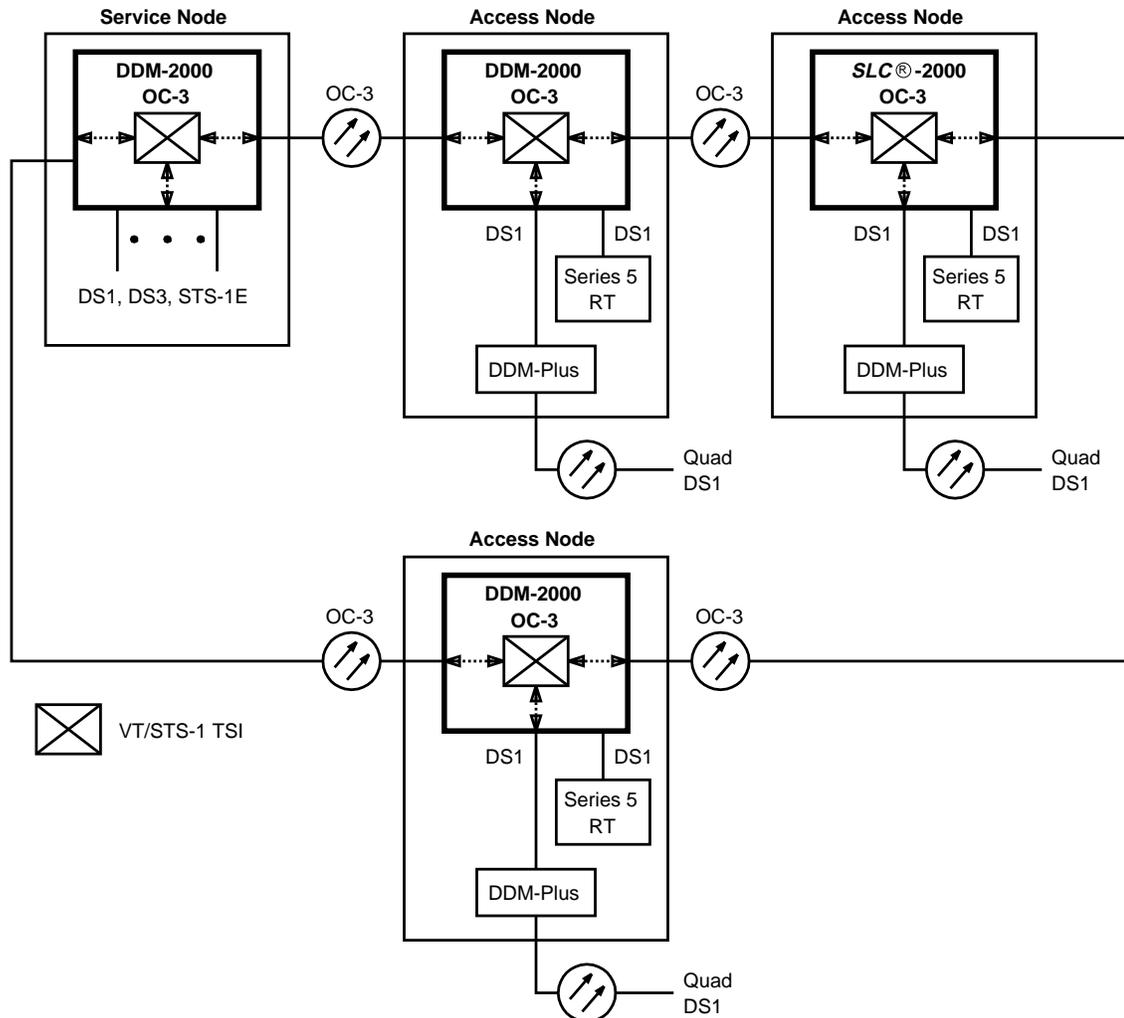
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Service Net-2000 (Continued)

OC-3 self-healing ring application illustration

This figure shows how the access nodes can be connected to the service node using the SONET OC-3 standard optical facility in a self-healing ring configuration.



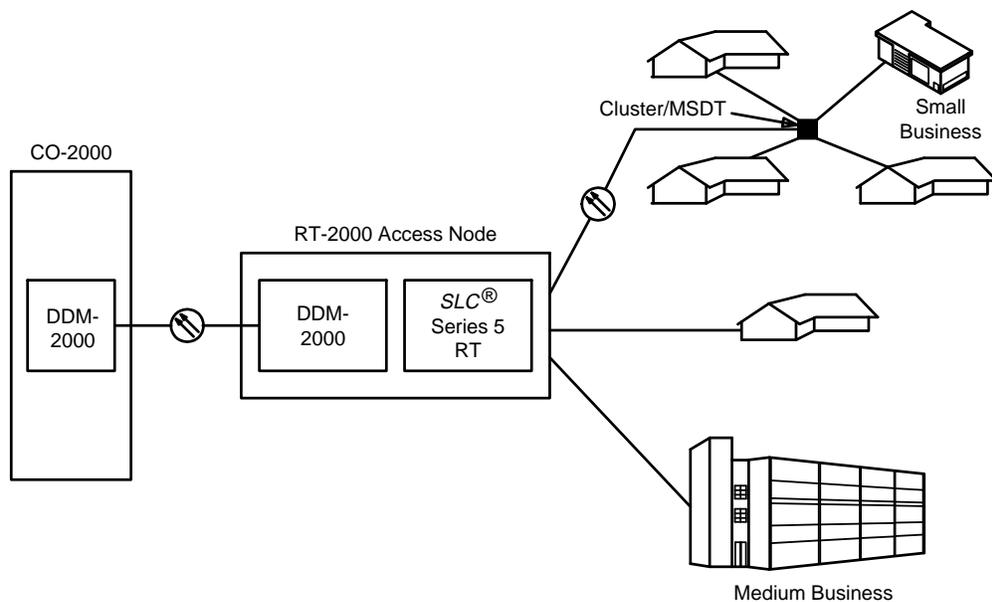
Service Net-2000 Access Node

Description

The RT-2000 access node is focused on the residential, small, and medium business markets that typically are distributed throughout a carrier serving area. Services provided from the Series 5 system include basic telephone service, special services, data, and ISDN. The distribution media can be either metallic or fiber. With fiber distribution, the service interface is extended to *SLC-2000* MSDTs at or near the customer location to support narrowband and video services. The same channel units being used at the Series 5 RT also can be used in the *SLC-2000* MSDT to reduce inventory requirements and simplify personnel training.

RT-2000 access node illustration

This figure shows how the RT-2000 access node may be used in a carrier serving area.



Service Net-2000 Business Node

Description

The BRT-2000 access node is focused on the medium and large business markets, where the ability to provide a wide variety of services and high bandwidth with quick turnaround is crucial. For these reasons, the BRT-2000 access node is implemented at the customer location, and connected to the central office with high-speed SONET-based fiber systems. In the BRT-2000 access node, fiber is terminated at the Series 5 business remote terminal (BRT) and can be distributed via DDM-2000, DDM-Plus, or an Integrated Access and Cross-Connect System (IACS).

The BRT-2000 access node supports SONET applications such as optical carrier level 3 (OC-3) and OC-12 in point-to-point, hubbed, tapered, and ring topologies that provide protection against nodal equipment and facility failures.

The BRT-2000 modules can be deployed in the basements of buildings with connections to modules on other floors to distribute the bandwidth throughout the building as required. A metropolitan area network (MAN) may be used to connect local area networks (LANs) within the building or used as a terminal adapter to provide efficient network access.

Service interfaces include basic telephone service, special services, data, ISDN, DS1, DS3, options for switched multi-megabit data, local switching and *CENTREX* service using the *5ESS*[®] switch remote switch module (RSM-2000), and optical and metallic extensions for intra- and inter-building connectivity.

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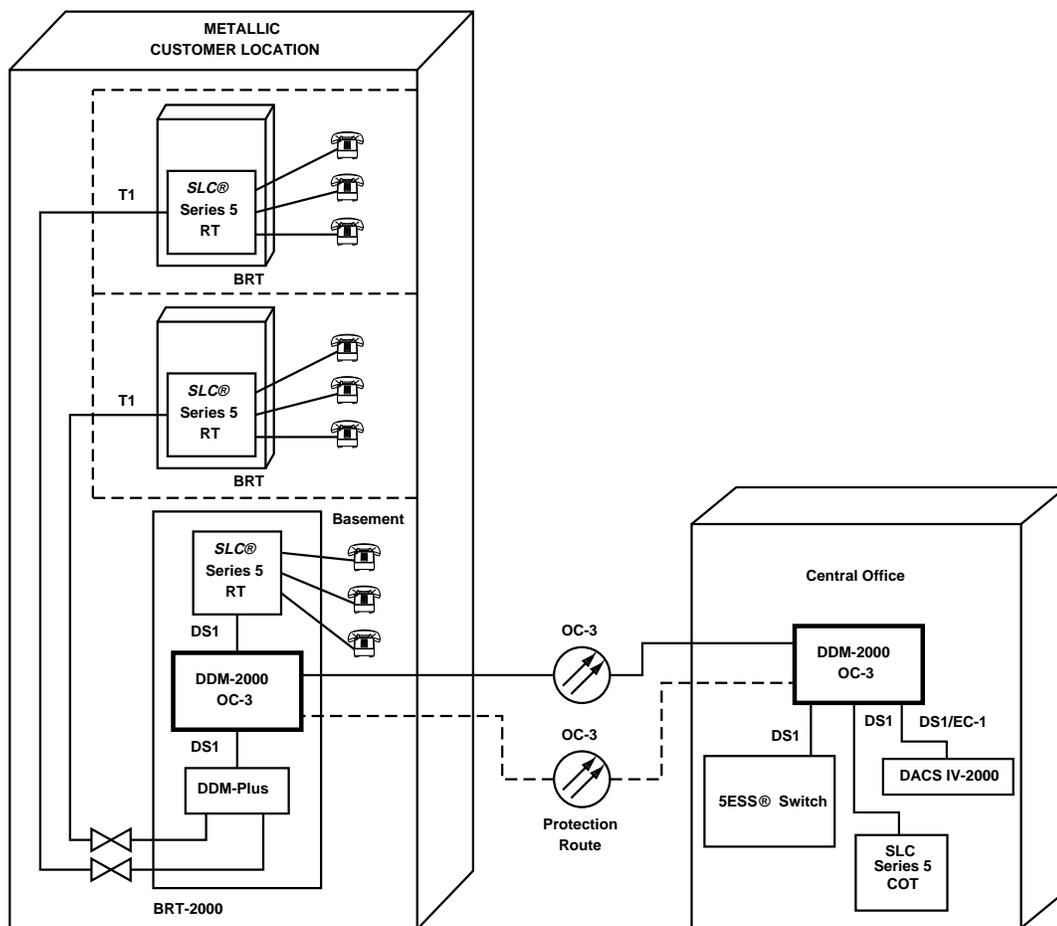
Service Net-2000 Business Node (Continued)

Metropolitan applications

In a metropolitan high-rise application, an OC-3 point-to-point network runs from the central office to the customer's building.

Metro application - copper in the riser

The figure below shows an application with copper wiring in the building's risers. From a basement cabinet, the DDM-2000 OC-3 multiplexer and DDM-Plus provide DS1 service to the cabinets in the floors above.

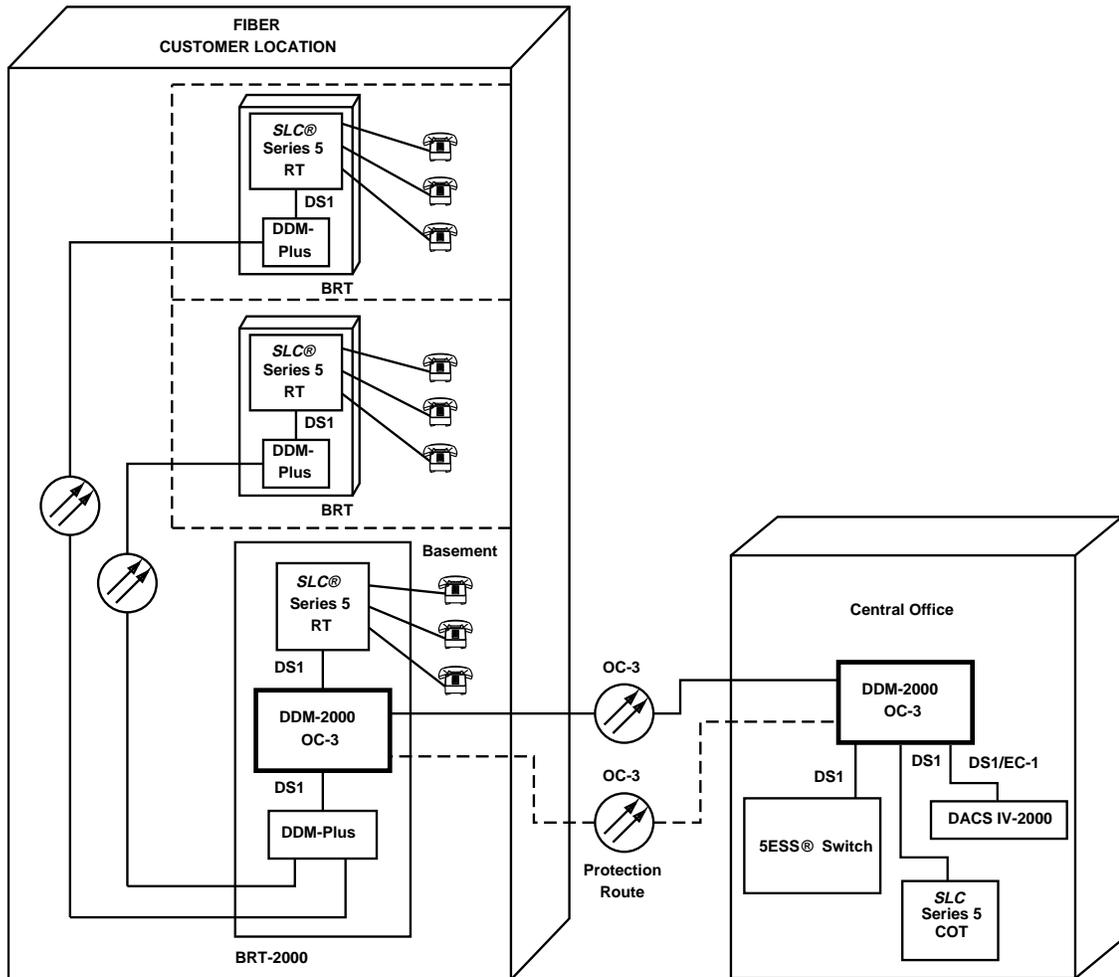


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Service Net-2000 Business Node (Continued)

Metro application - fiber in the riser

The figure below shows an application with fiber in the building's risers. The optical extension capability of the DDM-Plus extends optical bandwidth to the individual floors. DDM-Plus terminals in the floors above convert the optical extension interface into DS1 signals. Self-healing needs can be met with cabled rings or diverse routing.

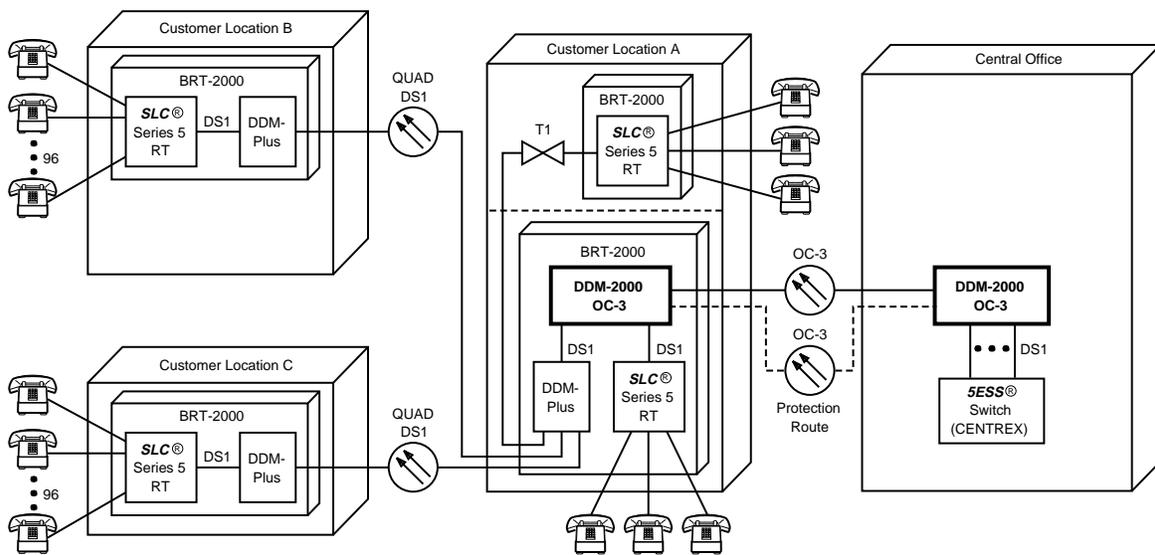


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Service Net-2000 Business Node (Continued)

Campus CENTREX services

In a multisite campus application, as shown below, the Series 5 RTs and the DDM-Plus extensions carry voice and data traffic from each building to a DDM-2000 OC-3 multiplexer at a strategically located remote terminal site. The DDM-2000 OC-3 multiplexer provides economical and reliable access to the serving switch.



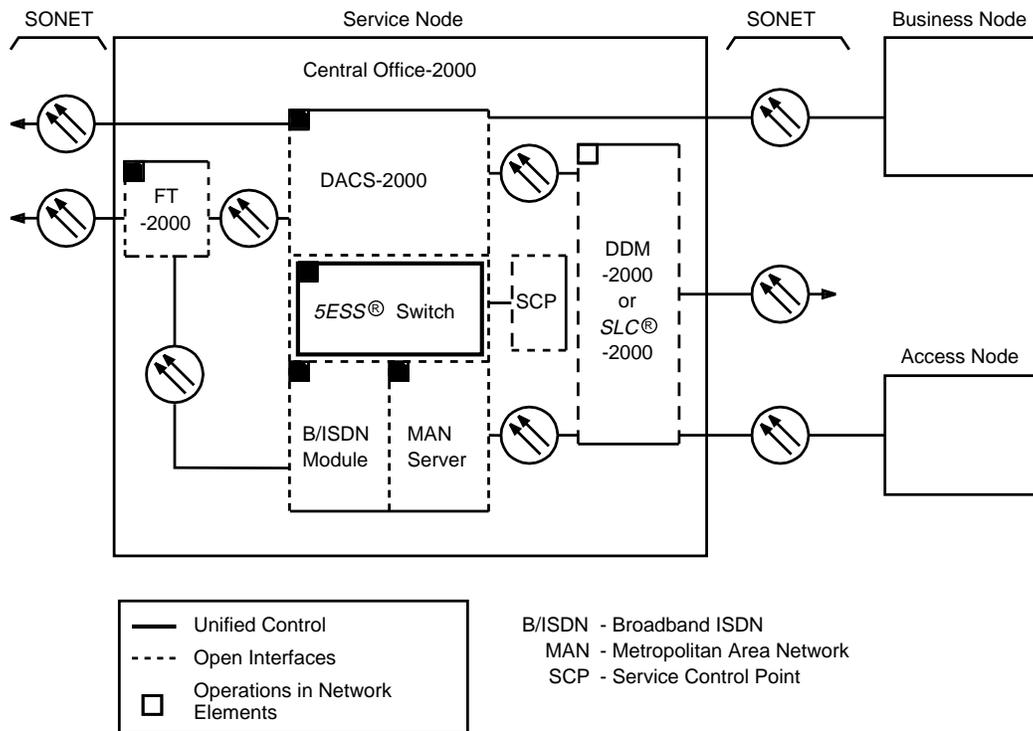
Service Net-2000 Service Node

Description

The entire service node - all systems in the wire center - is treated as a single, logical unit. This integrated concept may be referred to as central office 2000.

CO-2000 service node illustration

The CO-2000 architecture shows connections within the service node representing the increased intelligence for operations, administration, maintenance, and provisioning control.



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Service Net-2000 Service Node (Continued)

CO-2000 service node illustration (continued)

Network access is provided by the 2000 family of multiplexers, products that terminate high-speed fiber systems. The DDM-2000 multiplexer provides the OC-3 SONET rate and can be upgraded to provide the OC-12 SONET rate. Using an FT-2000 OC-48 Lightwave System, the feeder bandwidth can be upgraded to OC-48. Shown at the top of the CO-2000 node in the previous figure are the Digital Access and Cross-Connect System (DACS) 2000 family (also SONET compatible) for channel switching. These systems connect channels at DS0/DS1/DS3 digital signal rates.

In the center of the node is the *5ESS* switch, which provides, along with many other functions, ISDN switching capabilities. Also shown is the service control point, the first step in implementing the intelligent network concept.

Below the switch is a MAN server. This product is being developed to provide LAN interconnect and data transport with or without call setup (using packet addressing).

SLC[®] Series 5 Carrier System

Capabilities

The Series 5 system offers customers a wide range of service capabilities to support residential and business applications. Fiber in the Loop provides fiber distribution through the *SLC-2000* MSDT.

The advanced firmware-based technology of the Series 5 system allows testing of basic telephone services and special services including Digital Data System (DDS) services. The Series 5 system also allows electronic provisioning of special services. This characteristic enables quick response to changing customer needs simply by reprovisioning the Series 5 channel units.

Physical description

The Series 5 system provides 192 channels in two separately-administered 96-line systems packaged in one dual channel bank assembly. This modular system accommodates most remote terminal (RT) sites, including the customer location. The Series 5 system is compatible with Lucent Technologies' transmission and switching equipment, including the *SLC-2000* Access System, *DDM-1000* and *DDM-2000* multiplexers, D4-type channel banks, *DACS*, and the *5ESS* switch.

The Series 5 system can be installed in remote enclosures with *SLC-2000* Access Systems and *SLC 96* Carrier Systems to relieve an overcrowded enclosure or to accommodate unexpected demand. Also, the ability to get up to 1,536 lines into an environmentally aesthetic cabinet means responding faster to customer needs without incurring the long delays in land acquisition.

System flexibility

Using microprocessors (firmware), the Series 5 system provides flexibility without the expense of major hardware changes. By changing a few common plug-in circuit packs at one or both ends of the system, the Series 5 system can be used in different applications as demand requires or as new features become available.

Series 5 Benefits and Features

Full service platform

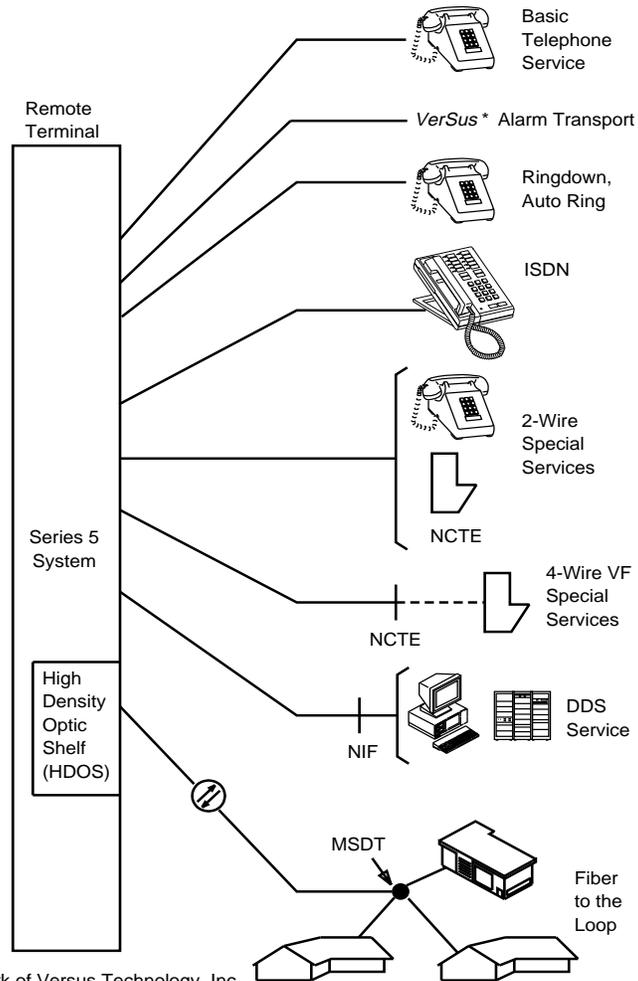
The Series 5 system offers a full range of more than 130 DS0 services over T1 or fiber facilities including: POTS, *CLASS* services, and business and residence customer services (BRCS). Nonswitched and nonlocally-switched special services can be mixed with other services in the same remote terminal. In the integrated configuration, these services can be hairpinned (IDCU only), nailed-up, or groomed by a DACS II placed between the RT and switch. In the universal configuration, specials can be dropped off at the main distributing frame (MDF) or groomed through a DACS II.

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Series 5 Benefits and Features (Continued)

Current services illustrated

Shown in the figure are the current services available with the Series 5 system.



* Registered trademark of Versus Technology, Inc.
Network channel terminating equipment
Network interface

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Series 5 Benefits and Features (Continued)

Integrated services digital network (ISDN)

An FP303 Release 2.0 remote terminal (RT) integrated into a TR-303 switch, such as the *5ESS* switch equipped with an IDCU, provides cost-effective ISDN that complies with the *ANSI* U-interface digital subscriber line (U-DSL) standard. The FP303 remote terminal allows a full bank of AUA94 U-DSL channel units (without placement restrictions) with each channel unit providing basic rate access to two customers.

FPB Mode 1 and FPC arrangements also provide ISDN that complies with the *ANSI* U-DSL standard. In these arrangements, a basic rate interface extension - second generation (BRITE II) channel unit provides basic rate access to one customer. In an FPB Mode 1 RT integrated into a *5ESS* switch equipped with an IDCU, the DS0s associated with a BRITE II channel unit can be hairpinned to a D4 or D5 channel bank.

FPB Mode 1 arrangements can also provide ISDN that complies with the International Telegraph and Telephone Consultative Committee (CCITT) T-interface standard. In this arrangement, a T-interface basic rate interface extension (T-BRITE) channel unit provides basic rate access to one customer. In FPB Mode 1 systems integrated into a *5ESS* switch equipped with an IDCU, the DS0s associated with a T-BRITE channel unit can be hairpinned to a D4 or D5 channel bank.

(Continued on next page)

Series 5 Benefits and Features (Continued)

Standard interfaces

The Series 5 system meets the requirements for digital loop carrier specified in TR-57* and is compatible with the TR-08 and TR-303 interfaces.

Broad applications

Many different equipment arrangements are available to suit any application. Standard arrangements are available for use in the central office environment, outside plant environment, and at the customer location. These arrangements accommodate fiber or metallic facilities, DS1 extensions (described in Chapter 3), and fiber distribution (Fiber in the Loop). Custom arrangements can be configured to any customer need.

Integrated and universal system architecture

In a *universal* system, a Series 5 RT is used at one end of the system, and either a Series 5 or *SLC* 96 central office terminal (COT) is used at the other end. The *integrated* system allows the Series 5 RT to interface directly with any TR-08 or TR-303 digital switch such as the *5ESS* switch.

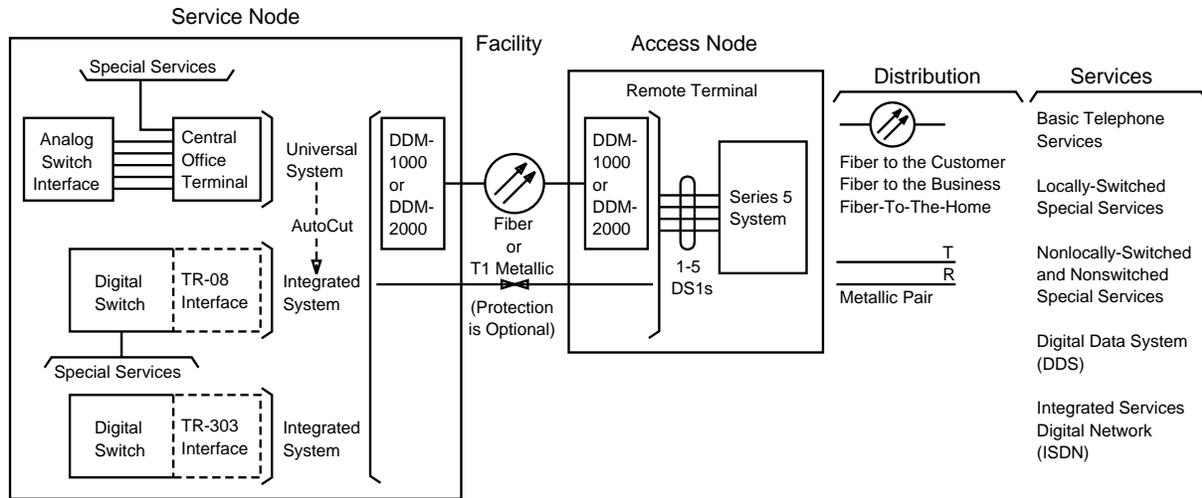
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* Bellcore Technical Reference TR-NWT-000057 Issue 2, January 1993, *Functional Criteria for Digital Loop Carrier Systems*.

Series 5 Benefits and Features (Continued)

Architecture comparison illustrated

This figure shows a comparison of the integrated and universal Series 5 system architectures.



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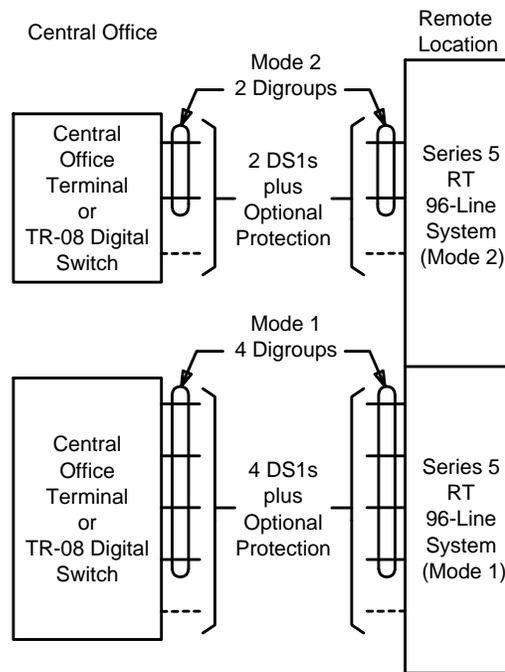
Series 5 Benefits and Features (Continued)

Concentration

Mode 2 operation provides concentration at the remote terminal. Only two DS1s are required for every 96-line system. This represents up to a 50 percent savings in the facilities and digital switch interface cost. The optional protection line requires an additional DS1 facility.

Mode 2 concentration illustrated

This figure shows the Series 5 system with Mode 2 concentration in comparison to Mode 1.

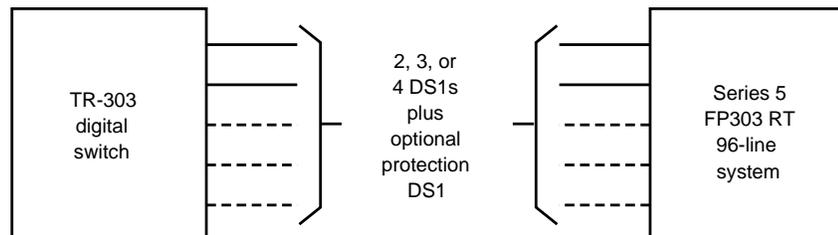


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Series 5 Benefits and Features (Continued)

FP303 variable concentration

FP303 has no fixed mapping of channel units to DS0 timeslots. Time slot assignment is full access over a 96-line system; that is, any line can map into any available DS0 timeslot on any DS1. Therefore, FP303 can concentrate up to 96 customer lines on 2, 3, or 4 DS1 facilities. This can result in up to a 50 percent savings in facility and switch termination costs. The optional protection line requires an additional DS1 facility.



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Metallic or fiber distribution

A single remote terminal configuration serves both metallic and fiber distribution to the customer (subscriber).

Fiber in the loop applications

The *SLC* Series 5 Carrier System supports a point-to-point Fiber in the Loop (FITL) architecture. When configured for FITL, the Series 5 RT serves as the host digital terminal (HDT) and is connected to *SLC*-2000 Multi-Services Distant Terminals (MSDTs), which serve as the optical network units (ONUs), through single-mode fiber links.

(Continued on next page)

Series 5 Benefits and Features (Continued)

SLC-2000 MSDT The *SLC-2000* MSDT is a flexible, compact access terminal that provides a full range of narrowband services, from POTS to special services and ISDN capabilities, for a wide range of applications. It uses Series 5 channel units and is compatible with the next generation *SLC-2000* quad channel units. Channel and drop testing with the MSDT are equivalent to testing with metallic distribution. The MSDT is compatible with the pair gain test controller (PGTC) and Mechanized Loop Testing (MLT) systems.

AutoCut The AutoCut feature allows a Series 5 remote terminal to be converted automatically from universal FPC system to an integrated FPB system. The remote terminal must be pre-equipped; that is, sometime before cutover, certain common units must be optioned and installed. This feature saves installation labor costs by providing cutover without a special dispatch to the remote terminal. Access cost is reduced by eliminating the central office terminal, which can be redeployed as needed.

Analog line to integrated SLC carrier at 5ESS switch cut (ALIC5) The ALIC5 feature allows for the benign bridging of the *SLC* Series 5 RT to in-service circuits on the 1A *ESS*TM analog switch in preparation for the transfer of the circuits to a *SLC* Series 5 RT integrated into a *5ESS* switch. Prior to the cut, a relay on the ALIC5 channel unit is kept open by *5ESS* signaling to prevent loading of the in-service circuit. During the pre-cutover period, the *5ESS* switch can momentarily close the relay to conduct automated office-to-office tests. At switch cutover, the *5ESS* switch signals the ALIC5 channel unit to permanently close the relay.

Field-proven remote terminal cabinets The field-proven 80A, 80D, and 80E remote terminal cabinet arrangements are available for serving both metallic and FITL distribution to the customer, and support T1 or fiber facilities (see Chapter 5).

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Series 5 Benefits and Features (Continued)

Business remote terminal-2000 (BRT-2000)

The BRT-2000 access node supports the emerging technology and accommodates the rapidly changing customer needs. The DDM-2000/DDM-1000 multiplexer and the Series 5 system are packaged in various cabinet configurations for applications at the customer location. The BRT provides digital loop carrier and multiplexing capabilities for a wide range of current and future services. The BRT also can provide up to 28 DS1 extensions using the DDM-Plus shelf. The DDM-Plus allows mixed electrical and optical DS1 extensions from the same shelf (but not in the same group). This offering provides business customers with the high capacity and reliability of fiber optic trunk lines while streamlining maintenance and provisioning.

Integrated network access- remote terminal (INA-RT)

INA-RT is a Series 5 RT equipped to provide integrated network access based on a subset of D4 channel bank services. The INA-RT can be used with a D4 channel bank, a D5 channel bank, or a digital cross-connect system such as DACS.

Series 5 Feature Packages

Definition and description

A feature package is defined as a set of capabilities that is controlled by a specific set of common units: the bank control unit (BCU), and the alarm display unit (ADU). Other common plug-ins may apply to a particular capability [for example, the channel test unit (CTU) and the digital test unit (DTU) for testing]. Each of these feature packages is available in a variety of arrangements designed to meet the needs of today's access customers.

The Series 5 system offers the following feature packages:

- Enhanced FPB
- FPC
 - FPC
 - FPC with AutoCut
- INA-RT
- FPF
- FP303

The Series 5 system options and services are briefly described in the following sections. Refer to Chapter 3, *System Applications and Services*, for detailed information on each feature package.

(Continued on next page)

Series 5 Feature Packages (Continued)

Enhanced feature package B (FPB)

Enhanced FPB provides direct access to the *5ESS* switch or any digital switch that supports the TR-08 interface. The enhanced FPB RT may be used in an integrated system (with the *5ESS* switch) or a universal system (with a *SLC 96* COT). Enhanced FPB provides universal or integrated Mode 1 or Mode 2 operation (*SLC 96* Carrier System or *5ESS* switch). (Mode 2 operation provides 2:1 channel concentration). It supports single party, multiparty, coin, and frequency selective ringing (FSR) services. Two-wire locally-switched special services are supported in the carrier serving area (CSA). It supports provisionable special services: 2- and 4-wire nonswitched or nonlocally-switched special services, dataport, and ISDN. The PGTC and other testing support systems used with the *SLC 96* Carrier System provide testing in the enhanced FPB system.

Feature package C (FPC)

Feature Package C operates in a universal Series 5 system. It supports single party, multiparty, FSR, and coin telephone service. On loops that follow CSA guidelines, FPC supports locally-switched special services (*CENTREX* services, etc. -- see Chapter 7).

In addition, FPC provides 2- and 4-wire nonswitched or nonlocally-switched special services, digital data service, ISDN applications including BRITE II channel units, and enhanced testing capabilities. Most special service channel units can be provisioned electronically with the craft interface unit (CIU). Single-ended provisioning can be performed at either the COT or RT. Enhanced testing capabilities are provided by the extended test controller (XTC). The XTC can be used in conjunction with the Switched Access Remote Testing System (SARTS) or MLT system. The XTC allows remote testing of special service channels in addition to providing all test capabilities of the PGTC. The PGTC may be used in FPC for channel testing without the enhancements provided by the XTC.

The FPC AutoCut feature allows a pre-equipped FPC RT (universal system, extended superframe format) to be converted automatically to an enhanced FPB RT (TR-08 interface) without dispatching to the RT at the time of cutover.

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Series 5 Feature Packages (Continued)

Integrated network access-remote terminal (INA-RT)

The INA-RT uses the Series 5 RT to provide integrated network access based on a subset of D4 channel bank features. The INA-RT is end-to-end compatible with digital cross-connect systems (like DACS) and D4 or D5 channel banks. Compared to a D4 bank, the INA-RT offers at least a 2:1 space savings and a significant 4:1 space savings using 2-wire services. The decision to use a system as an INA-RT or as some other feature package can be deferred until the system is equipped, and this decision can be reversed by changing a few common unit plug-ins.

Feature package F (FPF)

Feature Package F is used to configure a *SLC* Series 5 RT to be used as a "Host Digital Terminal" to support *SLC-2000* MSDT features in addition to the full range of services offered by FPC, FPC/AC, and FPB.

Feature package 303 (FP303)

The FP303 remote terminal integrates into a TR-303 switch, such as the *5ESS* switch equipped with an IDCU. With full-access time slot interchange (TSI), FP303 provides variable concentration of 96 lines on 2, 3, or 4 DS1 facilities. In addition, it allows for a full bank (no placement restrictions) of dual-circuit U-DSL ISDN channel units by allowing dynamic assignment of B-channels to DS0 time slots on a per-call basis. FP303 time-division multiplexes four 16-kb/s D-channels on a single full-time DS0. The service supported in the three releases of FP303

(Continued on next page)

Series 5 Feature Packages (Continued)

Feature package 303 (FP303) (continued) are supplied in the following table.

Service Applications	R 1.0	R 2.0	R3.0
single party service	Yes	Yes	Yes
multiparty service with superimposed and frequency selective ringing	Yes	Yes	Yes
coin service (coin first and dial tone first)	Yes	Yes	Yes
direct inward dialing service	Yes	Yes	Yes
2-wire locally-switched special services are supported in the CSA	Yes	Yes	Yes
digital data system services	No	Yes	Yes
2-wire and 4-wire non-switched or non-locally switched special services	No	Yes	Yes
private-line manual ring down and private line auto ring	No	Yes	Yes
ISDN U-DSL basic rate interface with 4 D channels to 1 DS0 multiplexing	No	Yes	Yes

Series 5 Channel Service Capabilities

Description

The Series 5 system supports basic telephone service as well as switched and nonswitched special services. In a given channel slot, any service can be provided by choosing the appropriate channel unit; however, with some feature packages there are some restrictions (ISDN service and Mode 2 operation) and some exceptions (INA-RT) [placement guidelines are covered in Chapter 6, *Channel Units*, and in Chapter 7, *Engineering and Planning*. Several Series 5 channel units are multifunction to lower inventory costs and provide more flexibility (without changing channel units at the RT for each service function). The Series 5 system feature packages support the services described in Chapter 3, *System Applications and Services*.

Basic telephone service

Basic telephone service includes plain old telephone service (POTS) and other locally-switched services as follows:

- single-party service (POTS CUs) (including on-hook transmission for calling party identification, meter reading, and energy management services)
 - 2-wire locally switched special services (*SPOTS*[®] and M *SPOTS* channel units and DID channel units)
 - POTS with derived channel alarm service
 - coin (coin first and dial-tone first)
 - multiparty (up to 8-party) service
 - frequency selective ringing (FSR).
-

Integrated services digital network (ISDN)

Cost-effective ISDN is supported by using T-BRITE, BRITE II and U-DSL channel units. The AUA94 is a 2-wire channel unit that complies with the TI.601-1988 American National Standards Institute for the U-interface digital subscriber line (U-DSL). The U-interface (2-wire) requires an NT1 at the customer location for the 2- to 4-wire conversion. ISDN can also be supported using basic rate interface transmission extension (BRITE) channel units for U-interface and T-interface applications. The AUA90 T-BRITE channel unit provides a basic access T-interface (4-wire) directly to a customer ISDN terminal. With a 4-wire interface, no NT1 (network termination level 1) is needed at the customer location. The AUA92 and AUA93 BRITE II channel unit complies with the *ANSI* U-DSL standard.

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Series 5 Channel Service Capabilities (Continued)

5ESS[®] switch special services grooming feature

The *5ESS* switch equipped with an Integrated Digital Carrier Unit (IDCU) allows the direct integration of nonswitched and nonlocally switched special services from the RT. At the IDCU, these services can be hairpinned to the interoffice network.

Designed special services

These services include nonlocally-switched and nonswitched special services as follows:

- manual ringdown (dual ringing repeater channel unit)
 - private line auto ring (PLAR)
 - 2-wire nonlocally switched voice frequency (VF) services (*E SPOTS* channel units)
 - 4-wire VF special services
 - DDS (dataport channel units).
-

Series 5 Provisioning

Description

The distributed intelligence of the Series 5 system provides simplified and automated provisioning of special services. The locally-switched special services are provisioned automatically by the bank controller (the BCU and ADU) (the channel units for these services have no options). For most channel units that have options, transmission and signaling characteristics are set electronically with the CIU. The CIU may be used at either end of a universal system to set the options of channel units at both ends. The options may be set before or after the channel units are installed.

Special channel administration tool

The Special Channel Administration Tool (SCAT) is an easy-to-use MS-DOS® PC software package with an interface device connection that allows interfacing with a SLC Series 5 Carrier System. SCAT can connect to a SLC Series 5 central office terminal or a remote terminal (RT). SCAT communicates with a Series 5 bank controller (BC) to provide the provisioning features, which enables specifying option settings for special service channel units. SCAT can also provide an inventory of the channel units at both the COT and the RT.

Series 5 System Maintenance

Feature list

The Series 5 system provides the following maintenance features.

- In FP303,
 - DS1 performance monitoring to detect marginal facilities and transmission equipment
 - digital subscriber line (DSL) performance monitoring to detect marginal ISDN basic rate lines and transmission equipment
 - system alarm status down to the circuit pack level (including channel units) sent in detailed ASN.1 message to the switch autonomously and by request.
- Local test access through the craft interface unit (CIU) for alignment and testing of special service channel units.
- Remote test access for voice and special service circuits through the extended test controller (XTC) for the Switched Access Remote Testing System (SARTS) or Mechanized Loop Testing (MLT) system (MLT-2), or a local test desk (LTD).
- Diagnostic testing of COT and RT channel units via the XTC.
- Compatible with the pair gain test controller (PGTC) and other provisioning and testing support systems used with the *SLC 96* Carrier System.
- Simplified electronic special services provisioning and single-ended circuit alignment.
- Continuous monitoring of circuits serving a digroup (24 channels), double digroup (48 channels), or system (96 channels).
- Alarm indicators at the COT and RT that display the system status and fail indicators that show defective plug-in units for sectionalizing faults to the COT, RT, MSDT or facility.

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Series 5 System Maintenance (Continued)

Feature list (continued)

- Floating contact closures for:
 - transmitting alarms via alarm telemetry systems (like TASC/E2A) to a remote alarm center
 - remote indication of specific digroups (customers) out of service
 - reporting miscellaneous RT conditions remotely.
 - An optional protection digital line with automatic or manual control.
 - Automatic isolation of failures to the COT, the digital facility, or the RT: manual loopback is not required.
-

System alarms and indicators

Depending on the immediate or potential effect on customer service, system alarms may be classified as major, minor, or power minor. System alarms are provided by COT/RT/MSDT local indicators, COT bay alarm indicators, central office audible and visual alarms, and maintenance center indications (remote telemetry). System alarms are supported by local indicators on the circuit packs. In FP303, system alarm status is sent in detailed ASN.1 message to the switch autonomously and by request.

Local indicators also provide a visual status for various system functions, including carrier line failure (CLF), digroup out of service or on protection, busy channels, blown fuses, busy testing, incompatibility (placement error), etc. Some units have a fail indicator that lights momentarily as part of a self-test when the unit is installed. The indicator goes off if the test is successful; otherwise, it stays lighted to show that the unit should be replaced. The fail indicator provides immediate visual verification if a unit fails during installation testing and trouble clearing.

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Series 5 System Maintenance (Continued)

Channel testing

The Series 5 system is equipped with automatic monitoring features to isolate trouble quickly and to report current or potential service outage using the existing local and remote alarm system. If the problem appears to be in the channel, the channel may be tested automatically via a test system or manually using a test set connected to the CIU for electronically provisionable channel units or faceplate jacks for POTS channel units.

The basic telephone service and locally-switched special service channel units are tested with MLT or a local test desk using the PGTC developed for the *SLC 96* Carrier System. The XTC provides enhanced PGTC test capabilities such as isolating trouble in the COT or RT channel unit. In addition, the XTC provides remote test access for SARTS in testing special service channel units. The XTC is designed to interface gracefully with MLT and SARTS. This allows testing of the interoffice portion of a special service circuit as well as the COT and RT channel units.

If testing of the loop beyond the RT is required, it can be tested via the local test desk or MLT on request by the special services center (SSC) to the maintenance center (MC). Drop testing from SARTS is available also. This enhanced testing capability expedites service restoration and reduces costly dispatch of personnel.

In a Series 5 system equipped with Fiber in the Loop, channels are tested remotely with MLT using the PGTC (or the XTC operating as a PGTC) for test access. Two types of tests are available for trouble sectionalization. The end-to-end channel tests check the quality of the subscriber loop between the COT channel unit and the MSDT channel unit. The drop tests check the condition of the drop from the MSDT channel unit to the subscriber's telephone set. The results are captured by MLT and displayed to the repair service administrator.

Integrated system also provide channel unit and drop access and testing. The *5ESS* switch software and hardware provides the capability to access and test Series 5 channel units and the customer drop. The testing can be requested by the trunk-line work station (TLWS), master control console (MCC), MLT or local test desk (LTD). FPB, FPF, and FP303 systems can be integrated.

Series 5 System Summary

Summary list

- The Series 5 system is an advanced, high-technology system with a flexible architecture for today and tomorrow.
- Feature packages allow flexibility in selecting different applications.
- The basic concept is that for most applications, the channel bank supports any service in any slot by simply changing plug-ins.
- The system supports full-featured voice, data, special services, and ISDN capabilities.
- The system supports circuit testing and provisioning capabilities.
- A single RT configuration (with a few different common units) serves both copper and fiber access in integrated and universal arrangements. This results in cost savings from reduced inventories of circuit packs.
- TR-08 Mode 2 operation and TR-303 variable concentration save in feeder facilities and switch terminations.
- The introduction of the *SLC-2000* MSDT reduces the per-home cost of fiber distribution.
- The system supports cost-effective ISDN that complies with the *ANSI U-DSL* standard.
- Cutover feature such as *FPC/AC* and *ALIC5* allow cost savings by reducing labor and/or equipment requirements.

These capabilities are provided with the existing backplane of the Series 5 system that is being deployed today. Different capabilities can be implemented by changing out some of the common circuit packs.

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Introduction

Feature and services resource

A brief description of SLC® Series 5 Carrier System features and services is given in Chapter 2.

Feature and services summary table

Some of the more important features and services are summarized by application in the following table. The table may be used to select a specific application for further inquiry. This table does not include features that are available in any system application [for example, the business remote terminal (BRT), fiber facilities, DS1 extensions, DDM-Plus, and others]. Features not listed in the table may be described in the text (refer to the table of contents for this chapter).



NOTE:

The services listed for an application may require specific common units. These requirements are defined in Chapter 4, *Equipment Description*.

(Continued on next page)

Introduction (Continued)

Feature and services summary table (continued)

System Application	Interface	DS1 Protection	Concentration	Test System	CIU Access (Note 1)	Special Services (Note 2)	ISDN	DS0 Services (Note 3)	SLC [®] -2000 MSDT
FPB/SS/U/M1	TR-08	4:1 Optional	No	MLT	at RT	Yes	Yes [*]	Yes	Yes [†]
FPB/SS/U/M2	TR-08	2:1 Optional	2:1	MLT	at RT	Yes ^{†‡}	No	Yes [§]	Yes [†]
FPB/SS/I/M1	TR-08	4:1 Optional	No	MLT	at RT	Yes	No	Yes [¶]	Yes [†]
FPB/SS/I/M1	TR-08	2:1 Optional	2:1	MLT	at RT	Yes [*]	No	Yes ^{**}	Yes [†]
FPC ^{††}	ESF	4:1 Optional	No	MLT/ SARTS	COT & RT	Yes	No	Yes	Yes [†]
INA-RT Mode I	FS	No ^{††}	No	N/A ^{§§}	at RT	Yes	Yes [*]	No	No
INA-RT Mode II	FS	No ^{††}	2:1	N/A ^{§§}	at RT	Yes [*]	Yes [*]	No	No
FP303	TR-303	4/3/2:1	Variable	MLT	at RT	Yes	Yes	Yes	No

Notes:

- 1 Provisioning and local test access may be available at DACS II.
- 2 2-wire nonlocally-switched special services (E *SPOTS*[®] channel units), 4-wire VF special services, and data service. 2-wire locally switched special service (*SPOTS* and M *SPOTS* channel units) and PLAR.
- 3 POTS, 2-wire locally-switched special service (*SPOTS* channel units and DID service), multiparty, coin, POTS with derived channel alarm. With enhanced FPB or FP303, POTS with derived channel alarm can be used only for POTS.

^{*} With placement restrictions.

[†] This feature can be implemented by changing some of the common units at the remote terminal (RT). See Chapter 4, *Equipment Description* for FPF configurations.

[‡] No SCEC provisioning allowed with dataports.

[§] No direct inward dial (DID) or POTS with derived channel alarm service.

[¶] No POTS with derived channel alarm service.

^{**} No POTS with derived channel alarm service, DID service, *SPOTS* channel units, or M *SPOTS* channel units.

^{††} Universal system only.

^{††} Can be provided externally by the customer.

^{§§} Test access for INA-RT is only through the CIU at the RT.

Enhanced Feature Package B (FPB)

Description

The Series 5 system enhanced FPB remote terminal (RT) is a full-service general-purpose access vehicle designed to interface to the *SLC* 96 central office terminal (COT) or any digital switch that complies with the TR-08 interface. The Series 5 enhanced FPB RT now offers the following:

- Mode 2 (2:1 channel concentration)
- the full range of special services
- integrated services digital network (ISDN) transport
- an auto-initialization feature for the FPB special services option
- conversion via AutoCut from a universal Feature Package C (FPC) system directly to an integrated enhanced FPB system (see Feature Package C)
- the *SLC*[®]-2000 multi-services distant terminal feature. When configured for fiber in the loop (FITL) the Series 5 RT serves as the host digital terminal (HDT) and is connected to the *SLC*-2000 MSDTs which serve as the optical network units (ONUs).

The new features can be implemented in an existing FPB system by changing some of the common units (see Chapter 4, *Equipment Description*). The enhanced FPB special services option allows craft interface unit (CIU) access at the Series 5 RT for provisioning and testing.

System interface compatibility

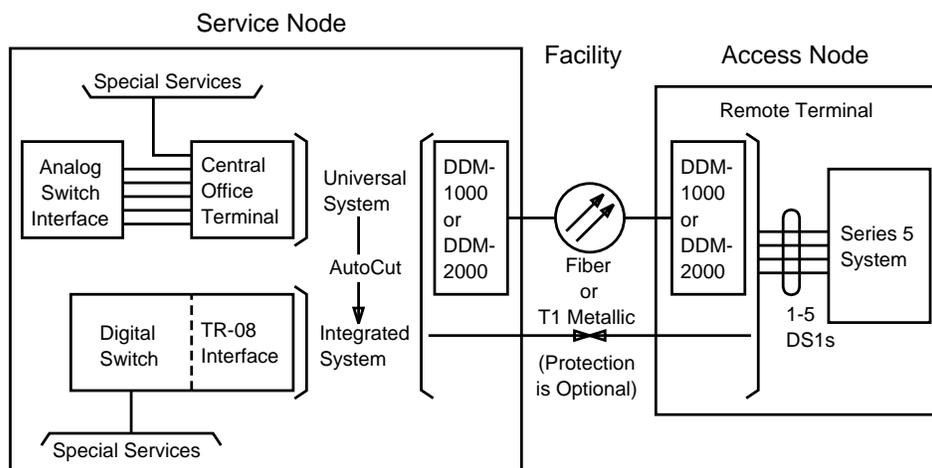
The Series 5 enhanced FPB RT is compatible with the *SLC* 96 COT and the *5ESS*[®] switch digital carrier line unit (DCLU) or integrated digital carrier unit (IDCU). Also, in an integrated configuration, the Series 5 enhanced FPB RT is compatible via the TR-08 interface with other digital switches (for example, the *DMS 100* switch).

(Continued on next page)

Enhanced Feature Package B (FPB) (Continued)

Enhanced FPB system interface compatibility illustrated

The Series 5 enhanced FPB RT is compatible with existing fiber facilities as shown in the following figure. See the Transmission Facilities section of this chapter for more information.



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Enhanced FPB naming conventions

Various names have been used to refer to the initial firmware release (MC97724A1) of the FPB system versus the enhanced FPB system.

The FPB system with the MC97724A1 bank control unit (BCU) has been referred to as existing or current FPB. This system has been superseded by the FPB system with the MC97776A1() BCU (referred to as enhanced FPB or sometimes as EFPB). Enhanced FPB with the MC97776A1() BCU includes all the features of FPB with the MC97724A1 BCU, plus many new features.

In addition to names for the old and new systems, the naming conventions in the following table specify various system characteristics. The enhanced FPB system configurations listed in the table also use different combinations of system common units. These combinations are defined in Chapter 4, *Equipment Description*. See also the Conventions Used section in the chapter, *About This Applications and Planning Guide*.

(Continued on next page)

Enhanced Feature Package B (FPB) (Continued)

Enhanced FPB naming conventions table

This table provides the naming conventions for the enhanced FPB.

<u>System Configuration and Options</u>	<u>Abbreviation</u>
FPB - Universal Mode 1	FPB/U/M1
FPB - Universal Mode 2	FPB/U/M2
FPB - Integrated Mode 1	FPB/I/M1
FPB - Integrated Mode 2	FPB/I/M2
FPB with Special Services Option - Universal Mode 1	FPB/SS/U/M1
FPB with Special Services Option - Universal Mode 2	FPB/SS/U/M2
FPB with Special Services Option - Integrated Mode 1	FPB/SS/I/M1
FPB with Special Services Option - Integrated Mode 2	FPB/SS/I/M2

The enhanced FPB Mode 1 system operates without channel concentration. The enhanced FPB Mode 2 system provides 2:1 channel concentration similar to SLC 96 Carrier System Mode 2. In a Mode 2 system, there are placement restrictions on some channel units (refer to Chapter 6, *Channel Units*). The special services (SS) option means that craft interface unit (CIU) provisioning is available at the Series 5 RT for the programmable special service channel units.

Additional information



NOTE:

The services listed for an application may require specific common units; these requirements are defined in Chapter 4, *Equipment Description*.

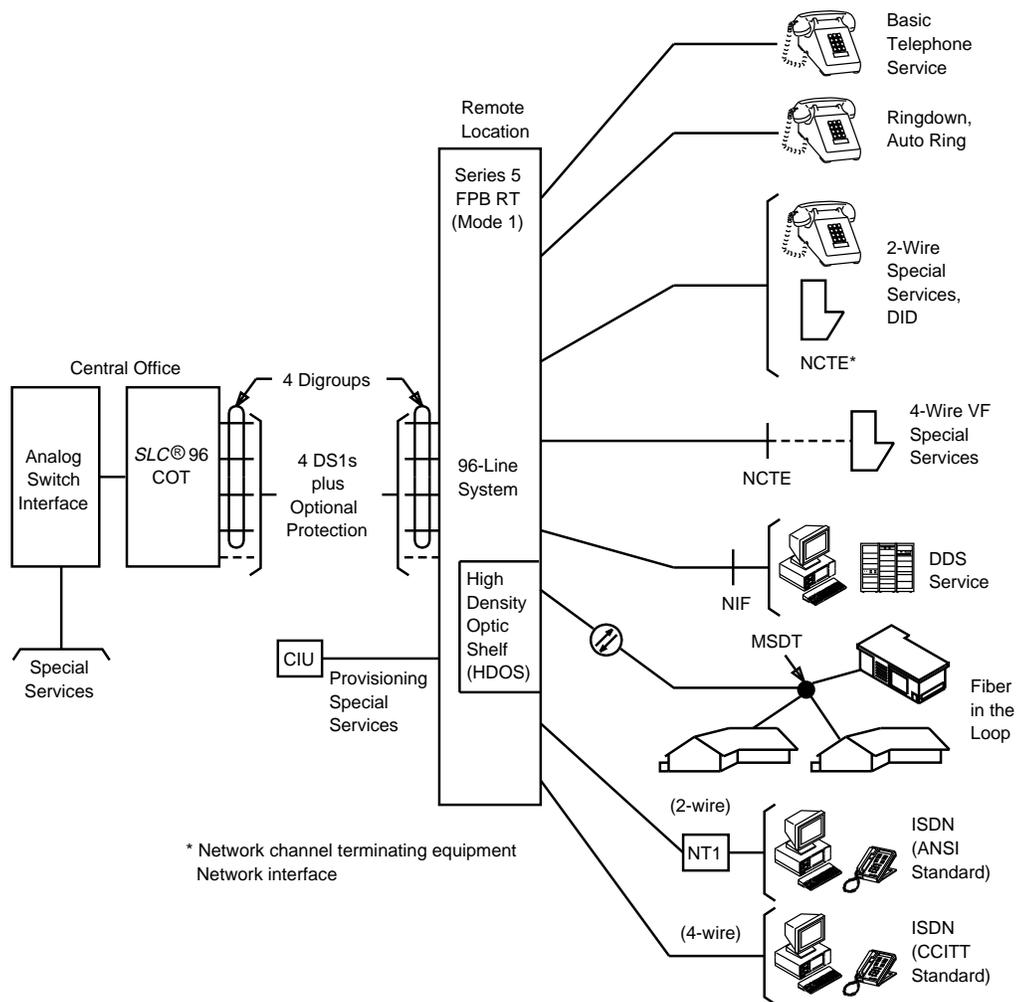
<u>Refer to ...</u>	<u>For information on ...</u>
915-710-116, Channel Unit Application and Prescription Setting	special services in each application
915-710-115, Series 5 System Engineering	basic telephone service channel units engineering information
Chapter 6 in this document	channel units

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Enhanced Feature Package B (FPB) (Continued)

Universal Mode 1 applications

The figure below shows the enhanced FPB universal mode 1 application of a Series 5 system using a SLC 96 COT and a Series 5 RT. System applications include business remote terminals (BRTs) and FITL. Two versions, FPB/U/M1 and FPB/U/M2, are supported in enhanced FPB universal Mode 1 applications.



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Enhanced Feature Package B (FPB) (Continued)

Universal Mode 1 services table

The services for enhanced FPB universal Mode 1 applications are listed in the table below.

<u>FPB/U/M1 System</u>	<u>FPB/SS/U/M1 System</u>
<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i>[®] and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Direct inward dial (DID)■ Integrated services digital network (ISDN)	<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i> and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Direct inward dialing (DID)■ Integrated services digital network (ISDN)■ Private-line manual ringdown (dual ringing repeater), private line auto ring (PLAR)■ 2-wire nonlocally-switched special services (E <i>SPOTS</i> channel units)■ 4-wire voice-frequency (VF) special services■ Digital Data System (DDS) services

For provisioning and testing voice-frequency (VF) special services and Digital Data System (DDS) service, CIU access is provided at the Series 5 RT. The ISDN applications have some placement restrictions as mentioned in Chapter 6, *Channel Units*. *VerSuS* alarm transport service (POTS with derived channel alarm) is not available in enhanced FPB Mode 1 systems.

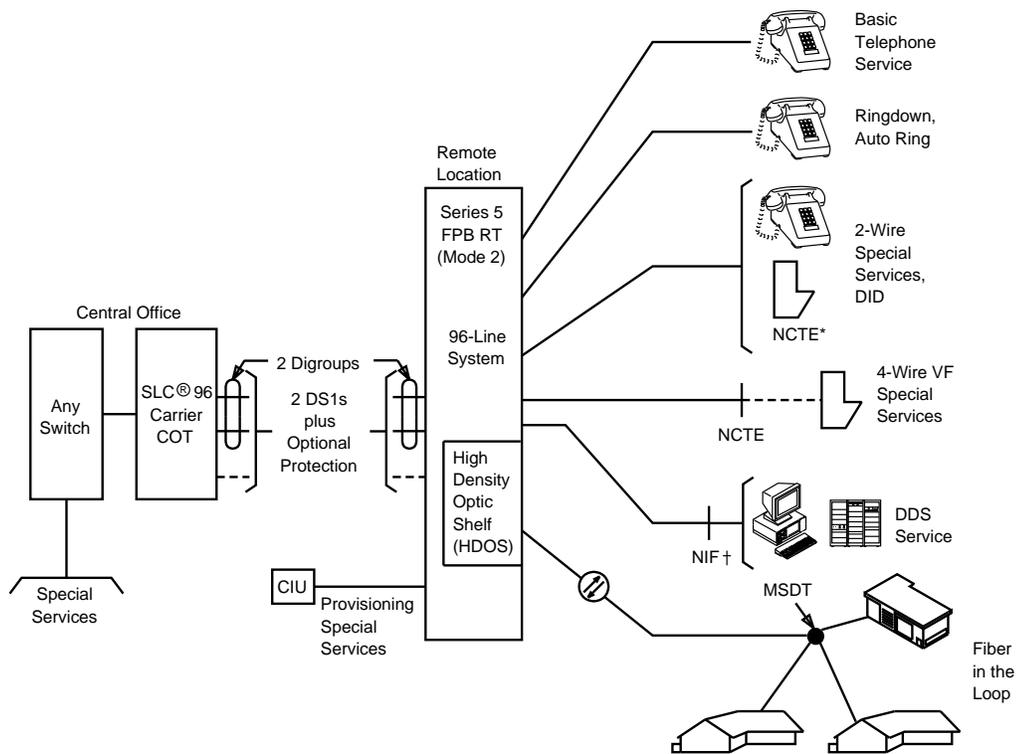
Fiber in the loop applications require specific common units. These requirements are defined in Chapter 4, *Equipment Description*.

(Continued on next page)

Enhanced Feature Package B (FPB) (Continued)

Universal Mode 2 applications

An enhanced FPB Mode 2 system, as depicted in the following figure, provides 2:1 facility concentration and protection line switching. Mode 2 uses the A and C digroup facilities to provide 2:1 channel concentration for a 96-channel Series 5 system. The A/B shelf has full access to the 24 DS0s on the A digroup DS1 facility. The C/D shelf has full access to the 24 DS0s on the C digroup DS1 facility.



* Network channel terminating equipment
 † Network interface

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Enhanced Feature Package B (FPB) (Continued)

Universal Mode 2 services table

Enhanced FPB supports two versions of universal Mode 2: FPB/U/M2 and FPB/SS/U/M2. The following table lists the services for each version. For *SPOTS* applications the COT permanently assigns a time slot.

<u>FPB/U/M2 System</u>	<u>FPB/SS/U/M2 System</u>
<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i>[®] and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)	<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i> and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Private-line manual ringdown (dual ringing repeater), private line auto ring (PLAR)■ 2-wire nonlocally-switched special services (E <i>SPOTS</i> channel units)■ 4-wire voice-frequency (VF) special services■ Digital Data System (DDS) services

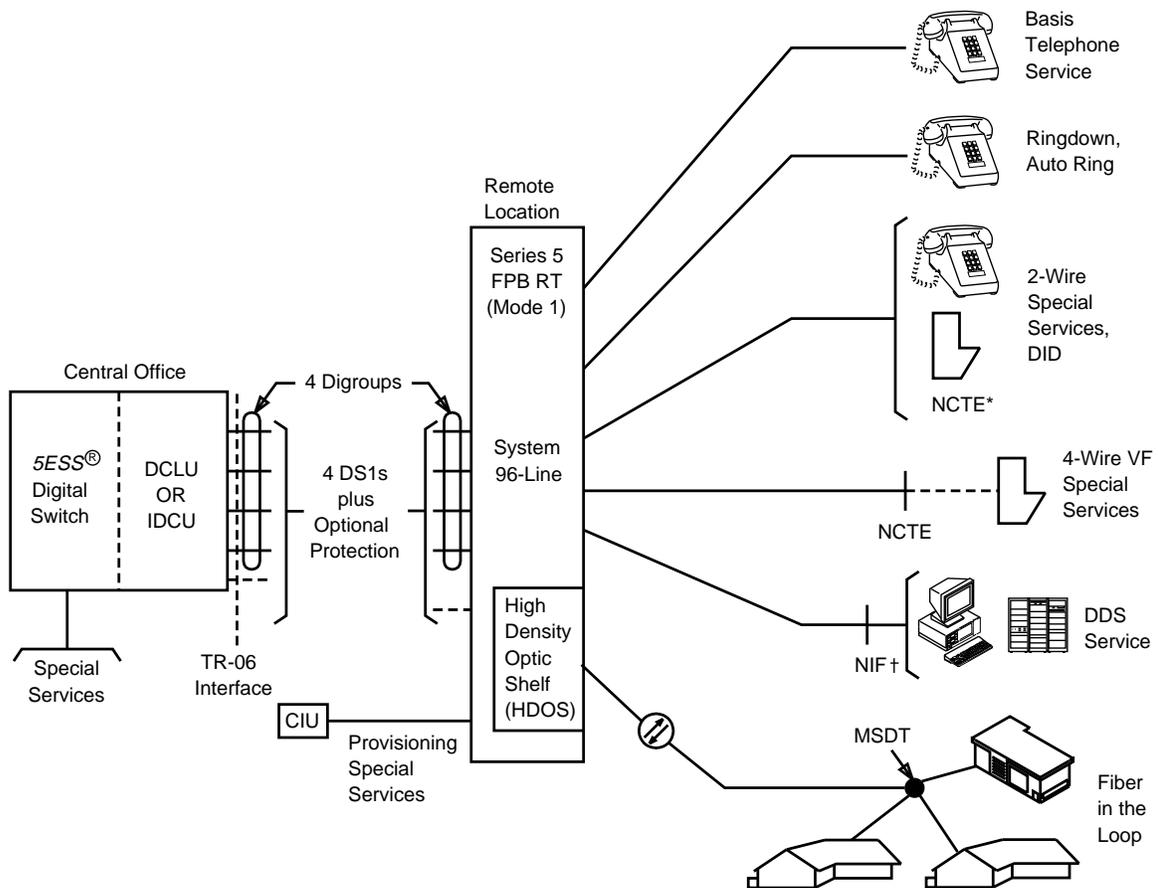
The *VerSuS* alarm transport service, ISDN, and DID are not available in enhanced FPB Mode 2 systems. Second channel error correction (SCEC) is not available with DDS service in enhanced FPB Mode 2 systems. For special services, CIU provisioning and testing are available at the Series 5 RT.

(Continued on next page)

Enhanced Feature Package B (FPB) (Continued)

Integrated Mode 1 applications

In an integrated application as shown in the following figure, the Series 5 enhanced FPB RT interfaces a 5ESS switch DCLU, IDCU, or equivalent TR-08 switch interface. Two versions of this interface exist: FPB/I/M1 and FPB/SS/I/M1.



* Network channel terminating equipment
† Network Interface

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(Continued on next page)

Enhanced Feature Package B (FPB) (Continued)

Integrated Mode 1 services table Services supported in an integrated system with an enhanced FPB Mode 1 RT are listed in the following table.

<u>FPB/I/M1 System</u>	<u>FPB/SS/I/M1 System</u>
<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i>[®] and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Direct inward dialing (DID) (<i>5ESS</i>[®] switch 5E6 generic)■ Integrated services digital network (ISDN) (through hairpin feature on IDCU)	<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ 2-wire locally-switched special service (<i>SPOTS</i> and M <i>SPOTS</i> channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Direct inward dialing (DID) (<i>5ESS</i> switch 5E6 generic)■ Integrated services digital network (ISDN) (through hairpin feature on IDCU)■ Private-line manual ringdown (dual ringing repeater), private line auto ring (PLAR)■ 2-wire nonlocally-switched special services (E <i>SPOTS</i> channel units)■ 4-wire voice-frequency (VF) special services■ Digital Data System (DDS) services (through hairpin feature on IDCU)

For special services, CIU provisioning and testing are available at the Series 5 RT. ISDN and DDS services [including second channel error correction (SCEC)] are available in configurations integrated into the IDCU through hairpinning. The *VerSuS* alarm transport service is not available in enhanced FPB Mode 1 integrated systems.

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Enhanced Feature Package B (FPB) (Continued)

Analog line to integrated SLC[®] carrier at 5ESS[®] switch cut (ALIC5)

ALIC5 is a new capability provided by *SLC Series 5 Carrier System* and the *5ESS* switch DCLU or IDCU. This enables the rehabilitation of copper plant on an analog switch through a direct conversion to integrated digital loop carrier (DLC), simultaneously with the *5ESS* switch cutover. Up to now, such copper rehabilitation was possible only through costly multistep processes. The process required the installation of either a central office terminal (COT) on the analog switch, or alternatively an analog line unit on the digital switch, and then cutting to integrated DLC on the digital switch. ALIC5 provides the technical feasibility for accomplishing such rehabilitation in a single step. The process involves a new type of channel unit that can be commanded from the *5ESS* switch to become electrically non-intrusive to a circuit connected to its tip/ring leads. This allows the new *5ESS* switch to be connected to all the circuits that are to be cut over, without degrading the transmission quality of the working circuit prior to the cut. Then, during times of low traffic, the various DLC circuits are temporarily revitalized in order to perform office-to-office testing to prepare for the cutover. The RT location is chosen so that the metallic extension onto the customer premises equipment (CPE) is within normal DLC design limits. But in some cases the range limit must be restricted to compensate for the effect, following the cut, of the connection back to the analog switch (thus allowing the cross-connects to be removed at the telephone company's convenience). The full range can be retained if a bridge lifter is used at the connection point to disconnect the portion of the loopback to the analog switch upon cutover, or if the cutover procedure includes an immediate manual disconnection of the bridged tap.

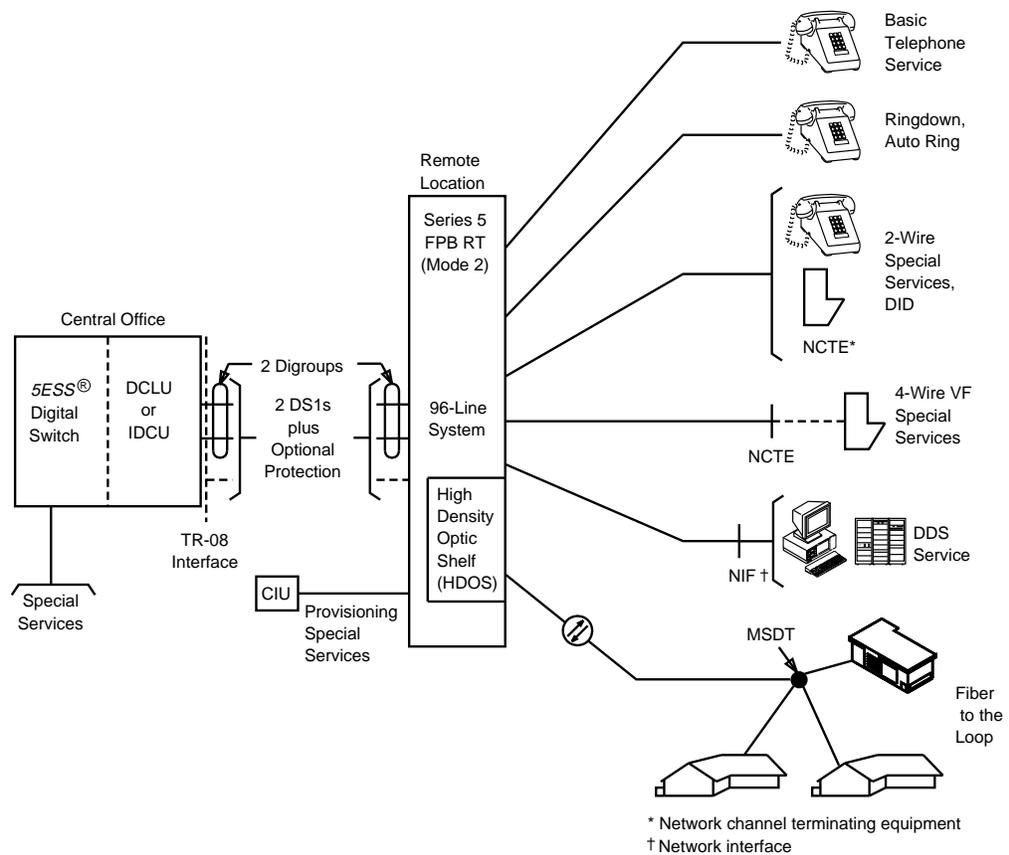
See 915-710-115, *SLC Series 5 Carrier System, Application Engineering*, Appendix A, for guidelines on the design of circuits that are part of an ALIC5 cutover process.

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Enhanced Feature Package B (FPB) (Continued)

Integrated Mode 2 applications

An enhanced FPB Mode 2 integrated system provides 2:1 channel concentration with a 5ESS switch DCLU, IDCU, or equivalent TR-08 switch interface. Mode 2 uses the A and C digroup facilities to provide 2:1 channel concentration for a 96-channel Series 5 system. The A/B shelf has full access to the 24 DS0s on the A digroup DS1 facility. The C/D shelf has full access to the 24 DS0s on the C digroup DS1 facility. Two versions of this interface exist: FPB/I/M2 and FPB/SS/I/M2.



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Enhanced Feature Package B (FPB) (Continued)

Integrated Mode 2 services table Services supported in an integrated system with an enhanced FPB Mode 2 RT are listed in the following table.

<u>FPB/I/M2 System</u>	<u>FPB/SS/I/M2 System</u>
<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)	<ul style="list-style-type: none">■ Single-party telephone service (POTS channel units)■ Coin■ Multiparty■ Frequency selective ringing (FSR)■ Private-line manual ringdown (dual ringing repeater), private line auto ring (PLAR)■ 2-wire nonlocally-switched special services (E <i>SPOTS</i>[®] channel units)■ 4-wire voice-frequency (VF) special services■ Digital data system (DDS) services (through hairpin feature on IDCU)

The *VerSuS* alarm transport service and ISDN are not available in enhanced FPB Mode 2 integrated systems. DDS service including second channel error correction (SCEC) is available in enhanced FPB Mode 2 integrated systems through IDCU hairpinning. For special services, CIU provisioning and testing are available at the Series 5 RT.

Fiber in the loop applications require specific common units. These requirements are defined in Chapter 4, *Equipment Description*.

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Enhanced Feature Package B (FPB) (Continued)

Auto-initialization in an enhanced FPB RT with special services option

Auto-initialization (jump start) refers to turn-up of an RT containing only basic telephone service (nonprogrammable) channel units without using the CIU. Normally, with special service channel units, the CIU is required at the RT during turn-up. The CIU is used to provision the channel units and may be needed to clear the provisioning memories. Copies of the provisioning memory are contained in three different common units for redundancy. The copies must match to turn up the system. If only nonprogrammable channel units are installed, the CIU is needed only to clear the electronically erasable programmable read-only memories (EEPROMs) when they do not match. Auto initialization [a CLEAR/NORM option plug (strap) on the alarm display unit (ADU)] allows the memories to be cleared without using the CIU.

Auto initialization applies only to the initial turn-up of a universal or integrated enhanced FPB RT with special services option. Special service channel units can still be installed and provisioned later. This feature does not apply to an FPB/U/M1, FPB/U/M2, FPB/I/M1, or an FPB/I/M2 RT (with the AUB24 ADU).

Channel testing capabilities

The enhanced FPB RT with special services option allows CIU provisioning and test access for special service channel units. Pair gain test controller (PGTC)* test access and features are available with all universal FPB RT applications; the same access and features are available through the digital switch for integrated systems. Enhanced FPB allows Mechanized Loop Testing (MLT) system and local test desk (LTD) channel and drop testing of basic telephone services and Fiber in the Loop feature (POTS).

The following table supplies testing, installation, and maintenance references.

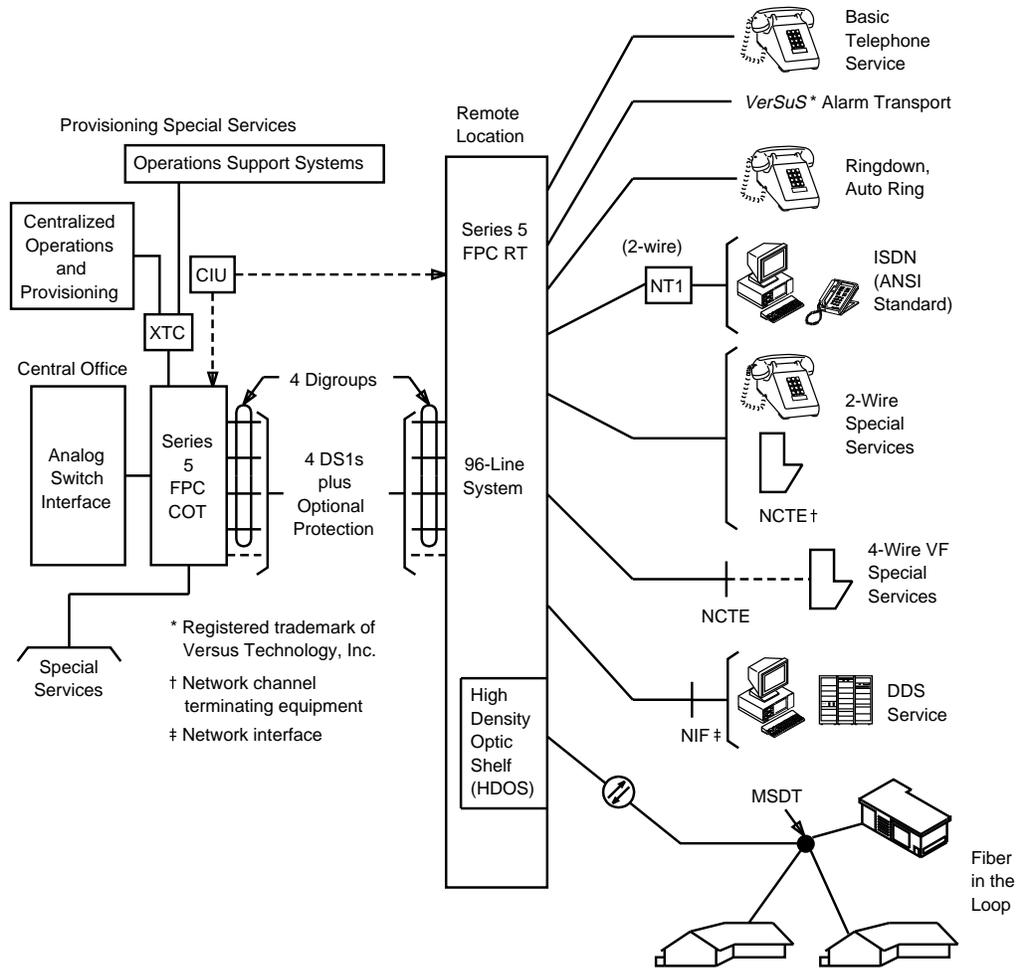
<u>Refer to ...</u>	<u>For information on ...</u>
363-205-402	Series 5 channel unit installation tests
363-205-004	testing Fiber in the Loop feature POTS channels
363-205-106	AUA90 T-BRITE channel unit installation and maintenance
363-205-107	AUA93 BRITE II channel unit installation and maintenance
363-005-238	the 950A maintenance test set used for ISDN

* Also, extended test controller (XTC) operating in PGTC mode.

Feature Package C (FPC)

FPC - universal arrangement description

The Series 5 FPC system is a universal arrangement with a full range of services, advanced testing capabilities, plus the AutoCut feature. This system is designed to interface any analog or digital switch via the Series 5 FPC COT. The FPC applications are illustrated in the figure below.



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Feature Package C (FPC) (Continued)

FPC features

Advanced testing allows Switched Access Remote Testing System (SARTS) access for special services. The AutoCut feature, the latest addition to FPC, allows a specially equipped FPC RT to be converted to an enhanced FPB RT (integrated) without dispatching personnel to the RT at the time of cutover. The Series 5 FPC system offers the following:

- the full range of special services
 - AutoCut feature for converting to an enhanced FPB Mode 1 system for direct access to a digital switch using a TR-08 interface.
-

Service applications

A Series 5 FPC system supports the following services:

- single-party telephone service (POTS channel units)
 - 2-wire locally-switched special service (*SPOTS* and *M SPOTS* channel units)
 - coin
 - multiparty
 - frequency selective ringing (FSR)
 - direct inward dial (DID)
 - *VerSuS* alarm transport service (POTS with derived channel alarm)
 - private-line manual ringdown (dual ringing repeater), private line auto ring (PLAR)
 - 2-wire nonlocally-switched special services (*E SPOTS* channel units)
 - 4-wire voice-frequency (VF) special services
 - digital data system (DDS) services
 - BRITE II U-interface digital subscriber line (U-DSL) transport.
-

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Feature Package C (FPC) (Continued)

AutoCut feature

An FPC with AutoCut (FPC/AC) system must be equipped with AutoCut common units in the RT (see Chapter 4, *Equipment Description*). Once this has been done (it can be done when the FPC/AC system is installed), no further action is required at the RT for cutover. Converting from FPC to enhanced FPB Mode 1 will interrupt service for a short time (to transfer the DS1 lines from the COT to the switch at the central office). With the proper switch settings on the RT Alarm Display Unit (ADU), cutover can be done without dispatching to the RT. After integrating, the RT automatically operates as an enhanced FPB Mode 1 RT. The AutoCut feature also allows conversions from an enhanced FPB Mode 1 RT to an FPC RT. Procedures for cutover are given in 363-200-005, *Integrated SLC Carrier System Recent Change* (TOP).

Feature package F (FPF)

Feature Package F is used to configure a SLC Series 5 RT to be used as a host digital terminal (HDT) to support the SLC-2000 multi services distant terminal (MSDT) feature, in addition to the full range of services offered by the SLC Series 5 FPC system.



NOTE:

The services listed for an application may require specific common units. These requirements are defined in Chapter 4, *Equipment Description*.

Channel testing capabilities

The Series 5 FPC system provides CIU provisioning and test access from the COT for special service channel units (the CIU also may be used at the RT for testing). Pair gain test controller and extended test controller test access and features are available with the FPC system. Test access for SARTS is provided for special services testing. The XTC complements SARTS for advanced circuit testing. Feature Package C allows channel and drop testing of basic telephone services and FITL POTS channels using a LTD or the MLT system.

Refer to ...

For information on ...

Chapter 9

channel testing

363-205-100

channel testing

363-205-402

circuit testing

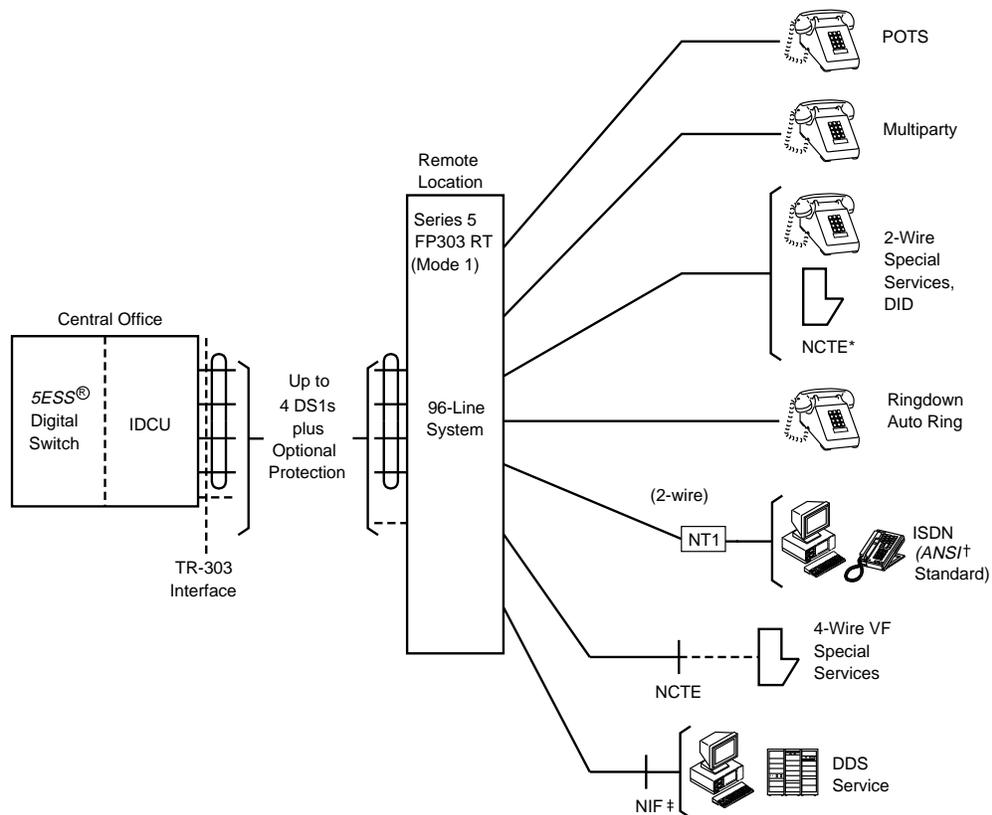
363-205-116

testing ISDN BRITE II channel units in FPC

Feature Package 303 (FP303) Release 3.0

Basic system configuration

The FP303 system terminates on a TR-303 compliant digital switch, such as a 5ESS, GTD-5, and Nortel. The 5ESS switch with an IDCU peripheral, as shown in the figure below, is a vehicle for providing cost-effective ISDN that complies with the ANS/ U-interface digital subscriber line (U-DSL) standard. FP303 concentrates a 96-line system on 2, 3, or 4 DS1s facilities. The optional protection line requires an additional DS1 facility. (5ESS only supports protection DS1 features.) The A and C line interface units and DS1 facilities carry the active and standby Embedded Operations Channel (EOC) and the timeslot management channel (TMC) used for carrying operations messages and call processing messages (such as time-slot assignments) between the switch and RT. Therefore, the minimum system must include the A and C LIUs.



* Network channel terminating equipment
 † Registered trademark of American National Standards Institute, Inc.
 ‡ Network Interface

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Feature Package 303 (FP303) Release 3.0 (Continued)

FP303 switch compatibilities

This table identifies the TR-303 compliant digital switches and their common unit compatibilities, that have been qualified by Lucent Technologies for support by SLC Series 5 FP303.

FP303	Switches Supported		
	Lucent Technologies	AGCS	Nortel
R1.0	5E9.2, 5E10 and later [*]	—	—
R2.0	5E9.2, 5E10 and later [*]	—	—
R3.0	5E9.2, 5E10 and later [*]	GTD-5 SRV173 [†]	DMS-100 NA004 [†]

^{*} Compatible with the AUA112() RT TRUs which can be used with both the MC97777A1 and MC97796A1 BCUs.

[†] Compatible with the AUA112B RT TRU which can be used with both the MC97777A1 and MC97796A1 BCUs.

Features supported

The following list summarizes key capabilities of TR-303 implemented into FP303:

- hybrid signaling — *(through the TMC and robbed bit signaling) for locally switched voice frequency (VF) circuits*
 - embedded operations channel using ASN.1 messages
 - full access dynamic time-slot assignment — *capable of efficiently handling up to 96 VF and ISDN customers served over 2, 3, or 4 DS1 facilities*
 - TMC and EOC path switching — *for data link robustness*
 - 4 kbps extended superframe new data link (ESF/ndl) — *for protection switching commands and yellow alarms*
 - 4:1 time division multiplexing (TDM) method — *for efficient ISDN basic rate access*
 - channel testing and drop access
 - optional DS1 facility protection switching
 - B8ZS clear channel capability
 - alarm and ISDN event reports
 - DS1 performance monitoring
-

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Feature Package 303 (FP303) Release 3.0 (Continued)

Features supported (continued)

- enhanced maintenance with the ability to provision DS1 performance monitoring thresholds, obtain threshold crossing alerts, and retrieve performance monitoring history at the switch
- DS1 facility loopbacks
- DSL overhead transport
- DSL performance monitoring
- full compliment of ISDN loopbacks.

Service applications

In FP303, the following channel unit types are supported:

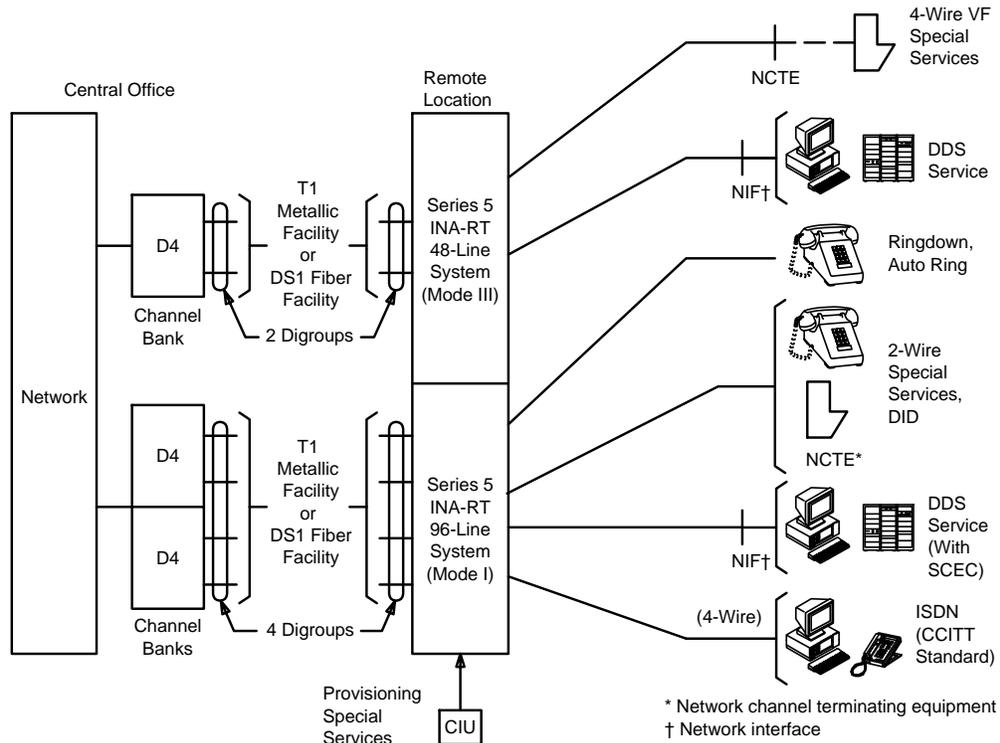
- single party (POTS)
- multiparty (superimposed ringing)
- multiparty (frequency selective ringing)
- 2-wire locally-switched special service (*SPOTS* and M *SPOTS* channel units)
- digital data system (DDS) services
- direct inward dialing (DID) (loop reverse battery)
- 4-wire voice-frequency special services
- Coin (coin-first and dial-tone-first)
- private-line manual ring down (dual ringing repeater) and private line auto ring (PLAR)
- ISDN U-DSL basic rate interface with 4 D channels to 1 DS0 multiplexing
- 2-wire non-locally switched special services (E *Spots* channel units).

Refer to the circuit packs section in Chapter 4 for the actual channel unit codes supported. If a specific minimum series number is recommended, it is listed, otherwise all series numbers are supported.

Integrated Network Access - Remote Terminal (INA-RT)

Description

The Series 5 INA-RT provides integrated network access based on a subset of D4 channel bank features. Applications for INA-RT, as shown in the figure below, include termination on a D4 or D5 digital terminal, a digital cross-connect system (DCS) such as the Digital Access and Cross-Connect System (DACS II), or a SLC 96 COT D4 emulator at the central office. The INA-RT provides Mode I and Mode III to maximize physical space and transmission bandwidth. These modes are compatible with any INA-RT application. Mode I provides more efficient operation with dual channel units; Mode III allows facility savings using mostly single channel units. The INA-RT contains two 96-line systems (Mode I) or 48-line systems (Mode III).



(Continued on next page)

Integrated Network Access - Remote Terminal (INA-RT) (Continued)

System interface compatibility

The INA-RT provides transmission and operating characteristics that are compatible with a Mode III D4 bank or a *SLC 96* COT emulating a D4 channel bank. The INA-RT uses the same framing formats as the D4 channel bank: superframe format (SF) or the extended superframe format (ESF). The INA-RT emulates Mode III D4 channel bank transmission and operating characteristics when interfaced with a D5 channel bank. In this application, INA-RT provides the same features as a Mode III D4 to D5 bank system. The INA-RT is compatible with a digital cross-connect system at the DS1 line rate.

Additional information

The table below provides the sources for more information on INA-RT.

Refer to ...	For information on ...
Chapter 4	common unit requirements with INA-RT
Chapter 6	channel unit placement restrictions with INA-RT
363-205-104	turnup and maintenance procedures for INA-RT
363-099-105TD	INA-RT
363-099-092NP	INA-RT

Service applications

The INA-RT supports the following services:

- direct inward dial (DID)
- integrated services digital network (ISDN)
- private-line manual ringdown (dual ringing repeater) and private line auto ring (PLAR)
- 2-wire nonlocally-switched special services (*E SPOTS* channel units)
- 4-wire voice-frequency (VF) special services
- digital data system (DDS) services.

For information on channel unit placement rules and channel availability in each mode, see Chapter 7, *Engineering and Planning*.

(Continued on next page)

Integrated Network Access - Remote Terminal (INA-RT) (Continued)

Features and benefits

The INA-RT common unit options allow best use of 2- and 4-wire special service channel units. The INA-RT can be mixed with other Series 5 systems (feature packages) in a dual channel bank assembly. In an INA-RT mixed bank application, half of the dual bank functions as INA-RT; the other half may be a Series 5 enhanced FPB RT or FPC RT.

Benefits of the INA-RT include the following:

- serves one or two D4 channel banks on each 96-line system (the Series 5 system provides a 2:1 size advantage over D4 banks)
- eliminates back-to-back (tandem) central office channel units
- needs no central office terminal
- provides cost-effective loop transmission for groomed special services
- uses existing Series 5 equipment and apparatus
- allows the specific remote terminal application (INA-RT or Series 5 RT) to be deferred until the system is equipped (the application can also be reversed)
- provides facility savings in Mode III comparable to *SLC 96 Carrier System Mode III*
- provides power backup and ringing generators with the system
- operates in an extended temperature range
- provides customized business remote terminal (BRT) designs for customer locations.

Mode I

Each system in a Mode I INA-RT can serve up to 96 subscriber circuits over four unconcentrated DS1 paths. The DS1 signals may be terminated on four D4 channel banks, offering a 4:1 space savings using a Mode I INA-RT compared to D4 channel banks (see the description portion of this section). The INA-RT Mode I is recommended for applications with a large percentage of dual channel units, DDS channel units using second channel error correction (SCEC), or ISDN channel units. This operating mode provides most efficient use of 48 dual-channel 2-wire channel units, although the single-channel 4-wire channel units may be used also.

(Continued on next page)

Integrated Network Access - Remote Terminal (INA-RT) (Continued)

Mode I (continued)

Each 96-line system in the Mode I INA-RT can be administered as one 96-line system or as two 48-line systems. Because the 96-line system can interface two 48-line D4 banks, two different system identification numbers may be assigned to a 96-line system, allowing each set of 48 channels to be provisioned independently of the other (a Mode I INA-RT may contain up to four 48-line systems).

Mode III

Each system in the Mode III INA-RT serves up to 48 subscriber circuits over two unconcentrated DS1 paths. The DS1 signals may be terminated on two D4 channel banks, offering a 2:1 space savings using a Mode III INA-RT compared to D4 channel banks (see the description portion of this section). The INA-RT Mode III is recommended for applications with a large percentage of single channel units: 4-wire VF channel units or DDS channel units (without SCEC). This operating mode is most efficient using 48 single-channel 4-wire channel units since facilities are reduced. Dual-channel 2-wire channel units may be used also.

Testing capabilities

Because the D4 format has no data link, the INA-RT does not have PGTC or XTC testing capabilities. Local channel testing is performed via the CIU and the 52A channel unit test extender. The CIU operations that refer to the far end (COT) are not supported.

Refer to ...	For information on ...
363-205-106	testing AUA90 T-BRITE ISDN channel units
363-005-238	the 950A maintenance test set used for ISDN
Chapter 9	INA-RT circuit testing

Digital line testing is limited to automatic loopback testing when input fails to an LIU and to jack access with an AUA78 fault-locating test adapter (FLTA). The loop terminal (LT) (manual terminal loopback) test switch on the D4 bank cannot be used in INA-RT applications. However, the far-end loop switch on the AUA78 does function with an INA-RT system. The Series 5 AUA78 FLTA and a fault-locating test set are used to troubleshoot T1 digital lines using standard fault-locating procedures.

Integrated Features

Hairpin feature for special services (5ESS[®] switch)

The hairpin feature provides a semi-permanent (for the duration of the service subscription) connection between two DS0 ports on the same integrated digital carrier unit (IDCU). Unlike nail-up connections which 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 (5E8 and later generics) allows hairpinning of non-switched and non-locally switched special services terminating in IDCUs (the same services supported with DCLU nail-up). In addition, hairpinning supports multi-channel (N x DS0) services such as digital data system (DDS) with secondary channel error correction (SCEC) and integrated services digital network (ISDN) basic rate interface extension (BRITE). For DDS with SCEC, the DS0 time slots associated with both the data channel and error correction channel are hairpinned. When hairpinning BRITE services to a D4 or D5 channel bank (equipped with BRITE channel units), up to three DS0 timeslots (B1, B2, and 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 subject to normal call processing — the 5ESS switch allows in-band signaling to pass through unaltered. There are no restrictions on hairpin connections since they are intra-IDCU. The hairpinned connection is provisioned by an assignment in the 5ESS switch data base using the recent change/verify (RC/V) capability.

A hairpin connection continues to provide normal service during switch failures that neither corrupt the IDCU data base or cause it hardware to malfunction. If an IDCU affecting failure occurs, the switch automatically restores any hairpin connections following recovery from the failure. The switch also routinely verifies (in a non-service affecting manner) the integrity of hairpin connections. If the integrity of a connection is in question, the switch automatically restores the connections.

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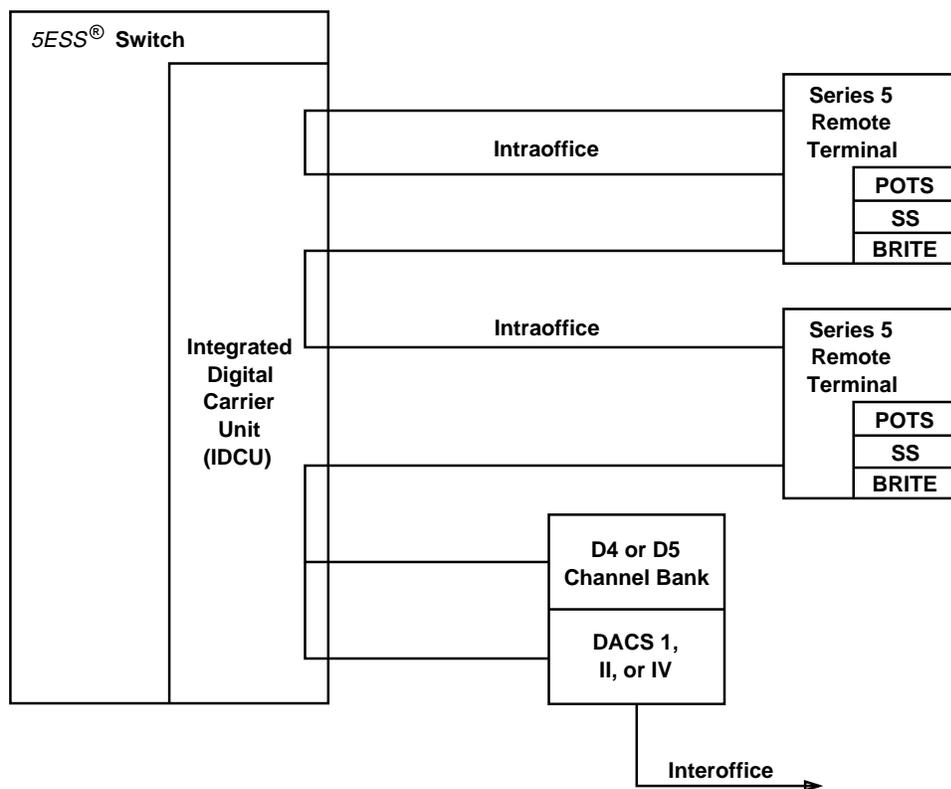
Integrated Features (Continued)

Hairpin feature application illustrated

The hairpin connection types applicable to the *SLC Series 5 RT* include:

- RT to RT
- RT to DACS I, II, or IV
- RT to D4 or D5 channel bank.

These applications are illustrated in the figure below.



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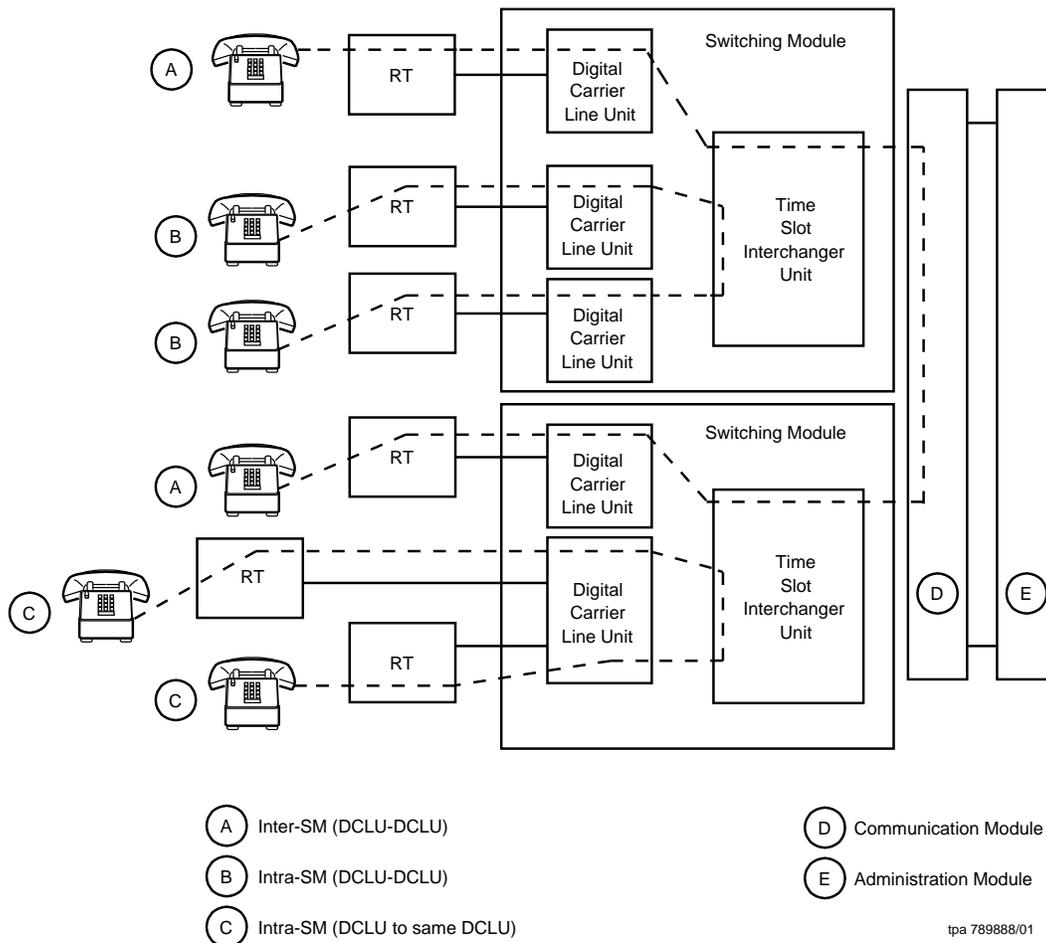
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Integrated Features (Continued)

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 Carrier System. This capability is called nail-up because the transmission path is pre-assigned and signaling information is not subject to normal call processing functions.

The 5ESS switch 5E4 and later generics allow nail-up of Series 5 enhanced FPB RT special service circuits terminating in DCLUs. This allows integrated special service circuit applications for intraoffice and interoffice circuits. The figure below shows typical routing paths used for nailed-up circuits.



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Integrated Features (Continued)

Nail-up applications described

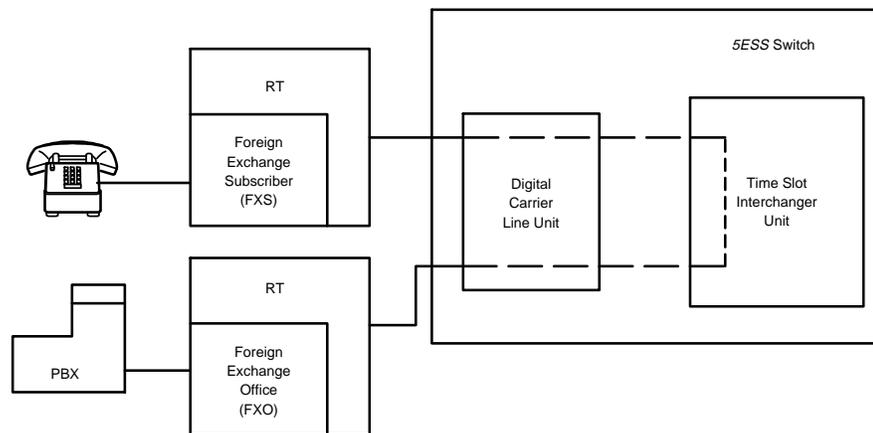
Intraoffice applications involve nail-up between two DCLUs in the same 5ESS switch. Interoffice applications refer to nail-up between a DCLU and a digital line trunk unit (DLTU) (usually to another office).

Most special service circuit (nail-up) applications fall into the categories listed below:

Intraoffice: Off premises station applications
Private data circuit applications

Interoffice: Foreign exchange applications
Off premises station applications
Private data circuit applications

This figure shows the intraoffice off premises station 5ESS[®] switch nail-up application.

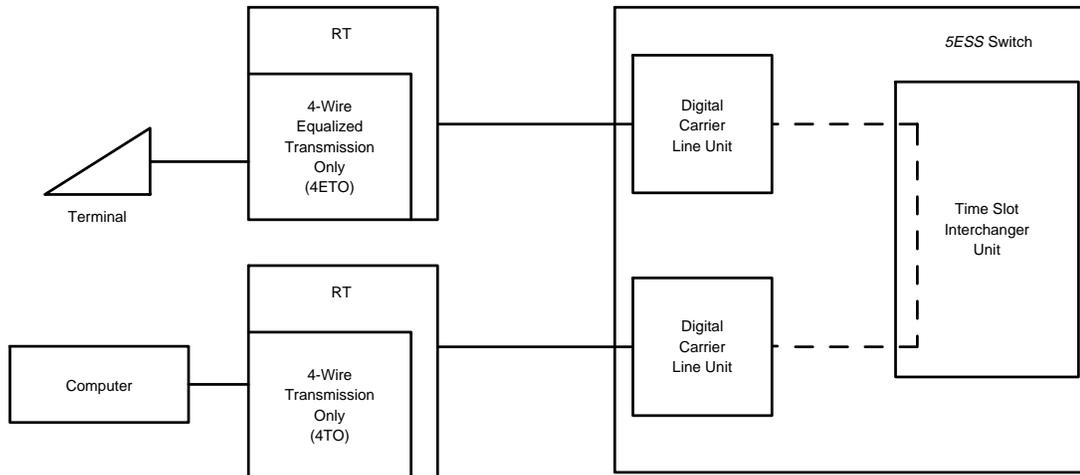


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Integrated Features (Continued)

Nail-up applications described (continued)

This figure shows the intraoffice private line data circuit *5ESS*[®] switch nail-up application.

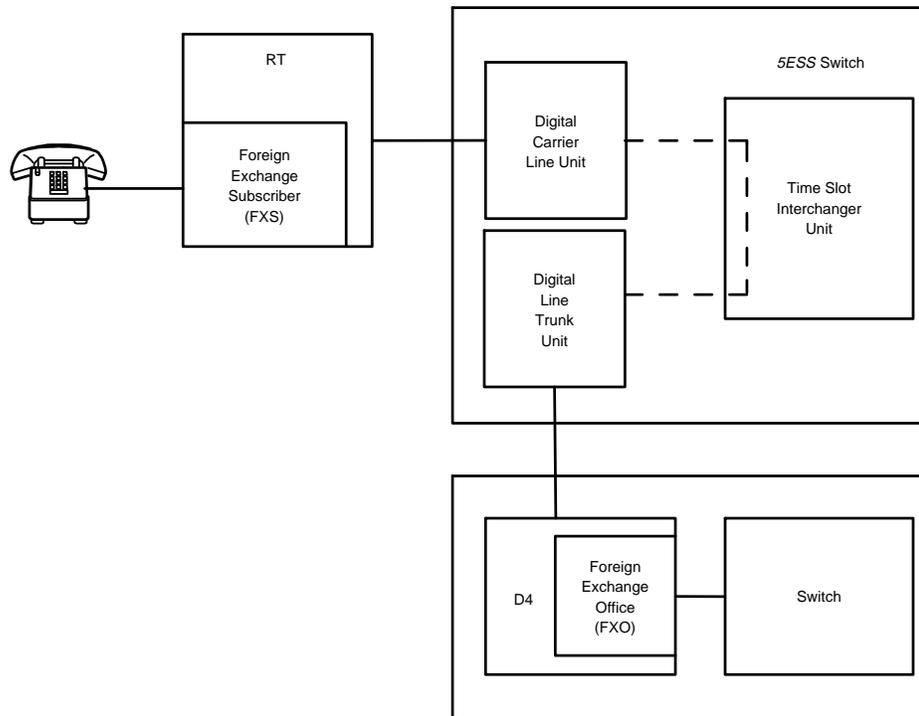


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Integrated Features (Continued)

Nail-up applications described (continued)

This figure shows the 5ESS[®] switch nail-up foreign exchange application.



Nail-up circuits explained

A nailed-up circuit acts like a stable switched call, except that the 5ESS switch allows in-band signaling (AB bits) to pass through unaltered. Nailed-up calls will not be disconnected when a phone goes on-hook or as a result of other station activity. The nail-up circuit is provisioned by an assignment in the 5ESS switch data base using the recent change/verify (RC/V) capability. The connection is continuously monitored; if the connection is dropped because of a software error or fault condition (such as initialization) the 5ESS switch will detect this and will take actions necessary to restore the circuit.

(Continued on next page)

Integrated Features (Continued)

Nail-up circuits explained (continued)

Because nail-ups require full-time usage of time slots, they reduce the number of available switching module (SM) time slots. The nail-up circuits are full-time usage connections and cannot be used for switched service while assigned in nail-up service. For traffic administration, nail-up circuits must be tracked by circuit orders processed by the circuit provisioning center (CPC).

Refer to 363-099-091TD for more information on the applications and implementation of 5ESS switch nail-up circuits.

Recent change activities

Administration and maintenance of an integrated Series 5 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. Database 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 Series 5 equipment or circuits 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.

Refer to 363-205-402, Series 5 channel unit installation (TOP) for RC/V procedures for Series 5 channel unit installation. For more detail on recent change, see 363-200-010, *DCLU Integrated SLC Carrier System, General Information Manual* and in the 5ESS switch documentation (235-xxx-xxx).

Transmission Facilities

Description

The digital transmission facility may be metallic T1 carrier or digital facility connected to a multiplexer with a DS1 interface. Or, the metallic DS1 system output may be multiplexed into a fiber facility (for example, the DDM-1000 or DDM-2000 multiplexer). Facility protection switching is an optional feature of the Series 5 system. The protection line can be provided as part of the Series 5 system (except INA-RT) or by connecting facilities (the digital multiplexer, etc). An option must be set on the alarm display units (ADUs) at both ends of the system if protection switching is desired. If the protection line is equipped (the LIU-P position), service is automatically switched to the protection line via the line switch unit (LSU) when a working (service) digital line fails.

Transmission Facilities — DS1 Digital Facilities Specifications

Overview The transmission facility between the Series 5 terminals and the maintenance pairs required for maintaining the digital line must meet certain specifications.

Specifications for the DS1 interface

The Series 5 system line interface units (LIUs) provide the following:

- Connection to a DSX-1 cross-connect. The AUA61-type LIU is used for this application. The DS1 LIU meets all requirements in the digital cross-connect specification. The LIU has equalizer switches that provide equalization to the DSX. The maximum separation between the system and DSX-1 is 655 feet unless the system and the DSX are collocated in outside plant cabinets (see 915-710-115, Series 5 Applications Engineering).
 - Line powering for a T1 line. The AUA62-type LIU is used for this application. The line current is 60 mA at a maximum voltage of -130 V.
 - Loop the power from the line. The AUA64-type LIU is used for this application.
 - Provide line build-out to meet existing T1 line end section and route junction level coordination requirements. The line-powering and power-looping LIUs have switchable pads in the transmit and receive paths. The transmit pads are 0 dB, 7.5 dB, 15.0 dB, and 22.5 dB. The receive pad is 0 dB or 7.5 dB. Standard T1 digital line engineering rules are used to design metallic digital facilities used with Series 5 systems.
-

Specifications for the fiber facility interface

The Series 5 system interfaces with fiber multiplexers at the DS1 rate as follows:

- The Series 5 system is equipped with DS1 LIUs and cabled to a standard DSX-1 cross-connect. The maximum separation between the Series 5 system and a DSX-1 cross-connect is 655 feet unless the system and the DSX are collocated in outside plant cabinets (see 915-710-115, Series 5 System Engineering). At the DSX-1, the Series 5 system is cross-connected to the multiplexer.
 - With FPC, the multiplexer must be compatible with the extended superframe format (ESF).
 - The option switches on the Series 5 system LIUs and the multiplexer must be set for the same line coding format.
-

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Transmission Facilities — DS1 Digital Facilities Specifications (Continued)

Specifications for the fiber facility interface (continued)

- Generally, multiplexers like the DDM-1000 and DDM-2000 provide protection for the fiber span. The customer has the option of providing 4:1 protection by connecting the protection DS1 output from the Series 5 system to the multiplexer. This option, which requires the allocation of the protection DS1 through the fiber system, provides protection against DS1 failures between the Series 5 terminal and the multiplexer. See the *Transmission Facilities — Protection Switching* section in this chapter.
- If desired, additional metallic pairs may be used for the DC test pair or for the order wire between the central office (CO) and the RT.

Specifications for metallic T1 lines

There are specific requirements for pairs in the metallic T1 lines as follows:

- Two T1 pairs for each line being used.
- Two T1 pairs for the protection line (optional).
- One pair for VF drop testing. It is recommended that this pair be shared by not more than 12 systems at the same RT location.
- Additional pairs as desired for order wire and fault locating as required on the route.
- One 96-line Series 5 system requires eight pairs (four T1 lines), or four pairs (two T1 lines) in enhanced FPB Mode 2, plus one or more VF pairs for maintenance. Two additional pairs (one T1 line) are required for the protection line, when equipped. A dual channel bank assembly (2 systems) may require up to 10 T1 lines (20 pairs) when fully equipped with protection, or to 6 T1 lines (12 pairs) when fully equipped for enhanced FPB Mode 2 with protection.

Specifications for repeater spacing

T1 repeater spacing on 22-gauge buried cable is typically 6 kilofeet except in cases of severe cross talk. The end section is normally 3 kft at the central office and up to 6 kft at the RT. Repeater spacing may be extended when thicker gauge cable is used and cable arrangements permit. See 915-710-115, **SLC Series 5 Carrier System - Application Engineering - Facility Design Systems**, for more information.

Transmission Facilities — Fault Locating

Description

The Series 5 system uses single-ended or double-ended fault locating with either active or passive fault-locating filters. The telephone company may use fault-locating and order-wire pairs for T1 line maintenance according to local practices.

Transmission Facilities — Framing and Coding Formats

Bit stream coding The bit stream coding for the Series 5 carrier system is 7-5/6 bit standard μ 255 pulse code modulation (PCM).

Framing formats The Series 5 system uses four different framing formats as follows:

- The extended framing format that uses an X.25 data link protocol between the central office and the RT.
- The TR-08 (*SLC 96 Carrier System*) framing format used in the enhanced FPB RT that is compatible with the *5ESS* switch DCLU and the *SLC 96 COT*. This format is the D4 format modified to include the data link on the A digroup (and on the C digroup in Mode 2).
- The superframe (SF) (D4 channel bank) framing format used in the INA-RT that is compatible with a D4 (Mode III) channel bank or the *SLC 96 COT D4 emulator*.
- The extended superframe/new data link (ESF/ndl) specified in TR-303 is used by the FP-303 RT (all active DS1s carry this format).

Line coding formats Two different line coding formats are available as follows:

- bipolar with per-channel zero code suppression (ZCS)
- bipolar with 8 zero substitution (B8ZS). The B8ZS line coding format provides 64 kb/s clear channel paths.

Transmission Facilities — Protection Switching

Description Protection switching is optional with any Series 5 system application except INA-RT. In INA-RT applications, the customer can provide external protection switching if desired. Using a digital loop multiplexer (over a fiber facility, for example) affects protection switching also.

Facility performance monitoring Facility performance monitoring is based on maintaining the average line error rate at better than 10^{-6} . The Series 5 line interface units (LIUs) continuously monitor the input for loss of signal, loss of DS1 frame, and line errors. If the ESF format is used, the LIUs monitor CRC-6 errors; if the TR-08 format is used, the LIUs monitor bipolar violations. A carrier line failure (CLF) is defined as a loss of signal or frame, or an average bit error rate (determined from line errors being monitored) worse than 10^{-6} . If loss of signal or frame, or an average error rate worse than 10^{-4} lasts more than 2.5 seconds (± 0.5 seconds), a carrier group alarm (CGA) (red) is declared on the failed line.

FPC system protection Protection switching is available with a 4:1 protection ratio in a universal Series 5 system. With Series 5 LIUs at both ends of the system, two line error rate thresholds are used for switching to protection.

- The first line error rate threshold is at 10^{-6} .
If the PCM error rate exceeds 10^{-6} , the LIU alerts the BCU that a switch to protection is "desired." A switch to protection occurs if the protection line is available. If the protection line is not available, the BCU raises a CLF alarm and allows the digroup associated with that LIU to continue operating as long as the error rate is better than 10^{-4} .
- The second threshold is at 10^{-4} .
If the PCM bit error rate exceeds 10^{-4} , the LIU signals the BCU that a switch to protection is "required." A switch to protection occurs if the protection line is available. If the protection line is not available, a major alarm is raised for the digroup associated with that LIU, and all transmission is terminated on that digroup until the protection line is available or until the trouble is cleared.

Once a Series 5 system digroup or shelf has switched to protection, the error rate on the main line must be better than 10^{-7} before the shelf will be allowed to switch back. The minimum amount of time for a shelf or digroup to switch back to the main facility is about 15 seconds.

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Transmission Facilities — Protection Switching (Continued)

FPC system protection (continued)

The Series 5 LIUs also detect a DS1 blue signal (unframed all ones data) on the input and declare CGA after 2.5 seconds. The bank controller will attempt to switch to protection; however, the facility carrying the blue signal will not be alarmed. The LIUs insert blue signal on the DS1 output when a failure prevents transmission of the normal signal or when a yellow alarm is received.

Series 5 enhanced FPB system protection

Series 5 enhanced FPB meets the TR-08 interface requirements for protection switching. The Series 5 enhanced FPB RT provides 4:1 protection switching (Mode 1) or 2:1 protection switching (Mode 2) in universal or integrated configurations. The LIUs detect bipolar violations, loss of signal, and out of frame conditions. If any of these conditions result in a PCM bit error rate greater than 10^{-4} , the LIUs will request a protection switch. When the error condition has cleared, the system switches back to the main facility.

In enhanced FPB Mode 2, the protection facility is shared between the A digroup LIU and the C digroup LIU (2:1 protection). In Mode 2, the A digroup LIU carries the A and B digroups; the C digroup LIU carries the C and D digroups. Protection switching operates the same as Mode 1; but the indicators are different. The transmit/receive unit (TRU) will have both "digroup on protection" indicators lighted, and the BCU will have two digroup indicators lighted (instead of one).

FP303 DS1 protection switching

FP303 supports 4:1, 3:1, or 2:1 DS1 protection switching ratios. FP303 stores in non-volatile memory an automatic protection switching threshold. The LDS can provision these thresholds to a BER of 10^{-4} , 10^{-5} , or 10^{-6} by sending operations messages to the RT over the EOC. The LIU monitors CRC-6 violations and out-of-frame conditions on the received DS1 and alerts the BC if the path error rate reaches the threshold.

If the error rate reaches the threshold and ...	Then ...
the protection DS1 is available	a switch to protection occurs
the protection DS1 is not available	the BC raises a CLF alarm and allows the DS1 to continue operating as long as the error rate is better than 10^{-4}

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Transmission Facilities — Protection Switching (Continued)

FP303 DS1 protection switching (continued)

If the error rate is worse than 10^{-4} and ...	Then ...
the protection DS1 is available	a switch to protection occurs
the protection DS1 is not available	a major alarm is raised and transmission is terminated on the DS1 until the protection DS1 is available or the trouble clears

Once a protection switch occurs, the error rate on the DS1 experiencing trouble must be better than 10^{-7} before a switch back to the DS1 can occur.

Protection switching and digital loop multiplexers

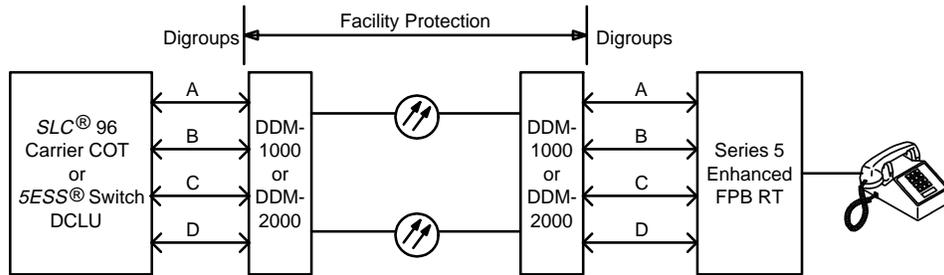
In most applications using digital loop multiplexers, end-to-end DS1 protection switching [from near-end to far-end digital loop carrier (DLC) terminal] is not necessary. Facility protection typically is provided by the digital loop multiplexer, as shown in the next figure. The multiplexer terminals provide both low-speed port (DS1) and high-speed fiber protection switching. Extending protection to the DLC terminals protects only against failure in the RT wiring between the DLC terminal and the multiplexer or against an LIU failure. Neither of these failures is likely enough to justify end-to-end protection switching. However, T1 extension applications may justify the use of a subscriber loop interface module (SLIM), as shown in the next figure, to provide full protection for the T1 digital line between RTs. For more details, see the *Facility Engineering* section in Chapter 7.

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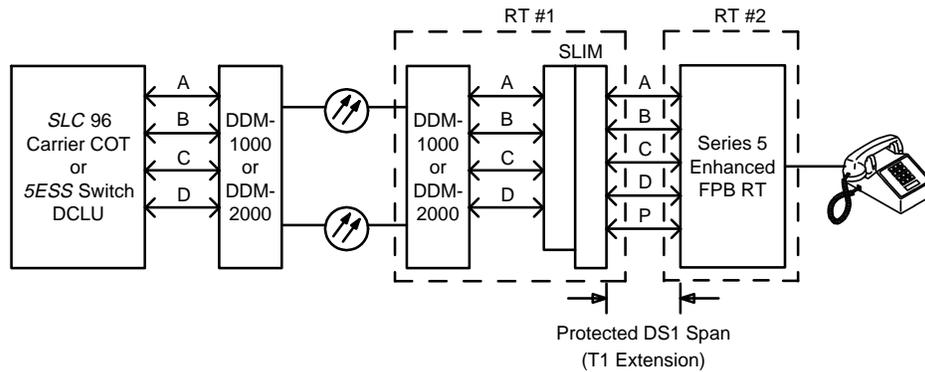
Transmission Facilities — Protection Switching (Continued)

Protection switching on fiber facilities with Series 5 enhanced FPB RT

The top portion of this figure shows facility protection provided by the digital loop multiplexer. The bottom portion shows facility protection provided by a SLIM.



a. Fiber System with Enhanced FPB



b. Fiber System with Enhanced FPB (SLIM Interface)

Transmission Facilities — Fiber facilities

Description

The DDM-2000 multiplexer and DDM-1000 multiplexer are compatible with Series 5 systems and the digital loop carrier environment in fiber facility applications. These multiplexers are designed for loop, interoffice, and customer location applications. The DDM-1000 is a DS1 to DS3 multiplexer. Its success proves the advantages and flexibility of using the DDM-1000 for stand-alone and point-to-point fiber or electrical multiplexer applications. The DDM-2000 multiplexer expands these capabilities to include SONET optical applications: OC-3 point-to-point, STS-1 drop, and OC-3 fiber hubs. Also, DDM-2000 will provide a DS3 or STS-1 high-speed electrical interface for high-capacity loop and interoffice applications. These configurations use a single common shelf with interchangeable circuit packs. This provides a flexible network that can be upgraded to meet changing service needs and in planning for future expansion.

Any of the Series 5 system applications may use the DDM-2000 or DDM-1000 multiplexer in place of the metallic facility between the RT and the central office. Also, the Series 5 system is compatible in many applications with other fiber or electrical multiplexers that are similar to the DDM-2000 or DDM-1000 multiplexer.



NOTE:

The Series 5 system LIUs have line code option switches that affect compatibility with digital loop multiplexers. These option switches must be set for the same line coding used by the multiplexer; otherwise, the system may not operate.

Also, there are protection switching considerations (see *Protection Switching* in this chapter and in Chapter 7, *Engineering and Planning*).

DS3 systems

The Series 5 system is fully compatible with any DS3 carrier facilities that accept DS1 input at a DSX-1 cross-connect. These lightwave facilities (including DDM-1000 and DDM-2000 multiplexers) are described in the Lucent Technologies documents covering those systems.

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Transmission Facilities — Fiber facilities (Continued)

High capacity systems

The DS3 (44.736 Mb/s) electrical output from a DS1 multiplexer may be connected to a high capacity lightwave system such as the FT Series G system. The FT Series G system is a lightwave digital transmission facility that multiplexes 9, 18, 36, or 72 DS3 signals over an optical facility at 417 Mb/s or 1.7 Gb/s. The FT Series G system can provide protection switching, diverse routing, and wavelength division multiplexing. It is compatible with most maintenance environments and features an optional embedded maintenance system. For more information, refer to 365-565-100, *FT Series G Lightwave Systems — Description, Application, and Engineering Manual*.

The high-capacity SONET system (under development) is the DDM-2000 OC-12 system. This system will handle up to four OC-3 optical or four DS3 electrical signals at the SONET rate of OC-12 (622 Mb/s). The DDM-2000 OC-12 system allows diverse routing and provides a self-healing network with add/drop capability.

Transmission Facilities — T1 Extension Applications

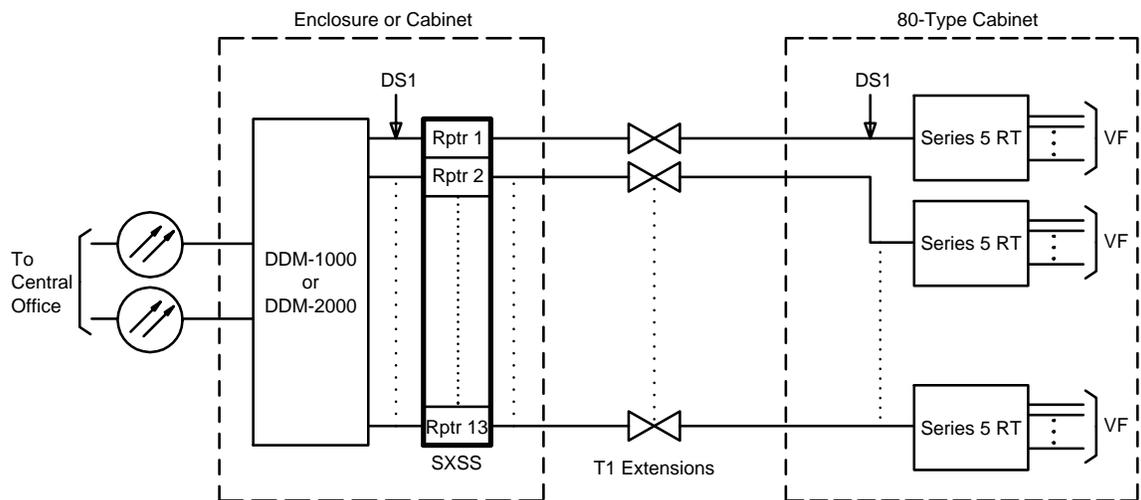
Feed methods

A T1 extension may be fed from:

- the small cross-section repeater shelf (SXSS)
- the DS1 extension shelf
- the DDM-Plus System.

SXSS feed method illustrated

This figure shows how a T1 extension may be fed from the small cross-section repeater shelf.



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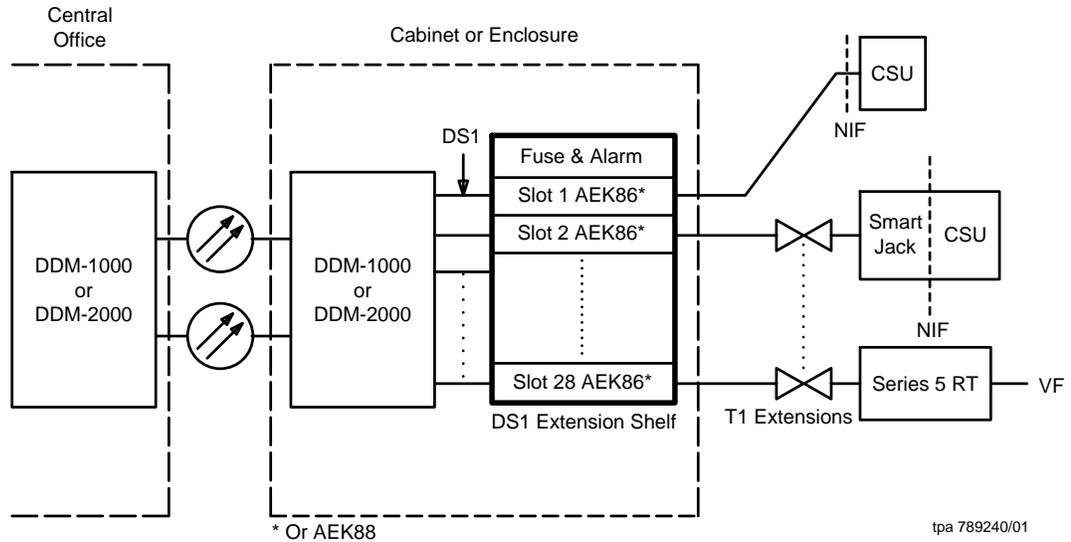
The SXSS extension shelf is shown in Chapter 4, *Equipment Description*. 365-200-106 describes the SXSS in more detail.

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Transmission Facilities — T1 Extension Applications (Continued)

DS1 extension shelf feed method illustrated

This figure shows how a T1 extension may be fed from the DS1 extension shelf.

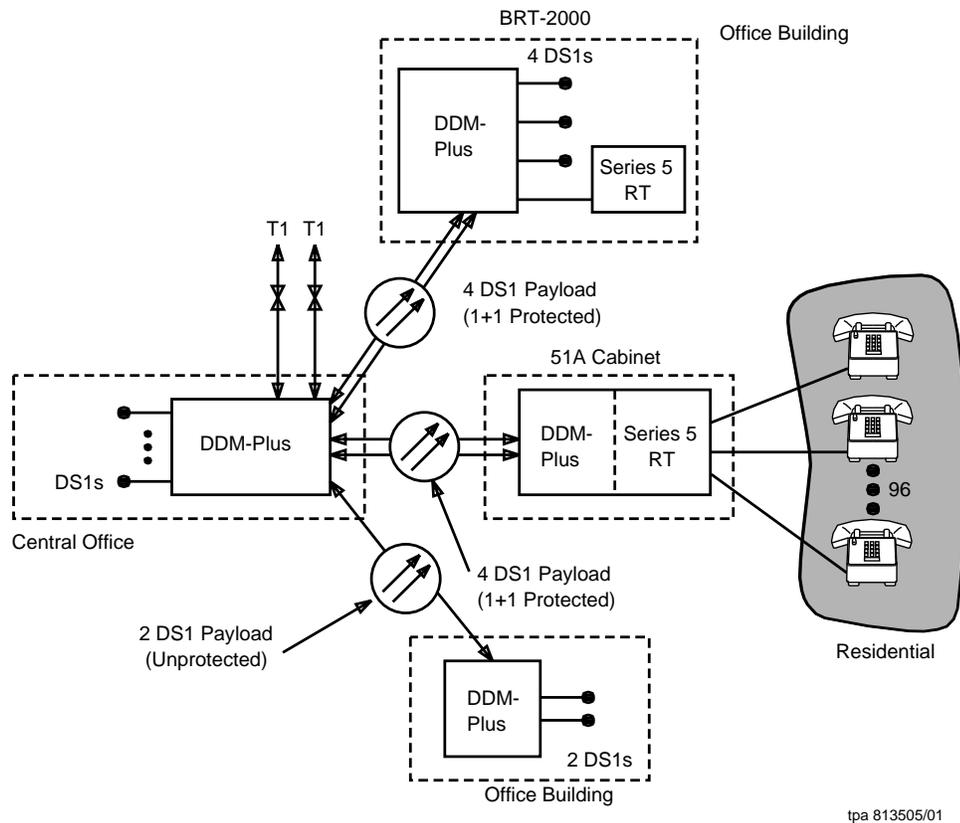


The DS1 extension shelf is shown in Chapter 4, *Equipment Description*. 365-200-107 describes the DS1 extension shelf in more detail.

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Transmission Facilities — T1 Extension Applications (Continued)

DDM-Plus system feed method illustrated This figure shows how a T1 extension may be fed from the DDM-Plus system.



For more information, see the *DDM-Plus System* section in this chapter.

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Transmission Facilities — T1 Extension Applications (Continued)

T1 extension applications

A T1 extension provides DS1 service beyond a fiber hub over short spans to digital loop carrier RTs and customer premises. Specific applications include the following:

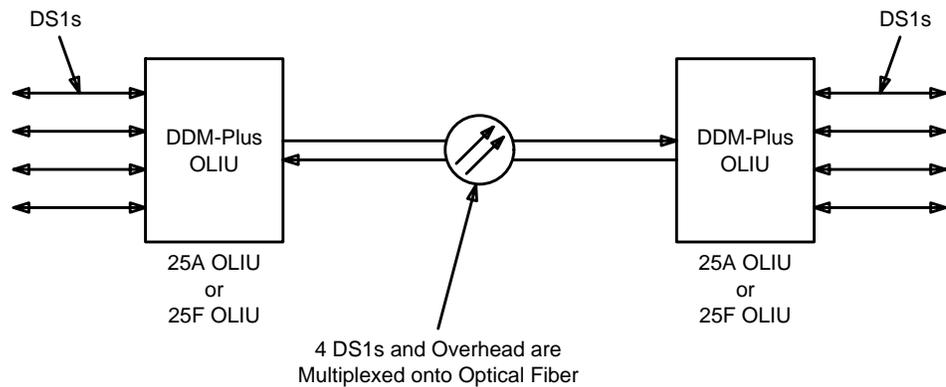
- Several DS1 signals are multiplexed by a loop multiplexer and transported via fiber to a controlled environment vault (CEV) or an 80-type outside plant cabinet where they are demultiplexed. The T1 extension provides DS1 service to customers or RTs located beyond the CEV or 80-type cabinet. This is shown in the previous figures illustrating the feed methods using the small cross-section repeater shelf, and the DS1 extension shelf.
 - Several DS1 signals are multiplexed by a loop multiplexer and transported via fiber to a business remote terminal (90-type cabinet) located in a building where they are demultiplexed. The DS1 (T1) extension distributes the DS1 signal to points within the building.
-

Transmission Facilities — DDM-Plus System

Description

The DDM-Plus is an optical and electrical transport system that carries DS1 signals between two locations. The DDM-Plus transports up to four electrical DS1 signals per optical fiber pair. It provides T1/DS1 extensions over existing copper wires that distribute DS1 service to points within or beyond the DDM-Plus location.

The figure below shows a DDM-Plus providing optical transport for four DS1s. In each direction, the system multiplexes four DS1s into a DS2 electrical signal, then encodes the DS2 electrical signal to an optical signal for transport over fiber to a connecting DDM-Plus. The connecting DDM-Plus converts the optical signal back to a DS2 electrical signal, then decodes and demultiplexes the DS2 signal into four DS1 signals.

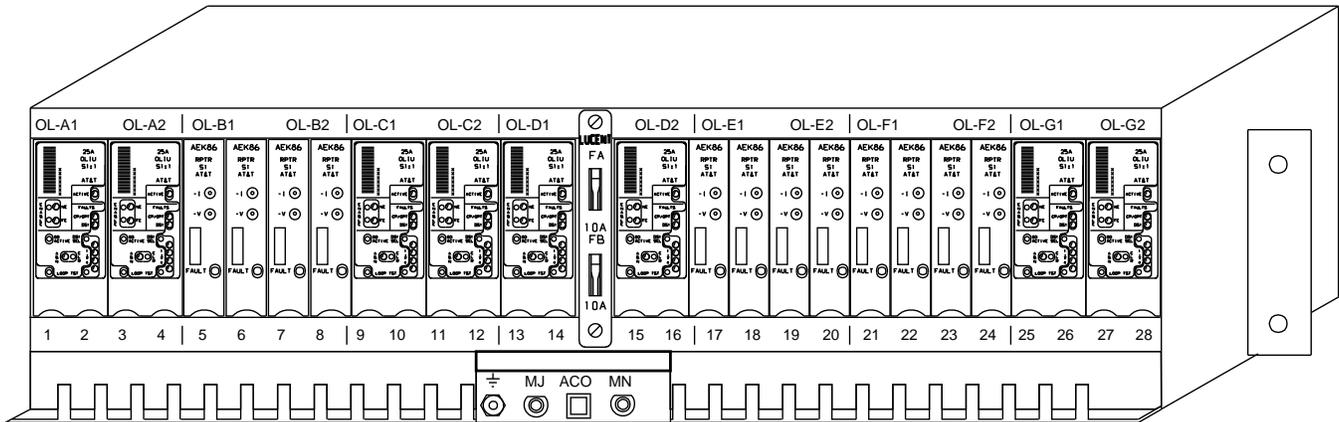


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Transmission Facilities — DDM-Plus System (Continued)

DDM-Plus typical arrangement

This is a figure of a typical DDM-Plus arrangement. It can be equipped with various combinations as described in the following sections.



DDM-Plus 25A OLIU

The DDM-Plus 25A OLIU uses a 780 nm laser with system gain to support operation over a 12 kft (3.7 km) span for single-mode fiber or a 9.8 kft (3 km) span for multimode fiber.



NOTE:

The fiber loss will determine the span length of the OLIU. Refer to 363-206-150, *DDM-Plus User/Service Manual* for detailed information on the 25A OLIU loss budget parameters.

(Continued on next page)

DDM-Plus System (Continued)

DDM-Plus 25F OLIU

The DDM-Plus 25F OLIU uses a 1300 nm laser with system gain to support operation over a 62 kft (19 km) span for single-mode fiber or a 36 kft (11 km) span for multimode fiber.

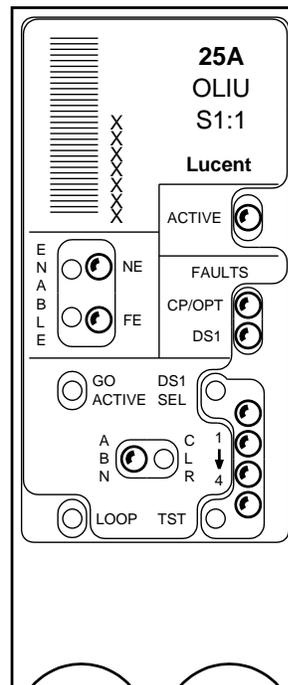


NOTE:

The fiber loss will determine the span length of the OLIU. Refer to 363-206-150, *DDM-Plus User/Service Manual* for detailed information on the 25F OLIU loss budget parameters.

DDM-Plus OLIU faceplate

The figure below illustrates the DDM-Plus OLIU circuit pack faceplate for the 25A OLIU. The 25F OLIU uses the same faceplate and is designated appropriately.



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DDM-Plus System (Continued)

AEK86B repeater

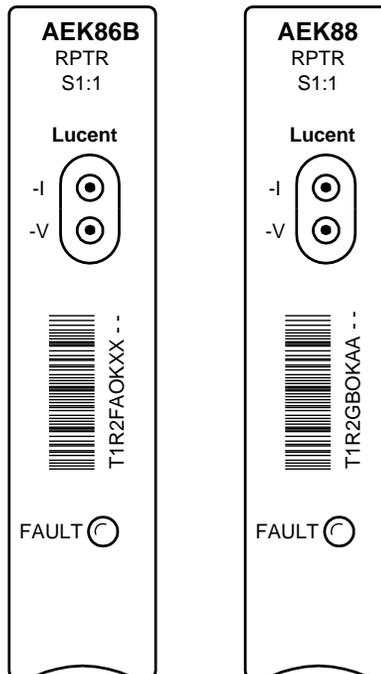
The AEK86B is capable of powering a span of 9 line repeaters and 50 kft of 22 AWG PIC cable. For engineering rules for T1 extensions, see 365-200-107, *DS1 Extension Shelf, Description, Installation, and Maintenance, T1 Digital Line*.

AEK88 repeater

The AEK88 is capable of powering one line repeater and more than 9 kft of 22 AWG PIC cable. For engineering rules for T1 extensions, see 365-200-107, *DS1 Extension Shelf, Description, Installation, and Maintenance, T1 Digital Line*.

AEK-type T1 repeaters illustrated

This figure shows the AEK86B and AEK88 T1 repeaters.



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DDM-Plus System (Continued)

DDM-Plus housings

Each DDM-Plus location has a housing containing one or more DDM-Plus circuit packs (OLIUs) and optional AEK-type T1 repeaters. The DDM-Plus is available in three housings.

- **DDM-Plus Extension Shelf** — The extension shelf is a 23-inch miscellaneous mounted shelf that provides up to seven DDM-Plus systems, either protected or unprotected. It supports up to 28 DS1s in the optical mode or up to 28 AEK-type T1 repeater circuit packs for T1 lines. The OLIU and AEK-type circuit packs can be mixed in the extension shelf. For detailed information on the extension shelf and its circuit pack configurations, see Chapter 4, *Equipment Description*.
- **DDM-Plus Wall Distant Terminal (DT)** — The wall DT provides one DDM-Plus system either protected or unprotected supporting up to four DS1s. The wall DT is small, attractive, and can be mounted on a wall or placed on a desk. It also provides a storage area for fiber jumpers. A power converter for 120 V AC to -48 V DC is available to allow operation from the 120 V AC used in many business locations. For detailed information on the wall DT, see Chapter 4.

All housings have connectorized backplane cables for connecting the DS1 signals; backplane connectors provide the interface to the circuit packs. The DDM-Plus OLIU has an *ST*[®] connector located just behind the faceplate for connecting the fiber jumpers from the optical cross-connect.

DDM-plus applications

The DDM-Plus can be used to provide a cost effective solution for electrical and optical extension in the loop plant. Features of the DDM-Plus system include compact size, environmental hardening, 1+1 (nonrevertive) protection, and easy equipment upgrades without having to upgrade existing fiber facilities.

The DDM-Plus system can operate in controlled or uncontrolled environments. Refer to 363-206-150, *DDM-Plus User/Service Manual*, for information on environmental data. The DDM-Plus can be deployed as follows:

- central offices (COs)
- controlled environment vaults (CEVs)
- outside plant cabinets (80-type or 51A)
- customer location cabinets [90-type cabinet or wall/desk distant terminal (DT)].

(Continued on next page)

DDM-Plus System (Continued)

DDM-Plus applications (continued)

The DDM-Plus provides DS1 extensions (protected or unprotected) when equipped with OLIUs. The DS1 extension typically is used in business remote terminals (BRTs) or office buildings to distribute DS1 service to points located within the building beyond the DDM-Plus location. The DDM-Plus provides T1 extensions (unprotected) when equipped with AEK-type T1 repeaters. T1 extensions typically are used to extend DS1 service to another outside plant cabinet when repeaters are required for the longer distances. The AEK-type T1 repeaters were previously deployed with the DS1 extension shelf (see Chapter 4). Both the DDM-Plus optical line interface unit (OLIU) and the AEK-type T1 repeaters can be mixed in the DDM-Plus because each slot can be equipped with either circuit pack, but they cannot be mixed within the same group.

The DDM-Plus system is particularly suited for the following applications:

- hubbing
- remote hubbing
- customer premises equipment.

These applications are distinguished by their route geography and traffic characteristics as well as economic concerns for the first cost of equipment and the cost of operations.

In applications where fiber does not currently exist, the DDM-Plus provides a low first-cost solution for deploying fiber or migrating from copper to fiber, thus supplying potential capacity for future needs, upgrading the transport facility, and eliminating expensive copper maintenance.

Another benefit of the DDM-Plus is that it works over both multimode and single-mode fiber. Buildings already equipped with multimode fiber can be accommodated to avoid the expense of installing new single-mode fiber.

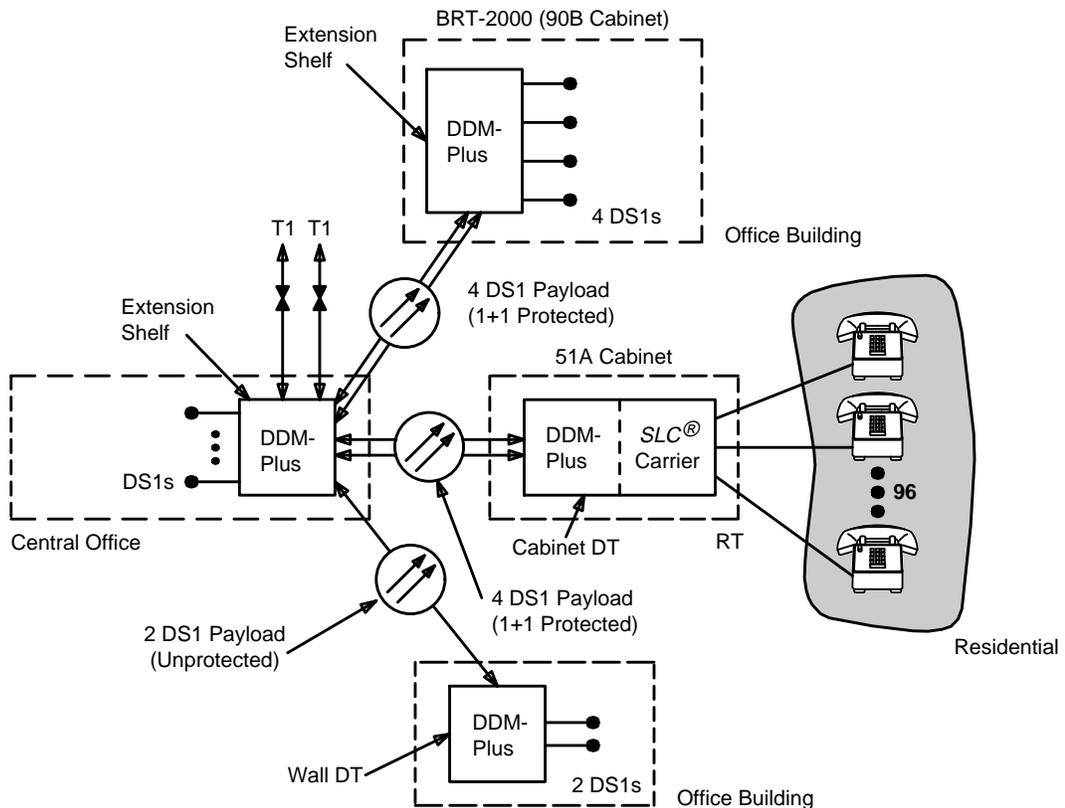
These are only examples. Many other combinations of protection, capacity, and topologies are possible. The examples include the DDM-Plus cabinet distant terminal (DT), which is a future feature of the DDM-Plus.

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DDM-Plus System (Continued)

Central office hubbing application example

The figure below shows a central office based hubbing application where a DDM-Plus unit at the central office supplies three separate end-user locations. The first DDM-Plus carries four 1+1 protected DS1s to an office building. The second DDM-Plus carries four DS1s on a 1+1 protected fiber link to a *SLC* Carrier System that supplies 96 voice channels to a residential area. The third DDM-Plus delivers two DS1s to an office building using an unprotected optical facility. The DDM-Plus at the central office is also providing two T1 lines. Supplying a single business with both telephone (voice) and DS1 service is common. This example shows some of the capacities, methods of protection, and types of end-users that might be found in a typical installation.



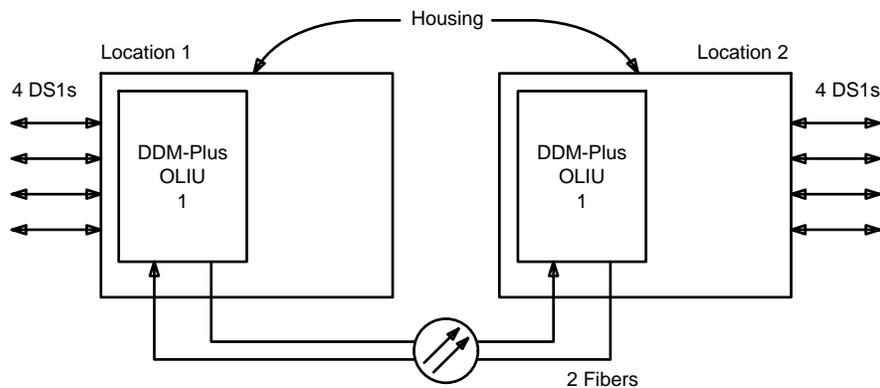
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DDM-Plus System (Continued)

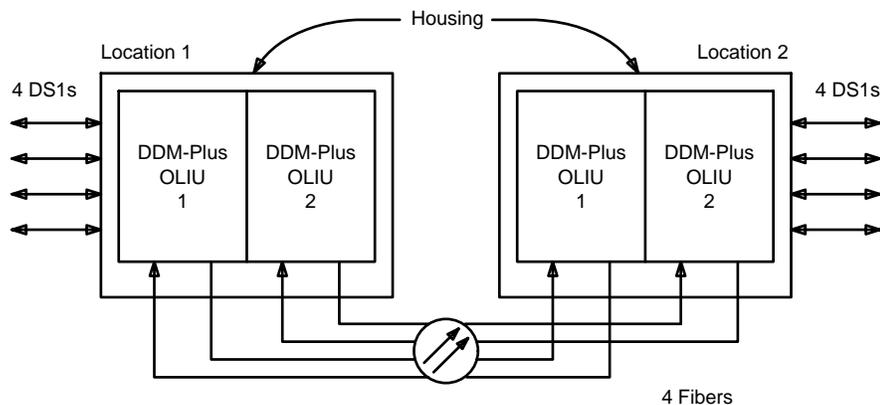
Protection switching

The DDM-Plus system with OLIUs can be deployed either fully protected or unprotected.

- An unprotected system is configured by installing one OLIU at each location and connecting these two circuit packs with two optical fibers. This arrangement is shown in the upper portion of the figure below.
- A 1+1 protected DDM-Plus system protects the OLIU (DS1 inputs and optical signal) and is arranged by installing two identical OLIUs at each location and connecting them with four optical fibers. This arrangement is shown in the lower portion of the figure below.



(A) Unprotected System



(B) 1+1 Protected System

(Continued on next page)

DDM-Plus System (Continued)

Protection switching provisioning

In a protected system, both OLIUs must be provisioned identically. The DDM-Plus system employs *nonrevertive protection switching*; that is, service does not switch back automatically to a primary circuit pack after correcting the problem that caused the system to switch. Since the OLIUs at each location are identical, either one can carry service. Thus, the circuit pack designations for "service" or "protection" are not needed.

Protection switching is bidirectional so that all four DS1s are carried on one side of the system or the other. The system currently carrying service has its ACTIVE indicator lighted. The DDM-Plus system can be reprovisioned easily from unprotected to protected or from protected to unprotected without affecting service.

Protection switching is not available for the AEK-type T1 repeaters in the shelf.

Operations, administration, maintenance, and provisioning

The DDM-Plus system with the OLIU supports a variety of operations, administration, maintenance, and provisioning (OAM&P) functions, including the following:

- failure detection
- alarming
- automatic and manual protection switching
- loopback and testing of individual DS1 signals
- provisioning of DS1 line characteristics.

These functions are operated and monitored using pushbuttons and indicators on the OLIU faceplate (described previously in this chapter). Many of these pushbuttons and indicators affect or report conditions at both the near- and the far-end DDM-Plus. The OLIU also supports an automatic turn-up installation test, thus eliminating the need for external test equipment.

The optical transmission signal contains overhead bandwidth capacity for end-to-end communications between far- and near-end DDM-Plus without using in-band DS1 information. Remote capabilities that can be performed from the near-end DDM-Plus include far-end loopbacks, monitoring of far-end alarms, far-end test failures, and far-end DS1 line characteristics.

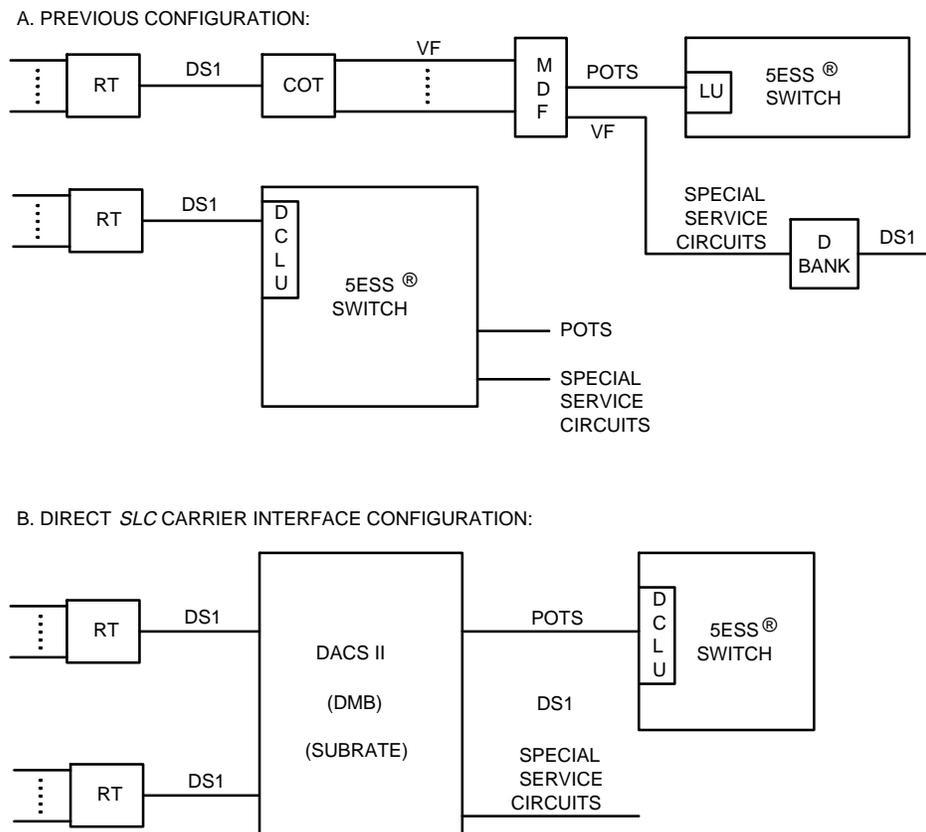
Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface

Applications

If your company is deploying Series 5 enhanced FPB or FPC, DACS II can provide an economical interface between the Series 5 RTs and the central office. The direct interface operates in mixed services mode (Mode I) or special services mode (Mode III). DACS II Mode I serves enhanced FPB Mode 1 RTs with mixed services. DACS II Mode III serves Series 5 RTs carrying special services only (enhanced FPB or FPC).

Mode I configurations illustrated

This figure shows the comparison between Mode 1 configurations without DACS II, in the upper portion (A) of the figure, and with DACS II, in the lower portion (B) of the figure.



(Continued on next page)

Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface (Continued)

Mode I configurations explained

The previous figure shows the basic Mode I configurations (without DACS II) as follows:

- Universal Series 5 systems (A-top) — T1 lines from an RT are terminated on a COT.
- Integrated Series 5 systems (A-bottom) — T1 lines from an RT are terminated on a digital switch. Special service channels are groomed at the RT or nailed up at the switch. Remote terminal grooming requires wiring changes at field locations. Switch nail up increases blockage at the switch and reduces availability of operation, administration, and maintenance (OA&M) for special circuits.

By comparison, the same figure (B) shows that the DACS II direct *SLC* carrier interface eliminates the intermediate equipment between the RT and the local digital switch for POTS and locally-switched circuits. For special service circuits, the direct interface eliminates intermediate equipment between the RT and the office equipment (such as a D bank).

Mode III configurations explained

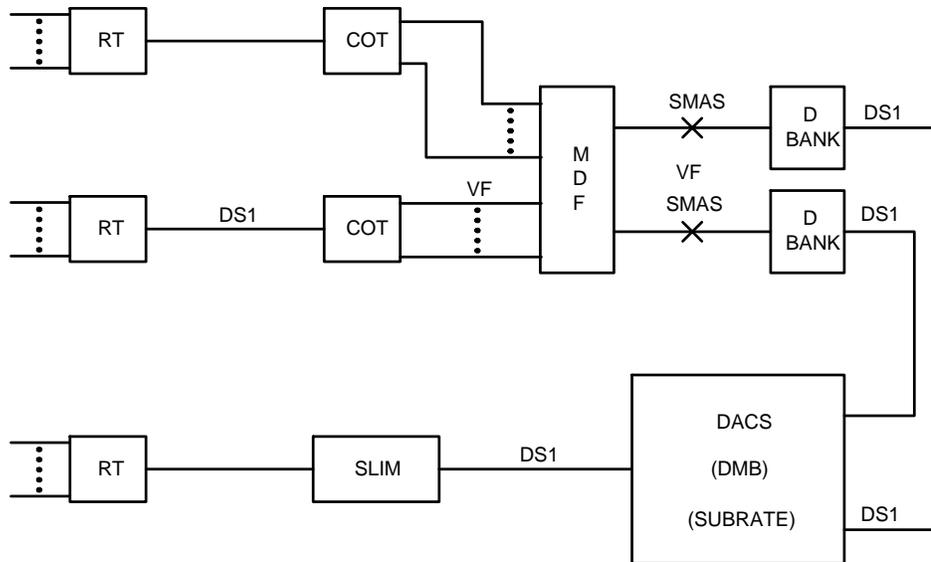
The following figure shows a comparison of the universal Series 5 FPC configuration, in the top portion of the figure, versus the direct interface at DACS II for Mode III (special services only), in the bottom portion of the figure. The elimination of intermediate equipment with the direct interface of DACS II reduces capital and operating expenses and increases network flexibility by providing end-to-end digital connectivity.

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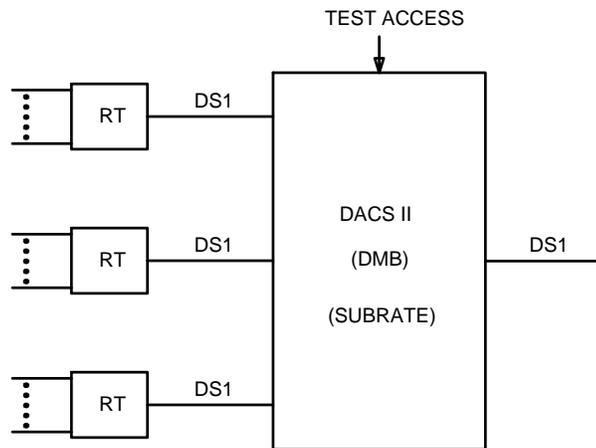
Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface (Continued)

Mode III configurations explained (continued)

A. PREVIOUS CONFIGURATION:



B. DIRECT SLC CARRIER INTERFACE CONFIGURATION:



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Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface (Continued)

Direct interface description

The DACS II direct interface (*SLC* carrier feature) provides a direct interface at DACS II for T1 lines from *SLC* 96 or Series 5 RTs. The channels from these remote terminal lines are then connected through DACS II to office equipment to provide the digital loop carrier services while incorporating the benefits of DACS II. The DACS II provides digital loop carrier alarm handling and facility protection switching so it can be placed in the route without altering the operation of the other equipment.

Circuit testing at the RT for switched channels is provided from the TR-08 digital switch. Special service (nonswitched) channels at the RT can be provisioned and tested from the DACS II using the craft interface unit. If special services center (SSC) access to DACS II channels is provided, special service channels may be tested from a SARTS or SSC workstation.

The DACS II (Release 3 and later) can provide direct DS1 termination and remote provisioning (at the DACS) for a Series 5 FPC RT carrying only nonlocally-switched special services. The direct interface does not require a FPC COT or a subscriber loop interface module (SLIM). Release 4 and later provide a direct interface for the Series 5 enhanced FPB Mode 1 RT carrying mixed services or special services only.

With a Series 5 enhanced FPB Mode 1 RT, mixed services (POTS and specials) carried on the same T1 line are brought to DACS II. Special service channels are packed and routed to the network, and the POTS and locally-switched channels are passed through the DACS II to the local digital switch. This interface allows Mode 1 systems to carry any combination of POTS and special services. DACS II also supports Mode 1 systems carrying special services only. DACS II terminates the TR-08 data link, packs the special services onto DS1 or DS3 facilities, and routes the services to their destination.

With a Series 5 FPC RT, the DACS II connects nonlocally switched special service channels to network equipment in the office. Provisioning of the RT channels can be done over the facility data link with the Series 5 craft interface unit connected at the DACS II. The DACS II continuously compares its provisioning memory against the provisioning memory in the RT.

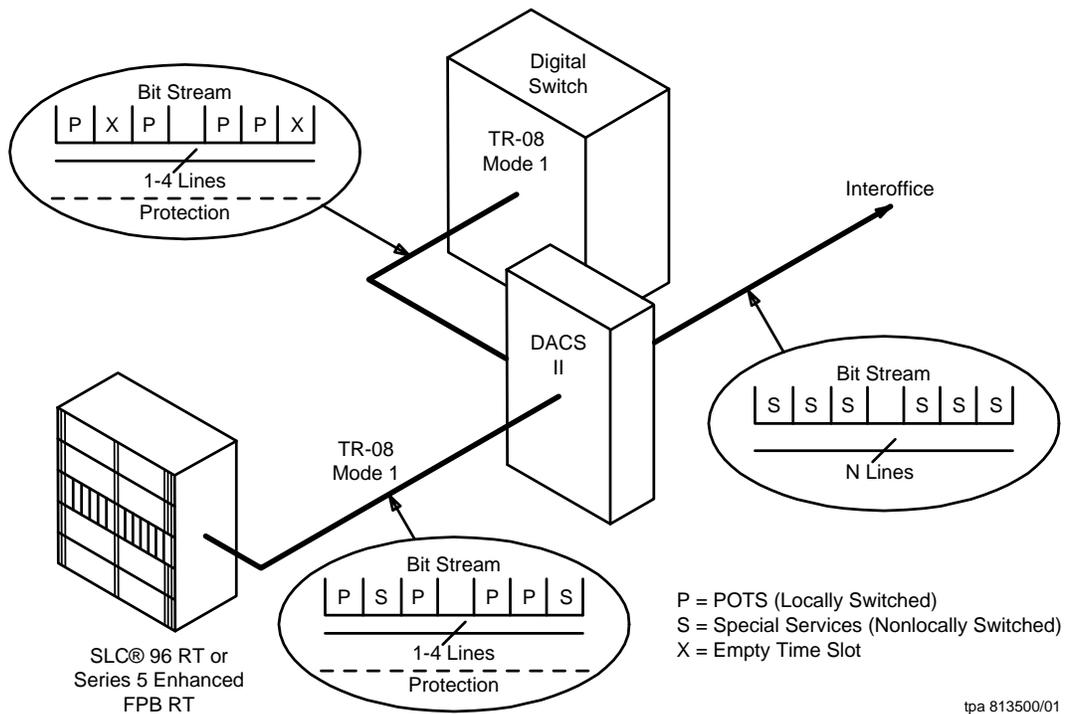
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Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface (Continued)

DACS II mode I pass through feature

This feature (Release 4.1 and later) can provide a cost effective interface for maximum compatibility between DACS II and TR-08 digital switches. The new arrangement shown in the figure below, called the 5:4 Protection Switching architecture, supports Series 5 enhanced FPB (Mode 1) RTs interfacing with a DACS II. The 5:4 designation refers to the five digroups interfacing with DACS II on the access side (four primary lines plus one protection line) and the four digroups interfacing with the TR-08 digital switch on the office side (four primary lines). This architecture replaces the previous 5:5 architecture (Release 3) that provided an optional protection line on both sides of the DACS II.

If the enhanced FPB RT is not optioned for protection (for example, when using a fiber facility), the 4:4 Pass Through architecture is used. The new 5:4 architecture removes the restriction that requires a protection line between the DACS II and the digital switch if there is a protection line between the RT and the DACS II. The benefits of the new arrangement include savings on the digital switch port as well as savings on the facility within the office.



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Transmission Facilities — Digital Access Cross-Connect System (DACS) Direct Interface (Continued)

Considerations with DACS II direct interface

Operation with the Series 5 system requires hardware and software design work to support the feature.

DACS II software

The DACS II software enables the following:

- protection switching
- addressing all 96 channels in any Series 5 system digroup via digroup A in DACS II commands
- provisioning of the RT channels from DACS II with the craft interface unit
- comparing the Series 5 provisioning memory in the near- and far-end.

Protection switching is achieved at DACS II by automatically cross-connecting channels from a failed line to the protection line.

DACS II hardware

The hardware provides the following:

- compatible DS1 line format for connecting Series 5 RTs
 - Series 5 alarm handling and data link communications
 - 9-state signaling for coin telephone circuits
 - facility performance monitoring
 - line loopback capabilities.
-

DACS II references

For more information on the DACS II feature *SLC* carrier direct interface, refer to 365-301-002, *DACS II Customer Reference Manual*, or to 365-099-093TD, technical description CIR.

Fiber in the Loop

Description

Fiber in the Loop (FITL) introduces a fiber-based network to stabilize the distribution plant and allow access to future information services. The FITL feature provides an all-fiber loop for residential and business distribution.

Product status

The Lucent Technologies' Series 5 system Fiber in the Loop (FITL) feature was introduced in August 1988. This FITL offering was the first product from any vendor that provided fiber optic transmission in the distribution plant to the residential customer by means of a distant terminal located adjacent to the residence or a pedestal housing several DTs serving several residences. The Fiber in the Loop product is currently serving over 20 sites both nationally and internationally with many more sites in the planning stages. By installing fiber in the "last mile," the local exchange carriers (LECs) are equipped with higher capacity and more flexible technology that will allow the transmission of broadband services such as cable television [community antenna television (CATV)] and switched video over a synchronous network.

Fiber in the Loop — Fiber in the Distribution Plant

Planning requirements

With lightguide cable in the feeder portion, the loop is stabilized for future demand. Traditionally, with copper, the entire feeder route must be engineered according to some forecasted demand. If the demand does not develop, the copper plant becomes a non-profitable investment. With fiber distribution, the cost of providing initial service on the route (for forecasted demand) can be less than copper. Using digital loop carrier, electronics can be changed to increase service capacity (bandwidth) instead of laying new feeder cable. Thus, additional investment to meet increased demand can be deferred until it actually develops. If the demand does not develop, the electronics can be reused in other applications.

Introducing fiber in the distribution plant is based on economics comparable to delivering current services and does not require drastic changes in telephone company operations.

Benefits

Benefits associated with fiber in the distribution plant include the following:

- eliminate outside plant repeaters and manhole congestion and the installation and maintenance costs associated with them
 - reduced maintenance, administration, and re-arrangement costs
 - allow low-cost incremental growth
 - provide high-speed SONET fiber for an array of business services ranging from POTS to DS3 pipes
 - support future demand and broadband services.
-

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Fiber in the Loop — The SLC[®]-2000 Multi-Services Distant Terminal (MSDT) Feature

Background

Lucent Technologies continues to be committed to the development of new digital loop carrier and Fiber in the Loop systems. As a result of working closely with various LECs since our initial deployment, we have gained a strong understanding of your evolving needs in the loop and the needs of your customers. This working relationship has helped us to develop a cost effective, service rich, next generation fiber optic transmission called the *SLC-2000* Multi-Services Distant Terminal (MSDT) feature. The *SLC-2000* MSDT feature serves both residential and business customers and is a significant element for linking present network capabilities to the synchronous network of tomorrow.

Description

The *SLC-2000* MSDT is a compact, fiber-based terminal that provides a full range of narrowband services, from POTS to special services and ISDN capabilities, for a wide range of applications. Initially, it provides fiber distribution from a Series 5 system and will later be offered as a feature of the *SLC-2000* Access System, ensuring a seamless evolution from today's network.

The 24 DS0 line capacity of the *SLC-2000* MSDT allows for sharing over several customers to achieve economic deployment today compared to existing copper loops. The *SLC-2000* MSDT uses existing Series 5 system channel units and our next generation *SLC-2000* channel units. Its flexible optical capability allows bi-directional transmission over one single mode fiber at 1310 nm wavelength. Through an adjunct enclosure, the *SLC-2000* MSDT can also add fiber optic CATV transport.

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Fiber in the Loop — The SLC[®]-2000 Multi-Services Distant Terminal (MSDT) Feature (Continued)

Services supported in the SLC-2000 MSDT feature

The SLC-2000 MSDT feature provides a full range of narrowband services including the following:

- basic telephone service (POTS, multiparty, FSR, and coin)
- 2-wire switched special services (including *CENTREX* services)
- 2-wire foreign exchange and nonswitched special services
- 4-wire VF special services
- DDS service (digital data)
- ISDN service
- *VerSuS* alarm transport service.

Broadband services support reference

Refer to 363-099-144NP CIR and 363-205-003, *SLC-2000 Multi-Services Distant Terminal Feature - Applications, Planning, and Ordering Guide* for more information on broadband services support.

Business Customer Network Access

Description

The Lucent Technologies' Business Remote Terminal (BRT) and BRT-2000 access node are designed to meet the service needs of medium and large business customers. The BRT is a package of the required multiplexing and/or digital loop carrier capabilities needed to support a wide range of business customer network services. Based on specific service needs, various BRT cabinet configurations are available for medium-to-large businesses in urban and suburban areas.

Deploying fiber in the local loop to businesses and terminating it on a BRT provides businesses with access to network services over fiber. This provides a robust service-ready infrastructure for faster provisioning, higher reliability, and quicker restoration. A broad mix of services such as basic telephone service, special services, ISDN, and high capacity services such as DS1 and DS3 can be provisioned faster.

The BRT is part of the Lucent Technologies' Fiber to the Business offering and overall business access solution, which provides businesses with leading edge access to network services. The full service potential of fiber optics can be applied with the BRT. The BRT has built-in fiber access technology that permits an increase in usable bandwidth without adding new facilities. As part of the Lucent Technologies' Service Net 2000 product family, the BRT is fully compatible with SONET.

Motivation for using a BRT

Key motivations for using a BRT and fiber to provide businesses with network services include:

- improved service quality
- faster response to customer needs
- cost savings
- duct congestion relief
- resource savings from easy handling of rearrangements
- supports and complements private networks
- can multiplex baseband digital and analog inputs to a metallic DS1 or fiber network, or transport user-multiplexed information over DS1 or DS3 circuits.

New Series 5 channel units (described in Chapter 6) allow deployment of special purpose private lines including ISDN basic rate interface (BRI).

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Business Customer Network Access (Continued)

Architecture

The BRT cabinet configurations are designed for installation in business customer buildings. Typical installations are in large buildings with single or multiple customers, for business customers in an industrial park, or on a large campus with many buildings. The key elements of the BRT are:

- the Series 5 system
- the DDM-2000 multiplexer (or DDM-1000 multiplexer),
- and DDM-Plus system (or the DS1 extension shelf).

These elements are packaged in a cabinet designed especially for business customers. Several BRT and BRT-2000 configurations are, or soon will be, *UL* Listed and EMC compatible. Additional arrangements may be certified by special request.

Services supported

Business remote terminals support a full range of business services (most of the services specified by Bellcore) including the following:

- basic telephone service (POTS)
 - 2-wire locally-switched special services (including *CENTREX* services)
 - coin service
 - 2-wire nonlocally-switched and nonswitched special services
 - 4-wire VF special services
 - digital data service (DDS)
 - ISDN service
 - alarm services (DC and *VerSuS* alarm transport)
 - DS1 (1.544 Mb/s) and DS3 (45 Mb/s) services (optical and electrical).
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Business Customer Network Access (Continued)

Medium-to-large metropolitan building applications

These applications are designed to provide service to single or multiple customers in a large building. Based on specific business customer service needs, various BRT cabinet configurations are provided for medium-to-large businesses. Typically, the first BRT configuration installed in a large building contains a DDM-2000 or DDM-1000 multiplexer and the Series 5 system dual channel bank connected to the service node via fiber. As additional channelized service and Series 5 system capacity is required, a BRT with additional Series 5 systems is added. This cabinet can be located next to the first cabinet or on another floor where major groups of services are required.

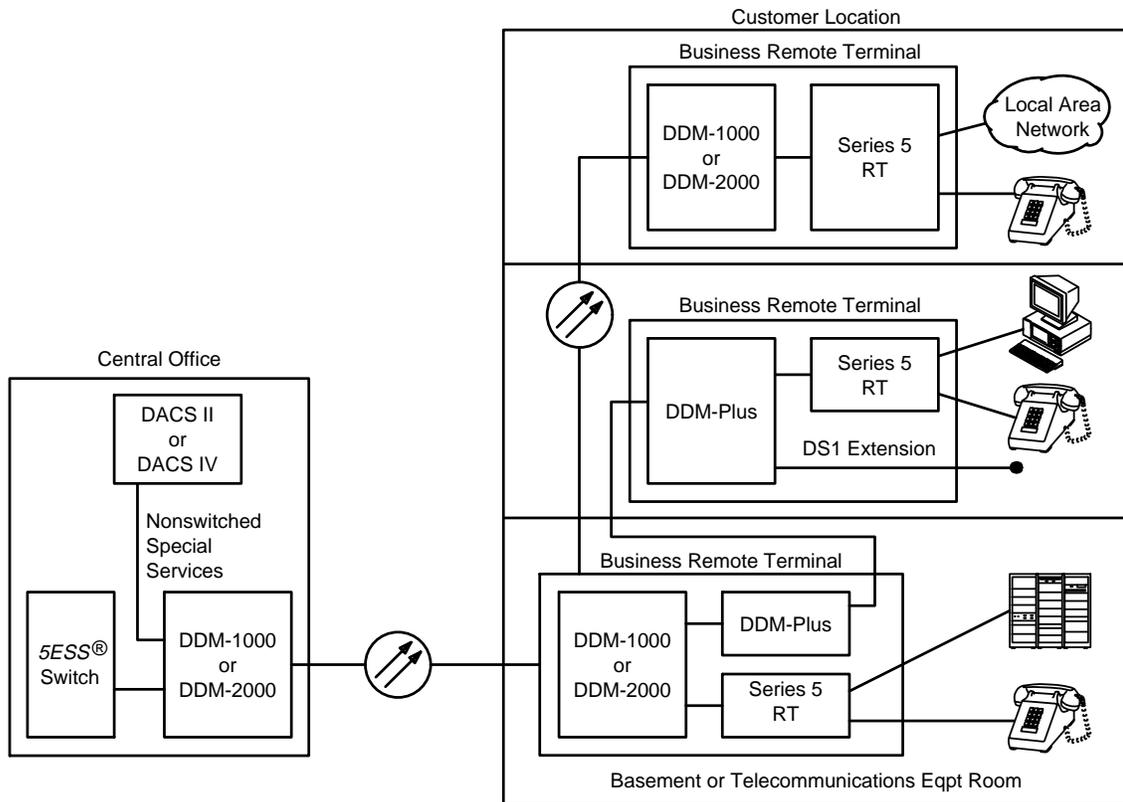
A building with fewer services may have applications for a BRT equipped with DDM-Plus and the Series 5 system. This arrangement reduces riser congestion and increases security. For businesses with moderate service needs that require the benefits of access to network services over fiber or that have expanding service needs, one solution can be: a DDM-Plus for DS1 services and the *SLC-2000* MSDT for channelized services provided using fiber access. These arrangements provide the bandwidth to meet service needs for today and tomorrow and provide a platform that supports faster service provisioning.

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Business Customer Network Access (Continued)

Large metropolitan building application (BRT) illustrated

This figure shows how the DS1 signals may be optically or electrically extended within the building to floors where businesses requiring DS1 service are located and to support BRTs installed on floors where large groups of services are required.



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Business Customer Network Access (Continued)

Campus/ industrial park application

This application is designed for a multibuilding environment (like a campus or industrial park with several buildings). For campus applications, a BRT located in a building on campus serves as the hub for network service for the other buildings. Optical or electrical DS1s are extended from the hub BRT to the satellite buildings using DDM-Plus. In the satellite buildings, a BRT with the Series 5 system distributes channelized service as required.

For industrial park applications with multiple customers, the hub BRT can be located in an outside plant enclosure. These enclosures, such as the 80-type cabinet, are designed for DDM-2000 or DDM-1000 multiplexer and Series 5 system operation in an outside plant environment. The need for a moderate amount of channelized service supported with fiber in a particular building or floor can be satisfied with a *SLC-2000* MSDT that is linked via fiber to a hub BRT equipped with the Series 5 system.

Business applications for high quality transmission

Many businesses require the highest quality services and continuous, uninterrupted access to their customers and markets. These businesses include banks, telemarketing centers, airline reservation centers, and data centers. For these firms, any disruption, from line hits on data services to loss of voice service, can have a devastating effect on profitability and quality of service provided to their customers. These businesses depend on the most reliable service and are looking for ways to reduce the likelihood of any interruption in their service.

Diverse routing is one solution for preventing service disruption from a cable cut on the local loop. With the DDM-2000 or DDM-1000 multiplexer, service is automatically switched to the protection route if one fiber route is cut. With DDM-Plus, fibers can be diversely routed by placement in separate conduits for applications inside buildings and in the local loop.

Since fiber is not affected by water and lightning, using fiber and installing the BRT in a secure, dry location in the building can reduce weather-related interruptions. For data applications, this is critical to reducing intermittent problems or interruptions that can cause retransmission of data; therefore, this solution maximizes the throughput of the network and users. Since fiber is virtually immune to taps, a fiber network provides increased security on all communication, above that available with copper or microwave and without expensive encryption.

(Continued on next page)

Business Customer Network Access (Continued)

Channel testing capabilities

Refer to ...	For information on ...
363-205-402	Series 5 channel unit installation tests
363-205-106	AUA90 T-BRITE channel unit installation and maintenance
363-205-107	AUA93 BRITE II channel unit installation and maintenance
363-205-113	installation and maintenance of the AUA94 U-DSL channel unit
363-005-238	the 950A maintenance test set used for ISDN

Feature Package Conversion and Office-to-Office Testing

Description

To provide the enhanced services and/or testing features offered by another feature package, the Series 5 system can be converted or upgraded. This frequently can be done without affecting service by replacing a few common units. Details on the common units required for conversion are given in Chapter 4, *Equipment Description*. Procedures for conversion are listed in 363-205-400, COT installation and turnup (TOP) and 363-205-401, RT installation and turnup (TOP).

The following sections discuss cutover from universal systems to integrated TR-08 systems on digital switches. This overview applies specifically to the *5ESS* switch but may be generally applied to other TR-08 compliant switches.

AutoCut option

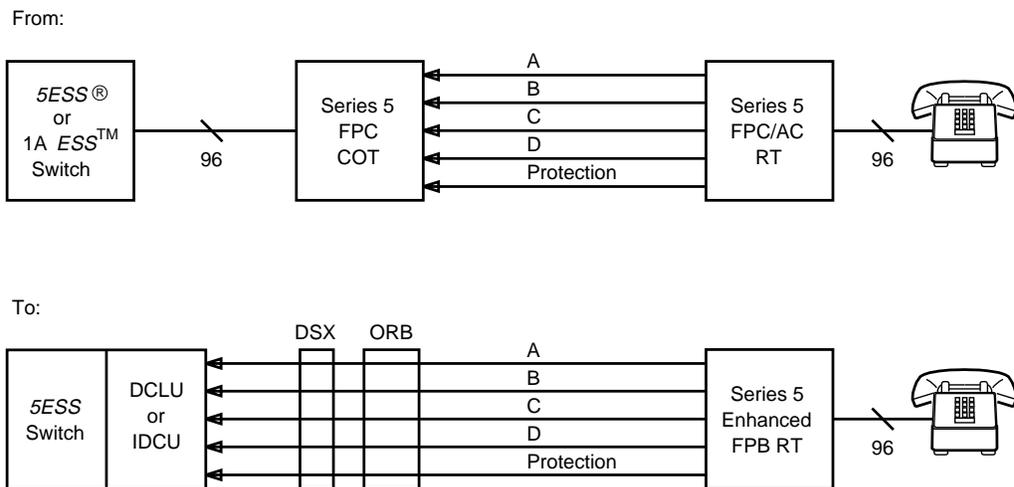
The AutoCut option (FPC/AC) allows conversion from an FPC RT to an enhanced FPB Mode 1 RT or from an enhanced FPB Mode 1 RT to an FPC RT. Converting from FPC/AC to enhanced FPB Mode I will interrupt service for a short time (to transfer the DS1 lines from the COT to the switch at the central office). With the appropriate switch settings on the RT ADU, the cutover can be done without sending personnel to the RT site. After integrating, the RT automatically operates as an enhanced FPB Mode 1 RT.

(Continued on next page)

Feature Package Conversion and Office-to-Office Testing (Continued)

Conversion to integrated system with an enhanced FPB RT

Cutover from a COT to a DCLU or IDCU involves the transfer of *SLC* Carrier System lines, originally served by an analog switch, to an integrated interface on a DCLU. This procedure, illustrated below, is being used more frequently as new *5ESS* switches are installed in offices with universal *SLC* Carrier Systems. Cutover includes growth procedures (to reassign equipment in the switch), patching procedures (at the DSX for the DS1 lines), and office-to-office testing (to verify directory numbers in the switch before the cutover is executed).



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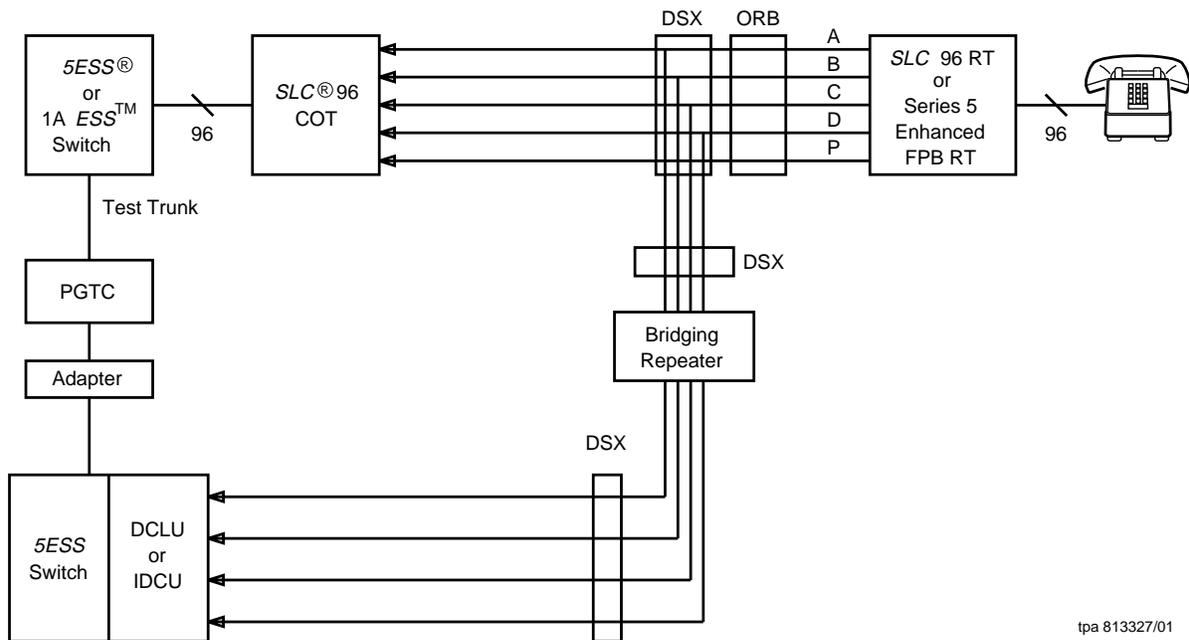
363-200-010, *DCLU Integrated SLC Carrier System General Information Manual*, gives a detailed explanation of *SLC* Carrier System conversion in the high-level description of cutover between offices (COT to DCLU). The description is written for the *SLC* 96 Carrier System, but also applies to the Series 5 system.

(Continued on next page)

Feature Package Conversion and Office-to-Office Testing (Continued)

Conversion to integrated system with a SLC 96 COT

The figure below shows the configuration for existing conversion of a universal SLC Carrier System. This configuration applies only to systems with a SLC 96 COT. New procedures for converting universal Series 5 systems to integrated are available in 363-099-143MG CIR. This CIR has attached to it 363-205-108, *Series 5 System Automated Office-to-Office Cutover Procedure*.



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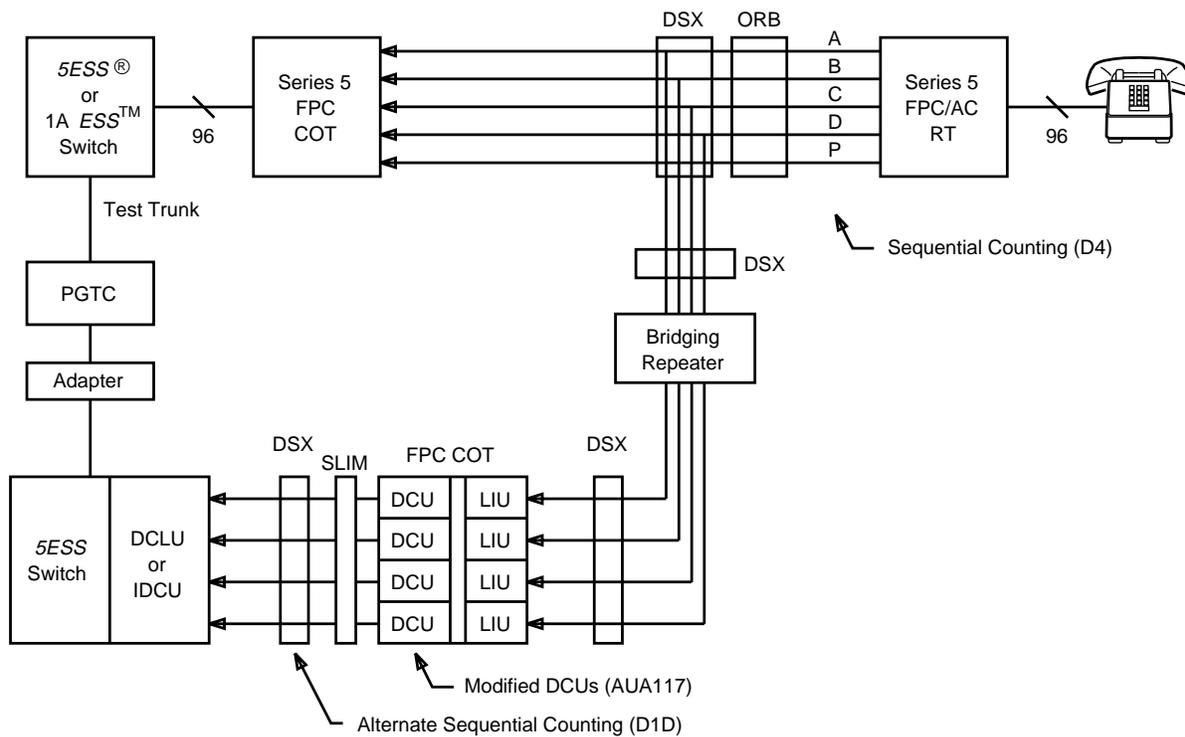
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Feature Package Conversion and Office-to-Office Testing (Continued)

Conversion to integrated system with FPC/AC system

The figure below shows the configuration for converting a Series 5 FPC/AC system to an integrated system. Besides the benefits of eliminating the COT and reducing the number of analog conversions, 5ESS switch integration and office-to-office testing provide the following:

- minimal disruption of service while validating directory numbers before cutover
- automated and convenient cutover
- with FPC AutoCut, no visits are required to the RT site at time of cutover.



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(Continued on next page)

Feature Package Conversion and Office-to-Office Testing (Continued)

Precutover office- to-office testing

Office-to-office testing of a precutover integrated Series 5 system requires a special conversion cabinet equipped with an FPC COT. The prewired 4-foot cabinet consists of the following:

- one Series 5 system dual channel bank assembly FPC COT with associated LIUs and digital connectivity units (DCUs)
- two subscriber loop interface module (SLIM) shelves
- four bridging repeater shelves (eight bridging repeaters)
- one 800-type digital signal cross-connect (DSX) panel
- one RT power shelf.

The Series 5 Conversion Cabinet may be ordered through Cockeysville Engineering as follows:

NE00279-15 G-2 *SLC* Series 5 Carrier System Conversion Cabinet

Ordering information should be verified through J. Casseri, Lucent Technologies-NS Engineering Center, at (410) 584-6147.

363-205-108 contains procedures for converting a universal FPC system to an integrated FPB system and for turning up and using the Series 5 Conversion Cabinet.

The figure shown previously in the section "Conversion to integrated system with a *SLC* 96 COT," shows the standard way to configure a universal *SLC* 96 Carrier System for office-to-office testing before cutover. Use of the Series 5 conversion cabinet is shown in the section, "Conversion to integrated system with FPC/AC system." The AUA117 digital connectivity unit (DCU) is described in 363-005-154 (data sheet).

Growth procedures for assigning the RT to the DCLU are given in 363-200-010. For detailed cutover procedures at the *5ESS* switch refer to 235-105-200, ***5ESS Switch Line Precutover and Cutover Procedures***. This document covers preparation, office-to-office testing, and cutover at the *5ESS* switch. Once the conversion cabinet is turned up, connection to the office wiring is done using the procedure listed in 235-105-200 [Procedure 7.25, Install Interoffice T1 Digital Carrier Wiring (Metallic Interface) Using Digital Signal Cross-Connect]. The system is now ready to for office-to-office testing as described in 235-105-200. After the office-to-office testing is complete, the system is cut over to the DCLU.

(Continued on next page)

Feature Package Conversion and Office-to-Office Testing (Continued)

Cutover activity summary

A summary of cutover related activities at the central office includes the following:

Step	Action
1	train personnel on conversions
2	turn up Series 5 Conversion Cabinet (363-205-108)
3	rewire DSX (universal to integrated) (235-105-200)
4	equip each FPC RT to be cutover with AutoCut common units (if not done already)
5	grow RT with directory number on 5ESS switch (363-200-010)
6	verify directory numbers (235-105-200)
7	patch RT to 5ESS switch (235-105-200)
8	test DSX and other central office wiring (235-105-200)
9	switch RT back to COT (235-105-200)
10	repeat Step 5 through Step 9 for each RT to be cutover
11	pull patch cords (235-105-200)
12	verify cutover (235-105-200)
13	update engineering and assignment records

Mixed Bank Applications

Description

Enhanced FPB, FPC, or INA-RT can be mixed in a Series 5 RT dual channel bank. However, there are some equipment considerations for testing and alarms in mixed bank applications. Refer to Chapter 4, *Equipment Description* for common unit requirements for testing. The alarm considerations are covered in Chapter 8, *System Alarms and Maintenance*.

The FP303 RT can be mixed in a Series 5 RT dual channel bank with Enhanced FPB.

Equipment Description

4

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Introduction

Equipment and apparatus categories

The Series 5 system equipment and apparatus can be grouped into several major categories as follows:

- central office terminal (COT) channel bank assembly, equipment, and apparatus
- bay arrangements and remote terminal (RT) enclosures
- RT channel bank assembly, mounting and powering equipment, and apparatus
- fiber distribution equipment and apparatus (optional)
- digital facilities, multiplexers, or repeaters and apparatus.

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Introduction (Continued)

Ordering information

Ordering information for Series 5 equipment is contained in 363-205-000, **SLC**[®] *Series 5 Carrier System, Ordering Guide*. The ordering guide covers ordering of Series 5 COT bays (including channel banks), the RT bay (miscellaneous frame), RT channel banks and powering equipment, circuit packs, and RT cabinets and enclosures. It also lists test equipment and miscellaneous items. **For current codes of equipment and apparatus listed in this chapter, refer to the ordering guide.** The Series 5 data sheets (363-005-101 through 363-005-300) provide a detailed description of each of the Series 5 circuit packs. The digital line equipment and apparatus is described in the documents in divisions 365-xxx-xxx and 640-525-xxx.

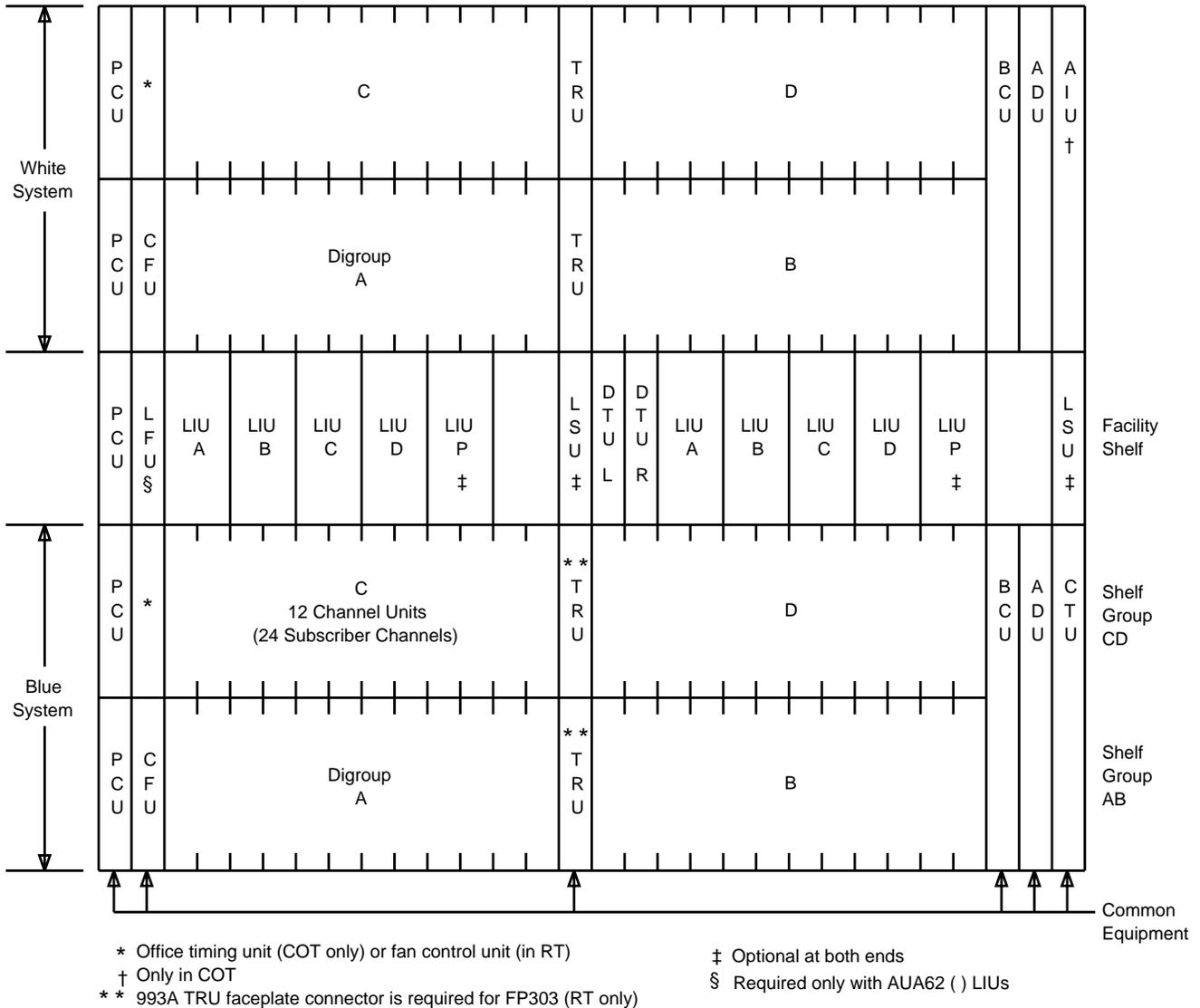
Series 5 system overview

The Series 5 system is based on a dual channel bank assembly containing two independent 96-line systems for the COT and RT. The dual bank assembly can accommodate any feature package; no special backplane is required for the AutoCut feature or Mode 2 operation. One Series 5 system dual bank assembly occupies 20 inches of vertical space and can provide service for up to 192 customers (depending on feature package and mode). This is double the density of the *SLC* 96 carrier system channel bank.

(Continued on next page)

Introduction (Continued)

Dual channel bank illustrated This figure shows a typical Series 5 system dual channel bank assembly.



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Introduction (Continued)

Dual channel bank assembly description

The dual channel bank assembly shown on the previous page contains two independent 96-line systems arranged on five shelves. The lower two shelves contain the **blue** system channel units and common equipment. The upper two shelves contain the channel units and common equipment for the **white** system. The middle (facility) shelf is equipped with the following:

- line interface units (LIUs) and line switch units (LSUs - optional) for both systems
- digital test unit (DTU - optional), which is shared by both systems
- power converter unit (PCU) for the units installed in the middle shelf.

The LIUs and LSU on the left-hand side of the shelf serve the blue system; those on the right-hand side serve the white system. A system provides service for up to 96 customers. The channel units are divided into 4 digroups (A, B, C, and D) of 12 channel units each. The channel units on the lower shelf of a system are referred to as shelf group A/B; shelf group C/D refers to the upper shelf of the system. Except for channel testing and the interface to the central office (CO) and remote alarm systems, the blue system and white system are independent and may be established separately. For more information on mixed bank considerations, see Chapter 7, *Engineering and Planning*.

Central Office Terminal (COT) Dual Channel Bank

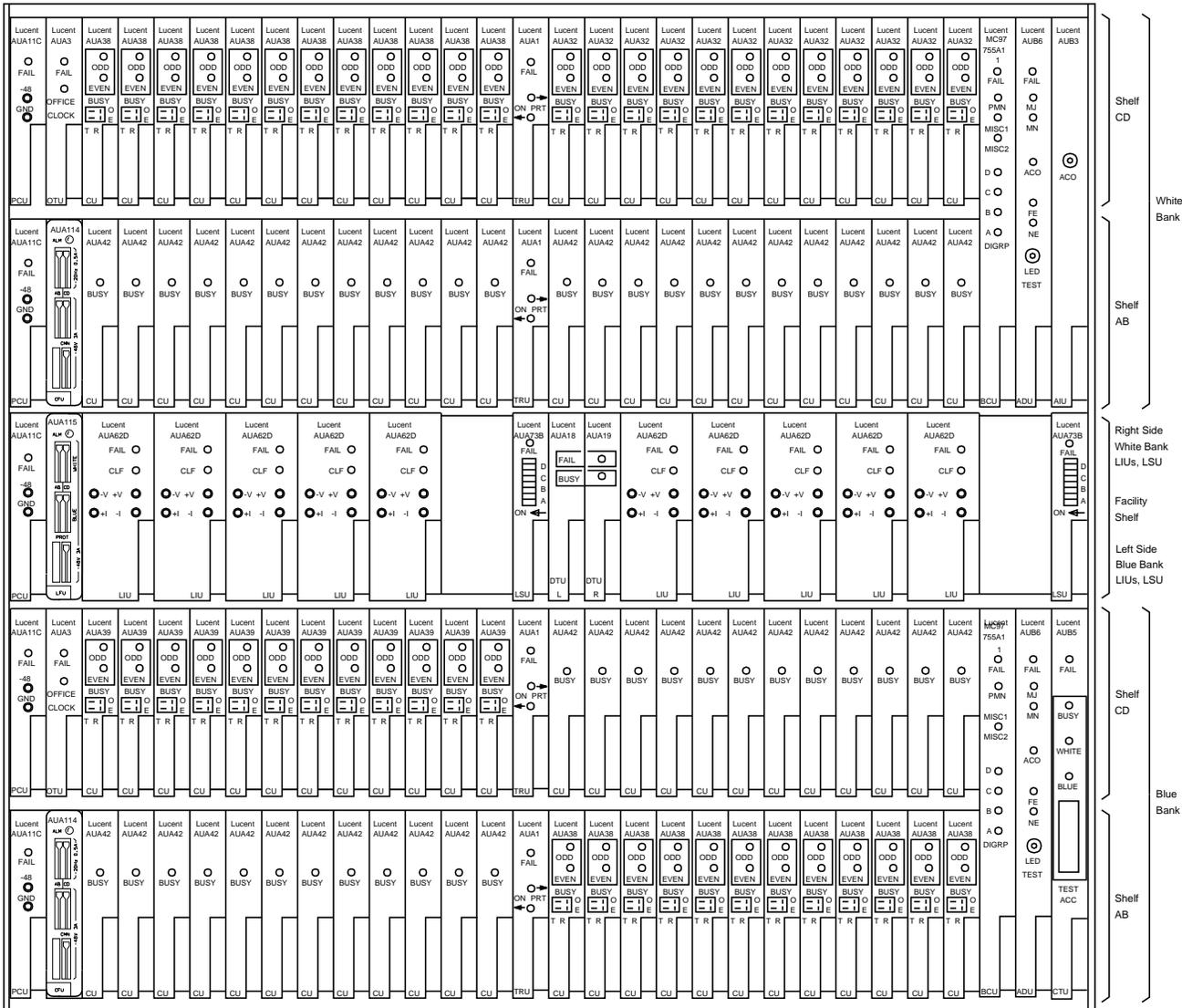
Description

The COT dual channel bank J1C182AD-1 replaces J1C182AA-1; this code is compatible with any of the RT dual bank assemblies. The channel bank assembly consists of five shelves with a one-piece covered backplane. The assembly uses 20 inches of vertical mounting space and accommodates all circuit packs required for two complete systems. All assembly wiring is completed by the factory using a combination of point-to-point wiring and a printed wiring board (PWB) backplane. The dual channel bank assembly is fully connectorized. A cable assembly (ED-7C700) can be installed in each digroup in the COT to provide access to the E&M leads (for COT E&M applications). Procedures for installing the cable assembly are listed in 363-205-400, COT acceptance and installation (TOP).

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Central Office Terminal (COT) Dual Channel Bank (Continued)

COT dual channel A fully-equipped COT dual channel bank is shown in this figure.



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COT Frame Arrangements

Description

The COT equipment consists of various combinations of a dual channel bank assembly and heat baffles mounted in a factory-wired bay. The bay may be ordered with cabling for fault-locating and order wire (FL/OW) panels if needed. The FL/OW panels and a writing shelf are also available for field installation.

Three sizes of bays are available as follows:

Bay Code Number	Replaces	Size	Cabled for ...
J1C182D-1, L1	J1C182A-1, L1	11-foot 6-inch	—
J1C182D-1, L2	J1C182A-1, L2	11-foot 6-inch	FL/OW panels
J1C182E-1, L1	J1C182B-1, L1	9-foot	FL/OW panels
J1C182F-1, L1	J1C182C-1, L1	7-foot	FL/OW panels

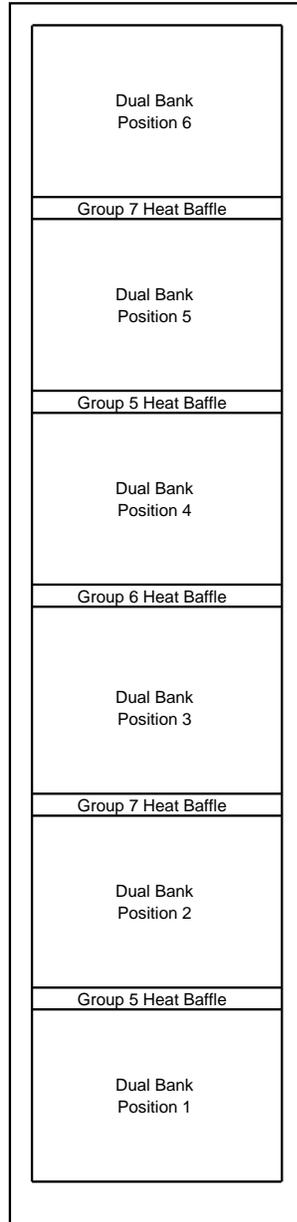
COT Bays

11-foot 6-inch bays The J1C182D-1, L1 bay shown in the left view of the following figure, provides six dual channel bank assemblies (twelve systems). It has no space or cabling for FL/OW panels. The J1C182D-1, L2 bay shown in the right view, provides five dual channel bank assemblies (ten systems) and is cabled for the optional FL/OW panels, which may be equipped as needed. In an 11-foot 6-inch COT bay lineup, the J1C182D-1, L2 is normally the first bay of each group of four bays, and the J1C182D-1, L1 is used in the other positions.

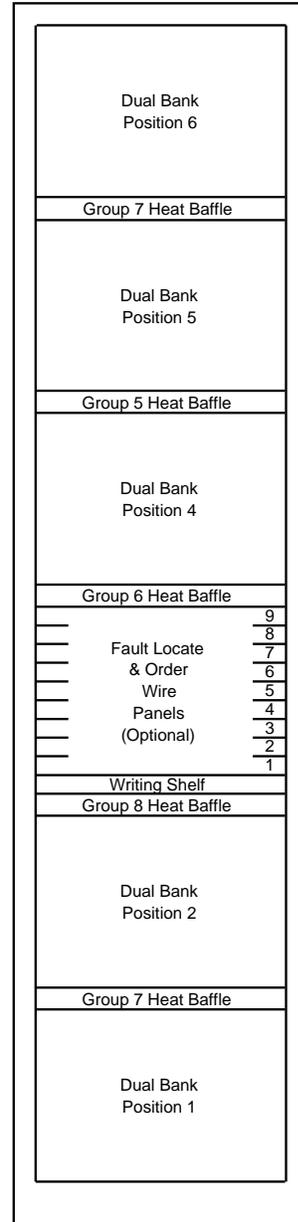
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COT Bays (Continued)

11-foot 6-inch bays (continued)



J1C182D-1, L1



J1C182D-1, L2

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COT Bays (Continued)

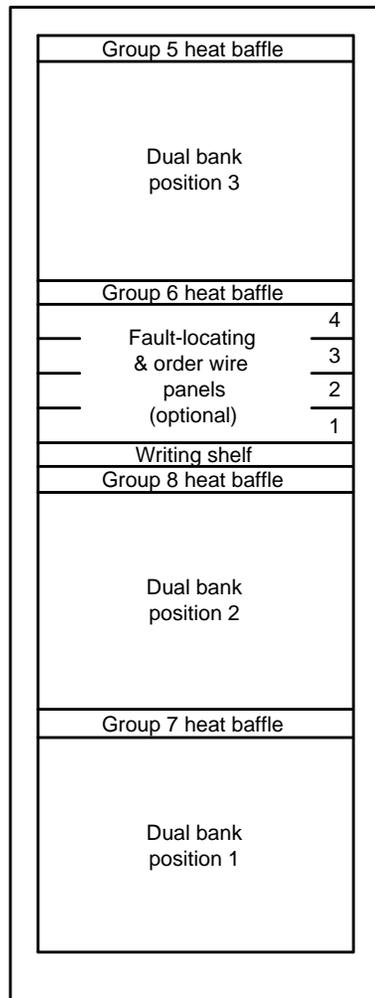
7-foot and 9-foot COT bays

The J1C182E-1, L1 bay, shown in the right view of the following figure, provides four dual channel bank assemblies (eight systems). The J1C182F-1, L1 bay, shown in the left view, provides three dual channel bank assemblies (six systems). Both bays are cabled for the optional FL/OW panels, which may be equipped as needed.

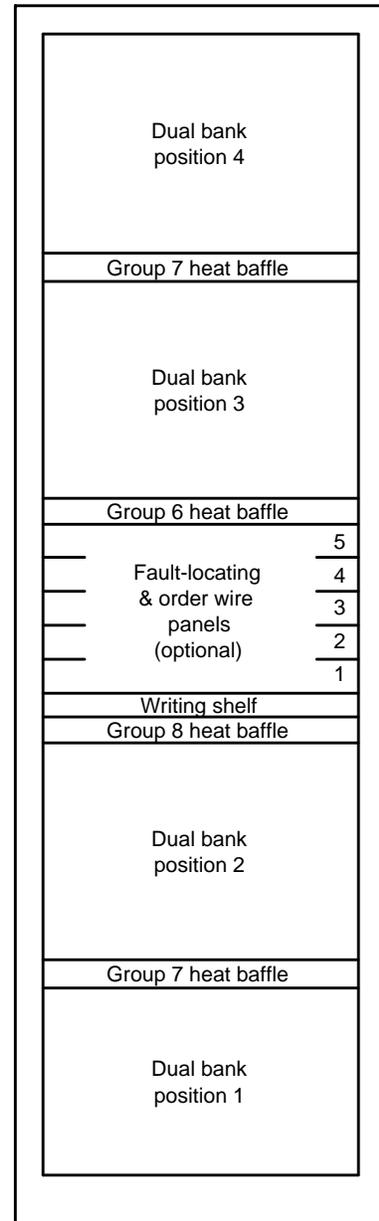
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COT Bays (Continued)

7-foot and 9-foot COT bays (continued)



J1C182F-1, L1 7'-0"



J1C182E-1, L1 9'-0"

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COT Bays (Continued)

Equipment arrangements

This table is a summary of COT bays and FL/OW panel capacities.

<u>Bay Code</u>	<u>Bay Configuration</u>	<u>Heat Baffle Requirements</u>				<u>Available Space for Fault- Locating and Order Wire Panels</u>	
		<u>G5</u>	<u>G6</u>	<u>G7</u>	<u>G8</u>	<u>With Writing Shelf (No. of Panels)</u>	<u>Without Writing Shelf (No. of Panels)</u>
J1C182D-1, L1	11-foot 6-inch 6 Dual Channel Banks (12 Systems)	2	1	2	0	None	None
J1C182D-2, L2	11-foot 6-inch 5 Dual Channel Banks (10 Systems)	1	1	2	1	9	10
J1C182E-1, L1	9-foot 0-inch 4 Dual Channel Banks (8 Systems)	0	1	2	1	5	6
J1C182F-1, L1	7-foot 0-inch 3 Dual Channel Banks (6 Systems)	1	1	1	1	4	5

(Continued on next page)

COT Bays (Continued)

Fuses and heat baffles

The Series 5 COT does not need a separate fuse and alarm panel. Instead, the COT bays are equipped with the appropriate ED-7C603-30 heat baffle that has fuses and indicators mounted on it for the -48 V supplies to the channel banks, the channel fuse units (CFUs), the line fuse unit (LFU) (if equipped), and the FL/OW panels. The ED-7C603-30 panel provides indicators for major, minor, and power minor alarms for the bay and a fuse alarm indicator for each dual channel bank. Each heat baffle uses 2 inches of vertical mounting space in the COT bay.

The heat baffle is provided in four groups. The ED-7C603-30, G5 through G8 replaces ED-7C603-30, G1 through G4.

ED-7C603-30	Has ...
Group 5	a 25A fuse and a FUSE ALM indicator [red light emitting diode (LED)] mounted on the right-hand side of the panel
Group 6	three BAY ALARM indicators. The bay alarm indicators are MJ (red LED), MN (yellow LED), and PMN (yellow LED). The PMN alarm signals a minor RT power failure.
Group 7	two 25A fuses and two FUSE ALM indicators
Group 8	five 2A fuses and one FUSE ALM indicator.

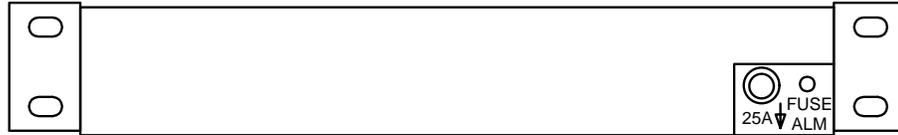
The location of the heat baffles for each bay arrangement is shown in the COT bay figures previously discussed.

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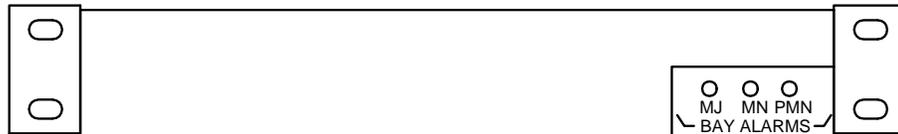
COT Bays (Continued)

Heat baffles illustrated

This figure shows the ED-7C603-30 heat baffle, G5 through G8.



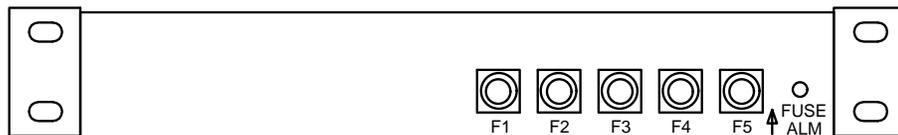
ED-7C603-30, G5



ED-7C603-30, G6



ED-7C603-30, G7



ED-7C603-30, G8

Note:
Arrows beside fuses indicate associated equipment.

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COT Bays (Continued)

Fault-locating and order wire panel

A J1C141AC-L1, 2 fault-locating and order wire panel is available for active and passive fault locating. The J1C141AC-L1, 2 panel is powered from the -48 V supply and contains a DC-to-DC converter to provide +130 V from the -48 V supply.

The J1C141AC-L1, 2 is a combination of the J1C141AC-L1 and J1C141AC-L2 panels. It uses the L1 panel with the L2 DC-to-DC converter and has the L1 options brought out to a terminal strip on the rear of the panel. A 118 V regulator provides the output for powering the fault locating line. The fault-locating and order wire panel also provides an independent order wire between the COT, the digital line repeater locations, and the RT.

The J1C141AC-L1, 2 panel can be installed in all 7- and 9-foot bays and in the List 2, 11-foot 6-inch bay. The List 2 bay is used as the first of every four bays in the COT lineup. The J1C141AC-L1, 2 panels may be equipped in these bays as needed. The number of panels required depends on the number of routes served by the COT lineup.

Guidelines for equipping the J1C141AC-L1, 2 are given in 915-710-115 (system engineering). The panel is described in 363-202-216 along with installation and turnup procedures for active fault-locating and order wire systems. The COT bay figures provided earlier in this chapter show the location of the J1C141AC-L1, 2 panels in the COT bays.

Remote Terminal (RT) Dual Channel Bank

Description

The RT dual channel bank J1C182AE-1 replaces J1C182AB-1. The J1C182AF-1 (replaces J1C182AC-1) RT dual channel bank is designed for E&M applications. The RT dual bank assemblies are compatible with any of the COT dual bank assemblies. Refer to the Series 5 ordering guide for current list numbers for the RT dual bank assemblies.

The RT dual channel bank is a 5-shelf assembly that requires 20 inches of vertical mounting space and accommodates two complete systems. All assembly wiring is completed by the factory using a combination of point-to-point wiring and PWB backplane. The cabling is tied to the bay frame or cabinet assembly. All external connections, including derived pairs, T1 lines, and alarms, are connectorized (710-type) and are made from the front of the assembly.

The E&M RT dual channel bank (J1C182AF-1 or J1C182AC-1) provides additional connectorized cables for access to the 4-wire channel unit (AUA54) E, M, SB and SG leads. Type I and II E&M signaling is supported.

(Continued on next page)

RT Frame Arrangements

Description

The RT frame arrangements consist of various combinations of a dual channel bank assembly (two systems), a power shelf assembly (including ringing supply), -48 V DC battery strings, and a fan assembly mounted in a 7-foot frame. If the AC power fails, the batteries will maintain normal equipment operation for a minimum of 8 hours. Frame-mounted RTs may be powered from the commercial AC supply or from a bulk power plant. Bulk-powered RT frames do not have the battery strings (auxiliary power) used in AC-powered frames.

The Series 5 RT dual channel bank is mounted in the 7-foot unequal flange cable duct-type network frame (bay). This bay can be equipped with four Series 5 systems. The concrete hut and the equipment platform may be ordered initially for *SLC* 96 carrier systems with additional empty bays cabled for the Series 5 RT equipment. Mini-hut and maxi-hut (EEE - electronic equipment enclosure) arrangements are also possible.

AC-Powered RT Frame

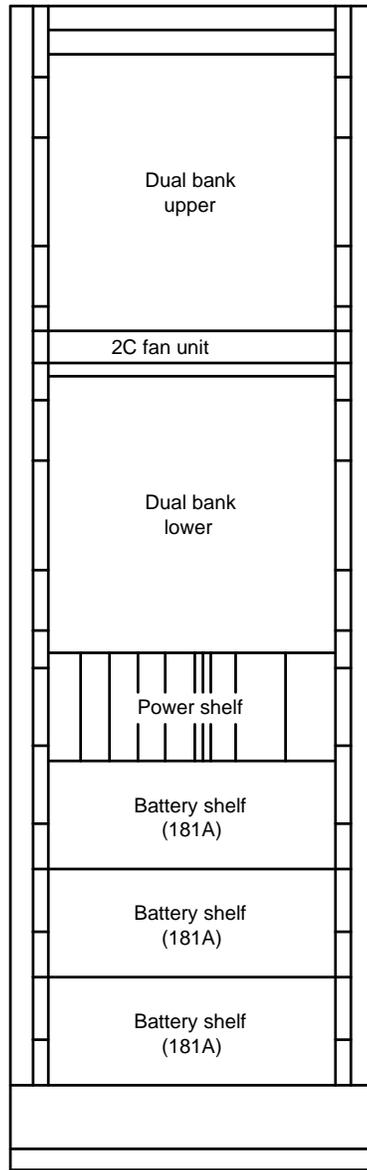
Physical description

All equipment is installed, maintained, and removed from the front of the 7-foot bay. Two connectorized dual channel bank assemblies are mounted in the AC-powered frame, as shown in the left view in the following figure. Also mounted in the frame are the connectorized power shelf, three connectorized battery shelves, battery packs, and a fan assembly. Primary protection must be added to the enclosure. This frame is powered from the commercial 120-V AC 60-Hz supply. The frame may be equipped with only one dual channel bank assembly, shown in the right view of the following figure. Detailed RT frame mounting information is given in floor plan data sheet FPD 801-450-106-5 — Series 5 RT Frame, 7-foot Frame with Two Dual Channel Banks (AC Power).

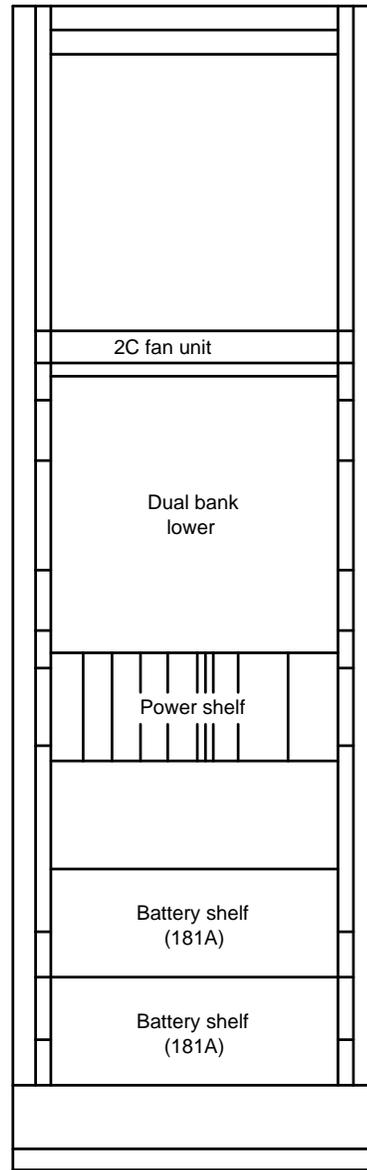
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AC-Powered RT Frame (Continued)

AC-powered RT
frame illustrated



Fully equipped



Partially equipped

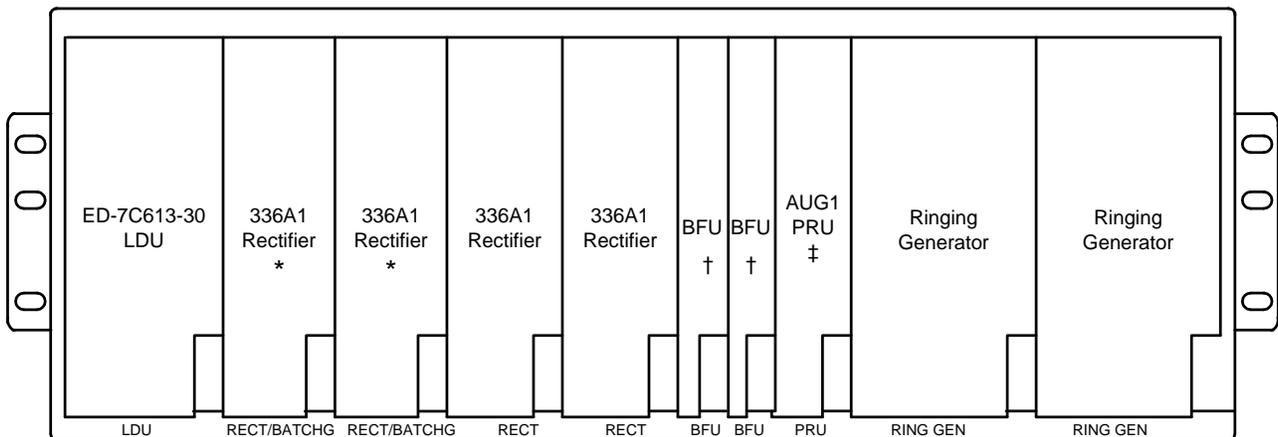
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AC-Powered RT Frame (Continued)

J1C182BA power shelf

This power shelf is used in distributed power applications (with the 117 V 60-Hz AC power supplied to RT cabinets and AC-powered RT frames). The power shelf circuit packs, shown in the figure below, provide power distribution, fusing, ringing supply, fault-locating jacks, and order wire terminals. Connectorized cables connect the power shelf assembly to the dual channel bank, the battery shelves, and the fan unit. The power shelf requires 8 inches of vertical mounting space and holds the following circuit packs:

- ED-7C613-30 LDU (load distribution unit)
- 336A1 power units
- AUG11 BFU (bank fuse unit)
- 3B1 or 3C1 ringing generator
- 337A1 battery charger (only in 51A cabinet)
- AUG1 positive ringing unit (only for multiparty service).



* RT frame and 80D cabinet use the 336A1 rectifiers in all four slots (as shown) with 337A1 battery chargers mounted in battery shelves. The 51A cabinet uses the 337A1 battery chargers in these two slots and 336A1 rectifiers in the remaining two slots.

† Bank fuse unit (AUG11)

‡ Positive ringing unit only for multiparty service.

(Continued on next page)

AC-Powered RT Frame (Continued)

J1C182BA power shelf (continued)

The 337A1 battery charger is located in the power shelf when the RT is housed in the 51A cabinet, otherwise it is located in each 181A apparatus mounting (battery shelf). Up to six 181A battery shelves can be connected to the power shelf. The table below summarizes the number of rectifiers and battery chargers required for each of the RT equipment arrangements.

Configuration (Note)	Dual Banks	336A1 Power Units Required	337A1 Battery Chargers Required
AC-Powered 7-ft. Frame	1	2	2
80D Cabinet*	1	2	2
	2	4	3
51A Cabinet	1	2	2†

Note: Other arrangements that provide additional battery backup are available. One additional 337A1 is required for each battery shelf added for backup.

* One side of cabinet equipped. Identical equipment is required for side two.

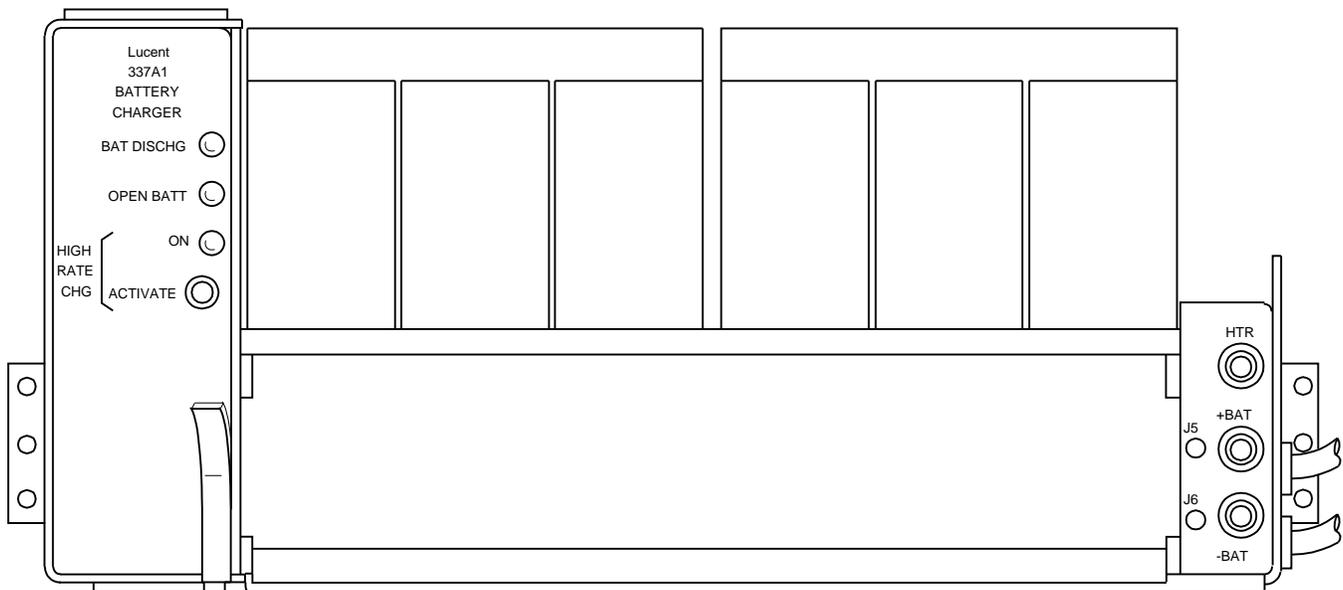
† Mounted in power shelf.

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AC-Powered RT Frame (Continued)

181A apparatus mounting

The 181A battery shelf, shown below, is used in distributed power applications and for additional power reserve in the 51A cabinet. The battery shelf holds four battery packs and one 337A1 battery charger. The RT frame arrangement holds three 181A battery shelves for two dual channel banks. All input and output leads to the power shelf are connectorized. The battery charger plugs into the left side of the shelf. In RT cabinets, a battery heater keeps the batteries warm when the temperature falls below freezing. The 181A battery shelf requires 8 inches of vertical mounting space.



DC-Powered RT Frame

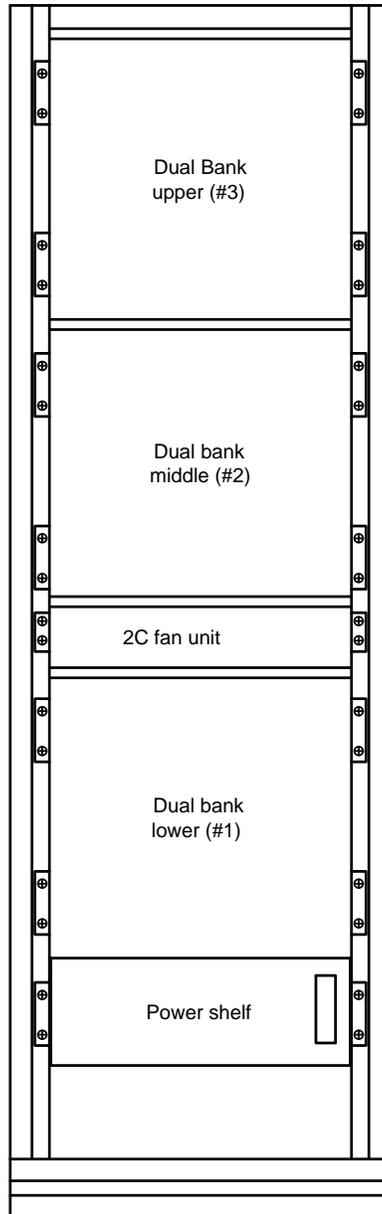
Physical description

The Series 5 system 7-foot RT frames used in structures or customer locations may be powered from DC rectifier/battery plants (bulk power). The bulk-powered RT frame is equipped with a bulk power shelf but does not require the battery shelves. The bulk power plants used in these applications are designed for a central office type environment. The RT frames that are powered from a DC rectifier plant require the J1C182BB bulk power shelf for DC power distribution. This arrangement, shown in the following figure, accommodates up to six systems (three dual channel banks) per frame. Cabling and RT frame mounting are detailed in SD/CD 7C118-01 and in Floor Plan Data Sheet FPD 801-450-106-6 — Series 5 RT Frame, 7-Foot Frame with Three Dual Channel Banks (DC Bulk Power). See 915-710-115 for details on bulk-powering considerations.

(Continued on next page)

DC-Powered RT Frame (Continued)

**DC-powered RT
illustrated**

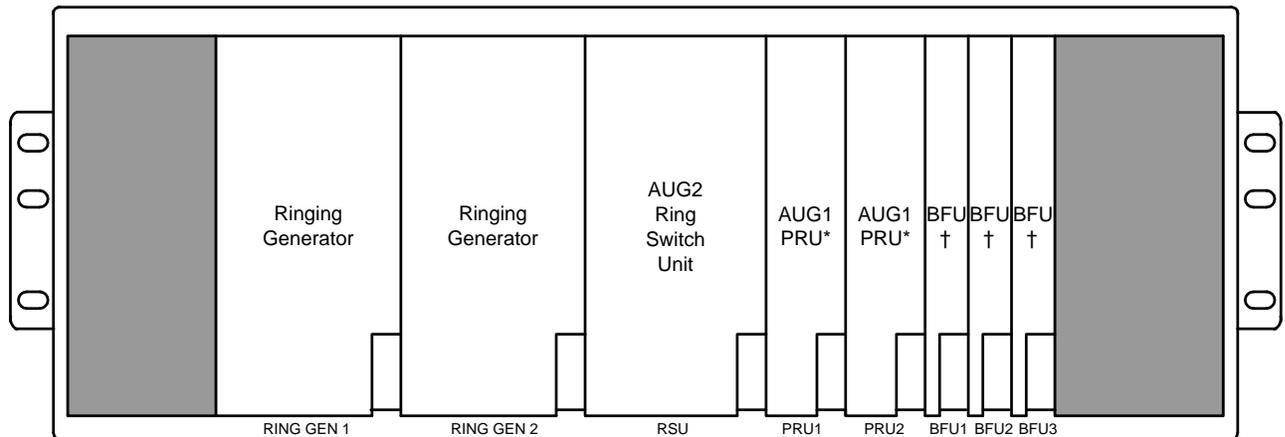


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DC-Powered RT Frame (Continued)

J1C182BB bulk power shelf

This power shelf, as illustrated below, distributes the -48 V DC power supplied to the bulk-powered RT frames. The J1C182BB power shelf provides space for installing one AUG2 RSU (ring switch unit), two AUG1 PRUs (positive ringing units), up to three AUG11 BFUs, and two 3B1 or 3C1 ringing generators. One AUG1 PRU can supply two dual banks; for three dual banks, two AUG1 PRUs are required. One bulk power shelf is required for each 6-system (three dual channel banks) RT 7-foot frame. The bulk power shelf is 22 inches wide, 11 inches deep, and requires 8 inches of vertical mounting space in remote terminal frames. Cabling between the bulk power shelf and dual channel banks is connectorized. A total of eight power, alarm, and return leads must be connected to a terminal strip on the front of the bulk power shelf.



* Postive ringing unit only for multiparty service.

† Bank fuse unit (AUG11)

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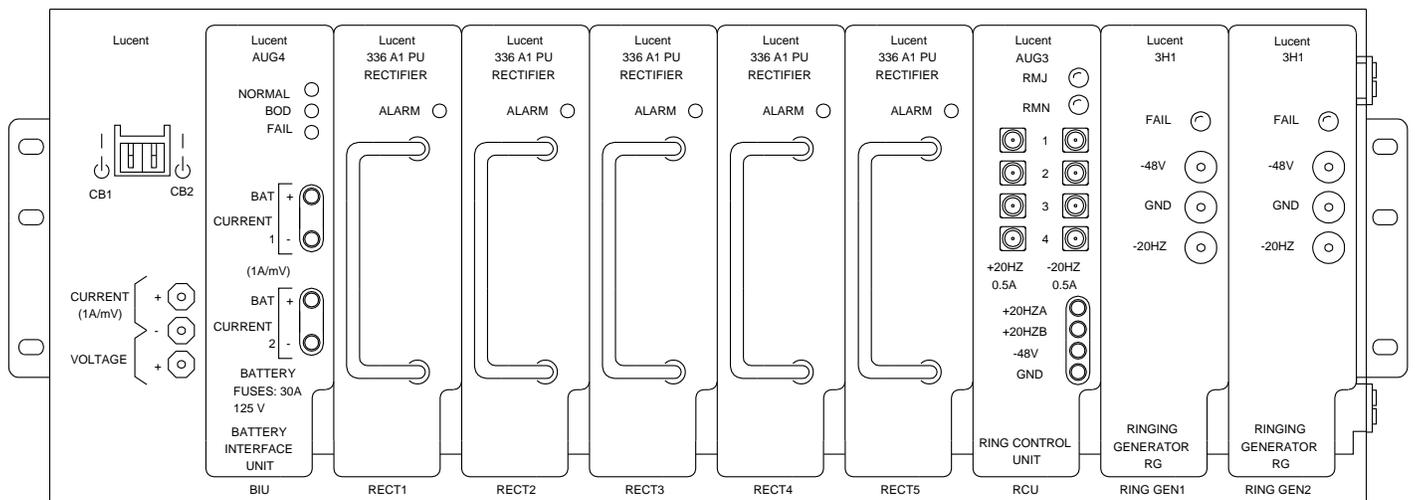
DC-Powered RT Frame (Continued)

J1C182BD bulk power shelf

The J1C182BD bulk power shelf provides both -48 V DC power and ringing equipment in a single 8.5 inch (216 mm) shelf assembly. The rectifiers, batteries, and load circuit breakers are connected to a common bus. Thus, the batteries start supplying load current when the bus voltage drops below a battery voltage of 51.5 V. No switching is required.

The following circuit packs are installed in the J1C182BD bulk power shelf, as shown in the figure below:

- one AUG4B battery interface unit (BIU) (the AUG4 BIU controls both the charging and discharging of the batteries)
- minimum of two, maximum of five 336A1 rectifiers
- one AUG3 ring control unit (RCU)
- two 3H1 ringing generators.



(Continued on next page)

RT Frame Fan Units

2B and 2C fan units

The 2B/2C fan unit is a shelf assembly with three 6-inch fans mounted on it. The fans are controlled by thermal switches on the fan control units (FCUs) and power shelf units (336A1 power units, 337A1 battery chargers, and ringing generators). A red FAIL LED indicator is mounted on the front panel of the fan assembly. The shelf is 3 inches high, 21 inches wide, and 10 inches deep, and mounts between dual channel banks in a frame. Chapter 5, *Remote Terminal Cabinets and Enclosures*, shows the position of the fan unit in various cabinet arrangements. The RT cabinets and frames come equipped with fan units as required for the equipment ordered. See the table in the Fan Unit Applications section of this chapter that describes the various applications and the appropriate fan unit.

The difference between the 2C and 2B fan unit is the direction of air flow (the 2B is downward and the 2C is upward). The 2C fan unit may replace the 2B fan unit in the 51A and 80D cabinets. However, the 2C fan unit should not be installed with the 2B fan unit in the same equipment framework or cabinet. For fan unit replacement and/or additions to existing structures, use the same type of fan unit (either 2C or 2B) already used in the structure. Following this guideline for fan replacement and/or additions ensures maximum efficiency.

4A and 4B fan units

The 4A/4B fan unit has an internal microprocessor controller and thermal sensor. The 4A/4B fan unit does not use external thermal sensors (for example, those in the AUA24 FCU or 336A1 rectifiers) for temperature control. The fan unit will turn on and operate at low speed when it senses a temperature above 50° F. At 104° F and above, the fans run at full speed for additional cooling. The fans turn off when the controller senses a temperature below 14° F. (At low temperatures, the fans circulate the heat generated by the electronics to prevent *cold spots* in the cabinet, thus, ensuring that condensation does not occur in lightly loaded cabinets.)

The faceplate of the 4A/4B fan unit has an **LED TEST** pushbutton that manually controls the fan speed when pressed and released. With each subsequent press of the push button, the fans cycle through 3600 RPM (full speed), 3200 RPM (low speed), and 0 RPM. This feature allows the craft personnel to reduce or eliminate acoustic noise during turnup and maintenance operations. Ten minutes after the last button press, the fans return to thermal sensor control.

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RT Frame Fan Units (Continued)

4A and 4B fan units (continued)

For cabinets operating on batteries, the fans operate at *battery* speed (approximately 2800 RPM) to conserve battery power. When the thermal sensor temperature drops below +14° F, the fans turn off. Since the heat dissipation in a cabinet operating on battery power is reduced by about 25% from a cabinet operating on AC power, no temperature increase results from this lower fan speed.

The faceplate of the 4A/4B fan unit has **TEMP** jacks that provide access to the voltage (directly proportional to temperature) output of the thermal sensor (10° C per Volt). A scale is provided on the faceplate for quick conversion of voltage to fahrenheit temperature.

The 4A fan unit is used in bulk power cabinets that contain door ducts. The 4B fan unit is used in bulk power cabinets equipped with door ducts *and* a heat exchanger.

Fan unit applications table

This table provides the fan unit type appropriate for the various applications.

Cabinet/Application	Fan Unit
51A (ED-7C601-30)	2B or 2C
80A (ED-7C711-30)	2B
80A (ED-7C711-30) with door ducts	4A
80D (ED-7C621-30)	2B or 2C
80D (ED-7C716-30) bulk power	4A
80E (ED-7C695-30) distributed power	2B
80E (ED-7C703-30) bulk power	2B
90A (ED-7C699-30)	2C
Frame	2C
Customer Location (including 7-Ft. Frames and Huts/Vaults)	2C

Circuit Packs

Description The Series 5 system circuit packs include the plug-in units for the dual bank assembly (common units and channel units), power shelf, 80E cabinet (ring shelf and miscellaneous units), and the *SLC-2000* MSDT.

Circuit pack table The following table lists the current Series 5 circuit packs and the number of the data sheet for each unit. The data sheet includes a description of options and indicators and shows a functional block diagram of each unit.

Apparatus Code (Note 1)	Faceplate Coding	Description	Data Sheet (363-005-)	Application (Note 2)	Location
AUA1	TRU	Transmit/Receive Unit	161	FPC	COT
AUA3	OTU	Office Timing Unit	202	FPC	COT
AUA11()	PCU	Power Converter Unit	204	All	RT/COT
AUA16	DCU	DS1 Digital Connectivity Unit - Left	142	FPC	RT/COT
AUA17	DCU	DS1 Digital Connectivity Unit-Right	143	FPC	RT/COT
AUA18	DTU-L	Digital Test Unit - Left	206	FPB/FPC/ 303,INA-RT	RT
AUA19	DTU-R	Digital Test Unit - Right	207	FPB/FPC/ 303,INA-RT	RT
AUA21()	TRU	Transmit/Receive Unit	162	FPC,INA-RT	RT
AUA22()	TRU	Transmit/Receive Unit	163	FPB	RT
AUA24	FCU	Fan Control Unit	205	All	RT
AUA25()	CU	M <i>SPOTS</i> [®] Channel Unit	124	FPB/C/303	RT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

Apparatus Code (Note 1)	Faceplate Coding	Description	Data Sheet (363-005-)	Application (Note 2)	Location
AUA26	CU	POTS with Derived Channel Alarm	127	FPC	COT
AUA27	CU	POTS with Derived Channel Alarm	128	FPC/303	RT
AUA33	CU	Coin Channel Unit (CS)*	103	FPC	COT
AUA34()	CU	DS0 Dataport Channel Unit	104	FPC	COT
AUA35	CU	Multiparty Channel Unit (CS)	109	FPC	COT
AUA36()	CU	DID 2-Wire Channel Unit	114	FPC	COT
AUA37	CU	FSR Channel Unit (CS)	121	FPC	COT
AUA38()	CU	POTS Channel Unit (CS)	118	FPC	COT
AUA39()	CU	<i>SPOTS</i> Channel Unit (CS)	120	FPC	COT
AUA41()	CU	4CF 4-Wire VF Channel Unit	105	FPB/C/303, INA-RT	RT/COT
AUA42()	CU	2-Wire E <i>SPOTS</i> Channel Unit (CS)	106	FPB/C/303, INA-RT	RT/COT
AUA43()	CU	2-Wire E <i>SPOTS</i> Channel Unit (CF)*	107	FPB/C/303, INA-RT	RT/COT
AUA44()	CU	4CS 4-Wire VF Channel Unit	108	FPB/C/303, INA-RT	RT/COT
AUA45()	CU	Dual Ringing Repeater CU	123	FPB/C/303, INA-RT	RT/COT
AUA52()	CU	OCU Dataport Channel Unit	111	FPB/C/303, INA-RT	RT/COT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

<u>Apparatus Code (Note 1)</u>	<u>Faceplate Coding</u>	<u>Description</u>	<u>Data Sheet (363-005-)</u>	<u>Application (Note 2)</u>	<u>Location</u>
AUA53()	CU	Coin Channel Unit (CF)	112	FPB/C/303	RT
AUA54()	CU	4EM 4-Wire VF Channel Unit	113	FPB/C/303, INA-RT	RT
AUA55	CU	Multiparty Channel Unit (CF)	116	FPB/C/303	RT
AUA56()	CU	DID 2-Wire Channel Unit	115	All	RT
AUA57	CU	FSR Channel Unit (CF)	122	FPB/C/303	RT
AUA58()	CU	POTS Channel Unit (CF)	117	FPB/C/303	RT
AUA59()	CU	POTS/ <i>SPOTS</i> Channel Unit	119	FPB/C/303	RT
AUA61D	LIU	DS1 Line Interface Unit	150	All	RT/COT
AUA62D	LIU	Line Powering (-130V) LIU	151	All	RT/COT
AUA64D	LIU	Power Looping LIU	152	All	RT/COT
AUA71	TCU	Transcoder Unit	164	INA-RT	RT
AUA73()	LSU	DS1 Line Switch Unit	165	FPB,FPC	RT/COT
AUA74	LSU	DS1 Line Switch Unit	196	FP303	RT
AUA75	CU	2WPLAR Channel Unit	132	FPB/C/303, INA-RT	RT/COT
AUA78	FLTA	T1 Fault-Locating Test Adapter	231	FPB,FPC	RT/COT
AUA80	—	Line Test Adapter	233	All	RT/COT
AUA90	CU	ISDN T-BRITE Channel Unit	129	FPB,INA-RT	RT
AUA92	CU	ISDN BRITE II Channel Unit	130	FPC	COT
AUA93	CU	ISDN BRITE II Channel Unit	131	FPB,FPC/AC	RT
AUA94	CU	ISDN U-DSL Channel Unit	135	FP303	RT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

<u>Apparatus Code (Note 1)</u>	<u>Faceplate Coding</u>	<u>Description</u>	<u>Data Sheet (363-005-)</u>	<u>Application (Note 2)</u>	<u>Location</u>
AUA105()	TRU	Transmit/Receive Unit	167	FPB/FPF, FPC/AC	RT
AUA109	TRU	Transmit/Receive Unit	168	FPB, FPC/AC	RT
AUA112	TRU	Transmit/Receive Unit	158	FP303	RT
AUA112B	TRU	Transmit/Receive Unit	158	FP303 Release 3	RT
AUA114	CFU	Channel Fuse Unit	228	All	RT/COT
AUA115	LFU	Line Fuse Unit	229	All	RT/COT
AUA117	DCU	FPB Digital Connectivity Unit	154	FPB	RT
AUA150()	CU	POTS and <i>SPOTS</i> Channel Unit	133	FPB/C/303	RT
AUA151	CU	POTS and <i>SPOTS</i> Channel Unit	134	FPB/C/303	RT
AUA158()	CU	RT POTS Channel Unit	303	FPB/C/303	RT
AUA159()	CU	RT <i>SPOTS</i> Channel Unit	304	FPB/C/303	RT
AUA178	CU	RT POTS Channel Unit	314	FPB/C/303	RT
AUA179	CU	ALIC5 Channel Unit	311	FPB	RT
AUA200	CU	<i>Datapath™</i> Extension DPX	313	FPB/C/303	RT
AUA232	CU	RS232 Data Port	312	FPB/FPC/INA/ 303	RT/COT
AUA252()	CU	OCU Dataport	212	FPB, FPC/ AC, FPF303, INA	RT/COT
AUA402	A/FCU	<i>SLC®</i> -2000 MSDT Alarm/Fan Control Unit	265	FPF†	RT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

Apparatus Code (Note 1)	Faceplate Coding	Description	Data Sheet (363-005-)	Application (Note 2)	Location
AUA406	CU	SLC-2000 MSDT Server	273	FPF	RT
AUA408	CU	SLC-2000 MSDT Server	274	FPF	RT
AUA411	CDTU	Channel and Drop Test Unit	275	FPF	MSDT
AUA412	PCU	Power Converter Unit	276	FPF	MSDT
AUA413	RGU	Ringing Generator Unit	277	FPF	MSDT
AUA414	PIU	Power Interface Unit	278	FPF	MSDT
AUA415	PIU	Power Interface Unit	279	FPF	MSDT
AUA416	PIU	Power Interface Unit	280	FPF	MSDT
AUA417	PCU	Power Converter Unit	281	FPF	MSDT
AUA418	CLU	Converter Limiter Unit	282	FPF	MSDT
AUA419	SCU	Shelf Common Unit (NPS)	283	FPF	MSDT
AUB2B	CTU	Channel Test Unit	198	FPC	COT
AUB3B	AIU	Alarm Interface Unit	197	FPC	COT
AUB4	ADU/ASU	Alarm Suppressor Unit	189	FPC	COT
AUB5	CTU	Channel Test Unit	200	FPC	COT
AUB6	ADU	Alarm Display Unit	186	FPC	COT
AUB22	CTU	Channel Test Unit	199	All	RT
AUB24	ADU	Alarm Display Unit	185	FPB	RT
AUB25	CTU	Channel Test Unit	201	All	RT
AUB26	ADU	Alarm Display Unit	187	FPC	RT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

<u>Apparatus Code (Note 1)</u>	<u>Faceplate Coding</u>	<u>Description</u>	<u>Data Sheet (363-005-)</u>	<u>Application (Note 2)</u>	<u>Location</u>
AUB27()	ADU	Alarm Display Unit	190	FPB/303 FPC/AC INA-RT/FPF	RT
AUG1	PRU	Positive Ringing Unit	240	FPB,FPC	RT
AUG2 ‡	RSU	Ring Switch Unit	241	All	RT
AUG3 §	RCU	Ring Control Unit	242	All	RT
AUG4() ‡	BIU	Battery Interface Unit	243	All	RT
AUG11	BFU	Bank Fuse Unit	230	All	RT
AYB1B	OU	SLC-2000 MSDT Optical Unit	224	FPF	RT
AYK1 §	—	Circuit Pack	224	All	RT
AYK2 §	—	Circuit Pack	225	All	RT
BYB1B	OU	Optical Unit	271	FPF	MSDT
MC97724A1()	BCU	Bank Control Unit	177	FPB	RT
MC97755A1()	BCU	Bank Control Unit	180	FPC	COT
MC97756A1	BCU	Bank Control Unit	181	FPC	RT
MC97769A1	BCU	Bank Control Unit	182	INA-RT	RT
MC97776A1() ¶	BCU	Bank Control Unit	173	FPC/AC, FPB	RT
MC97777A1()***	BCU	Bank Control Unit	195	FP303	RT
MC97796A1	BCU	Bank Control Unit	257	FP303 Release 3	RT
MC97779A1	BCU	Bank Control Unit	171	FPF	RT
MC97780A1	BIU	Backplane Interface Unit	272	FPF	MSDT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

<u>Apparatus Code (Note 1)</u>	<u>Faceplate Coding</u>	<u>Description</u>	<u>Data Sheet (363-005-)</u>	<u>Application (Note 2)</u>	<u>Location</u>
SPQ333	CU	Dual Coin Channel Unit (CS)	331	FPC	COT
SPQ453	CU	Dual Coin Channel Unit (CF)	342	FPC	RT
3B1	RINGING GENER- TOR	Ringling Generator (30 Hz)	223	All	RT
3C1	RINGING GENER- ATOR	Ringling Generator	226	All	RT
3H1 ‡	RINGING GENER- ATOR	Ringling Generator	244	All	RT
47B	—	PGTC/XTC Test Extender	237		
52A	—	Channel Unit Test Extender	235	All	RT/COT
336A1	RECTIFI- ER	Power Unit	220	All	RT
337A1 **	BATTER CHARG- ER	Battery Charger	221	All	RT
505A	—	Line Loss Measuring Adapter	234	All	RT/COT
950A	TEST SET	Maintenance Test Set	238	FPC,FPB,INA- RT	RT/COT
993A	—	TRU Faceplate Cable	—	FP303	RT

(Continued on next page)

Circuit Packs (Continued)

Circuit pack table (continued)

Apparatus Code (Note 1)	Faceplate Coding	Description	Data Sheet (363-005-)	Application (Note 2)	Location
CS787B540	POWER UNIT§	Power Unit (Rectifier)	227	All	RT
ED7C613-30,G3	LDU**	Load Distribution Unit	222	All	RT

Notes:

1. Refer to 363-205-000, Series 5 ordering guide for availability.
2. Some restrictions may apply. Refer to the tables in the Common Unit section of this chapter.

*CS = Current Sink; CF = Current Feed

†The FPF RT is equipped with the MC97779A1 BCU.

‡Used only with bulk (DC) power applications.

§Used only in 80E bulk power cabinet.

¶Replaces the MC97771A1 BCU.

**Used only with distributed power (AC-powered) applications.

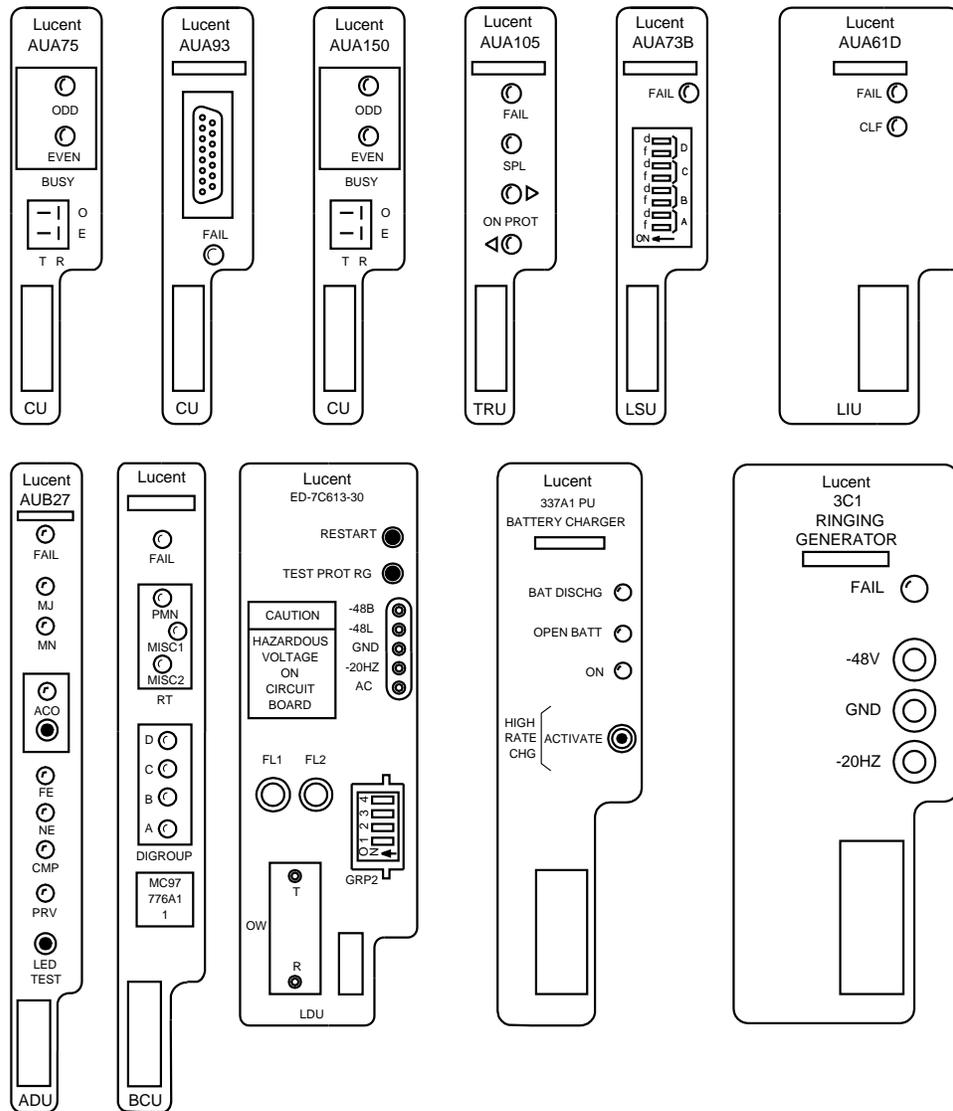
***The MC97777A1B BCU is required for FP303 Release 2.0 applications.

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Circuit Packs (Continued)

Circuit pack faceplates

This figure shows the faceplates of some typical circuit packs. For circuit packs not listed in the previous table, refer to 363-205-000, Series 5 ordering guide or 363-205-000 Appendix A, *Quick Reference Ordering Guide*.



(Continued on next page)

Circuit Packs (Continued)

Circuit pack apparatus codes

The dual channel bank circuit packs come in several families of apparatus codes:

- AUA
- AUB
- AUG
- MC
- miscellaneous numeric.

The power shelf and ring shelf circuit packs are AUG-coded and miscellaneous numeric-coded (the ring shelf is used in the 80E bulk power cabinet; see Chapter 5, *Remote Terminal Cabinets and Enclosures*). The circuit packs used in the optics shelf and optics power shelf to support *SLC-2000* MSDT in the RT are described under RT Arrangements for the *SLC-2000* MSDT. The circuit packs used in the *SLC-2000* MSDT are described under the *SLC-2000* MSDT Arrangement.

Circuit Pack Warranty Eligibility

Warranty period and applicable codes

The warranty period has been extended to 60 months for Series 5 system plug-in equipment including Fiber-To-The-Home plug-ins. This extension applies to units shipped after January 1, 1991 that have any of the following prefixes:

ASH ASJ AUA AUB AUG MC977 SM

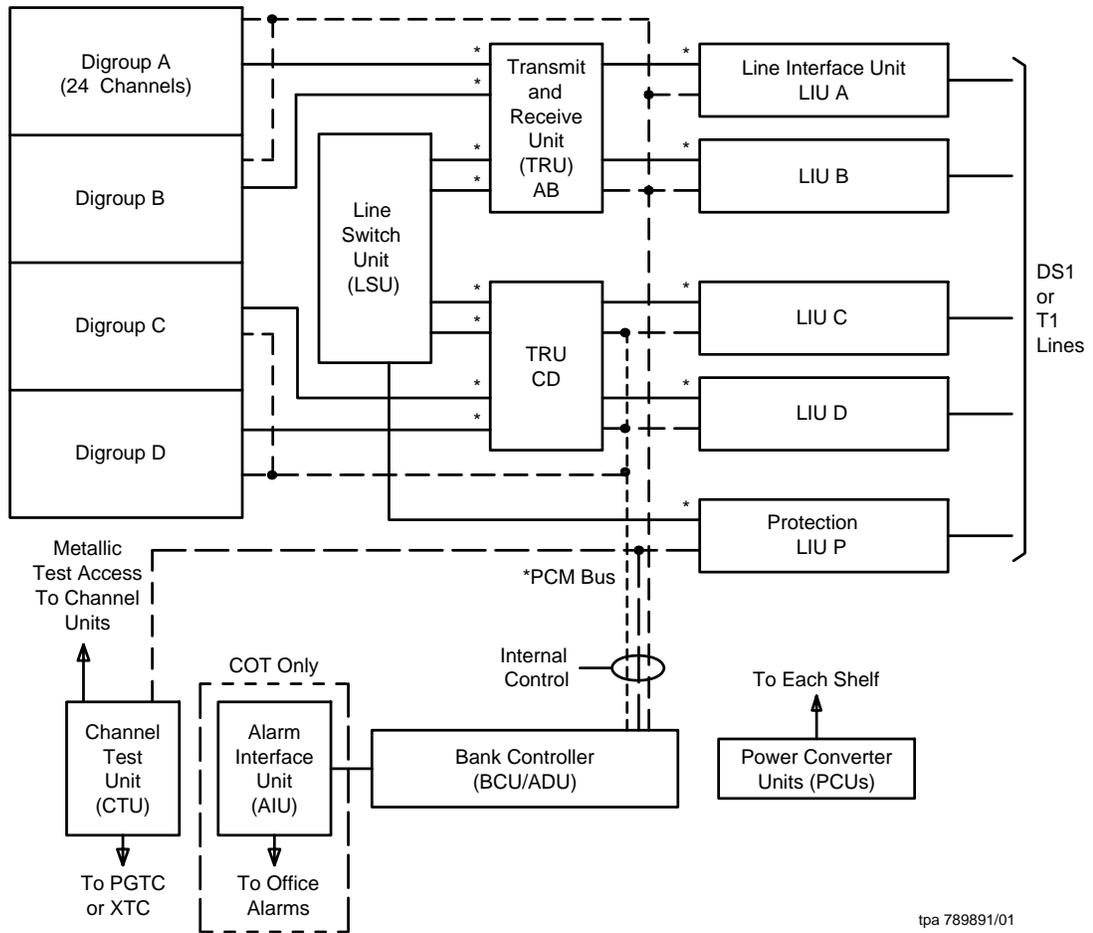
<u>Code</u>	<u>Description</u>	<u>CLEI* Code</u>	<u>Comcode</u>
AYB1B	Optical Unit	5SCF24ABXX	105550461
3C1 S1	Ringing Generator	5SCB644DAB	105727846
52A	CU Test Extender	5STE430CAA	104412911
47B	Test Extender	5STE240BAA	104435953
336A1	Rectifier	5SCB723EXX	105701726
337A1	Battery Charger	5SCB804FXX	105701734
505A	Line Loss Measuring Adapter	5SCSL03EXX	105191985
950A	Test Set	5STEA00DAB	105560627

* COMMON LANGUAGE is a registered trademark, and CLEI, CLLI, CLCI, and CLFI are trademarks of Bellcore.

All new plug-in introductions — starting October 1, 1990 — will have a 60-month warranty unless otherwise noted. Refer to product-specific documentation for further details.

FPB, FPC System Operation

System operation block diagram This is a block diagram of the overall operation of a Series 5 system terminal (96 channels).



(Continued on next page)

FPB, FPC System Operation (Continued)

Channel encoding explained

Referring to the system operation block diagram, in the transmit direction, voice-frequency signals enter the channel units and are converted to pulse amplitude modulation (PAM) samples at an 8-kHz rate. This sampling of channels is done in a fixed sequence, producing a stream of pulses. Every PAM pulse is encoded into a pulse code modulation (PCM) word by the channel unit coder/decoder (codec).

Each channel is encoded with the same format used in D3 and D4 channel banks: 7-5/6 bit, μ 255-companded PCM. This format uses 8 bits in a linear approximation of a curve as follows: bit 1 is the sign bit, bits 2 - 4 identify 8 segments, and bits 5 - 8 contain the linear coding of 15 decision levels within the segment.

There are two 8-bit DS0 channels (time slots) per channel unit slot, 24 channels per digroup, and 96 channels per system (universal Series 5 configuration). Channel unit slots are numbered 1/2, 3/4, ..., 95/96. The D4 channel polling sequence is used in extended superframe (ESF) format systems; the D1D channel polling sequence is used in TR-08 systems.

Usually, the 2-wire (dual-circuit) channel units use both channels, and the single-circuit [coin, frequency selective ringing (FSR), 4-wire voice-frequency (VF), and dataport] channel units use only the odd channel. Exceptions to this guideline include integrated services digital network (ISDN) channel units and dataport channel units provisioned for second channel error correction (SCEC). In TR-08 systems and in the integrated network access - remote terminal (INA-RT), the channels used by single- and dual-circuit channel units depend on the mode of operation.

(Continued on next page)

FPB, FPC System Operation (Continued)

Bank processing

The VF channels are encoded with 7-5/6 bit (about 64 kb/s) μ 255 PCM with robbed-bit signaling. Sequential polling is used to poll the channel units for PCM words. Each transmit/receive unit (TRU) processes two digroups: A and B or C and D. The TRU time division multiplexes the PCM words into a bit stream, inserts the data link information, and sends the bit stream to the line interface unit (LIU).

Each LIU processes one digroup. The LIU converts the bit stream from the TRU into the 1.544 Mb/s DS1 signal using the ESF or TR-08 format according to the system configuration. The DS1 signal is transmitted over the digital transmission facility.

In the receive direction, the LIU frames on the DS1 input from the facility and sends it to the TRU. The TRU extracts the data link information and sends it to the bank control unit (BCU) (in systems that have a data link). The TRU also distributes the PCM to the channel units that decode the PCM into corresponding PAM pulses and reconstruct the VF signals.

Framing and signaling

In universal Series 5 systems, the framing bits of the superframe serve three functions: they form the ESF framing sequence, carry the data link, and provide a code for measuring PCM bit errors.

The TR-08 bit stream in enhanced Feature Package B (FPB) uses the same frame as the ESF format, but the superframe is shorter. In TR-08 systems, the framing bits of the superframe provide terminal framing, signaling framing, and the TR-08 data link for channel testing, alarm reporting, and protection switching.

Channel signaling information is also transmitted over each channel. Signaling information for each of the VF channels is transmitted every sixth frame, using the least significant PCM bit (robbed-bit signaling). In other frames, all bits are used for encoding the speech signal. Robbed-bit signaling is not used on digital data channels. The TR-08 format provides two signaling bits; the ESF format provides four signaling bits.

(Continued on next page)

FPB, FPC System Operation (Continued)

Data link operation

In addition to channel signaling, the Series 5 system uses a 2-way data link for sending status and alarm conditions between the COT and the RT in universal configurations. The data link is transmitted on the A digroup (or A and C digroups in Mode 2) and the protection line, if available. The data link allows communication between the COT and RT.

In the Series 5 terminal, the bank controller [BCU and alarm display unit (ADU)] is the only common equipment that has access to the data link, even though the data link is transmitted through the TRU and LIU. In universal Series 5 systems, the bank controller uses the data link to communicate with the bank controller at the other terminal; each controller keeps its own common units informed of alarm and status conditions.

FP303 System Operation

Channel encoding For non-ISDN calls, the channel unit samples the voice-frequency, analog signal at an 8-kHz rate. The channel unit takes these 8-bit pulse amplitude modulation (PAM) samples and adds signaling and maintenance data to produce a 16-bit PCM word. For ISDN calls, the AUA94 channel unit combines 8-bits from each B-channel (B1 and B2) to produce a 16-bit PCM word. In addition, the ISDN channel unit insert 2-bits into the appropriate bit positions in the appropriate null time slot to support the D-channel.

In the transmit direction, each AUA112B transmit/receive unit (TRU) sequentially polls all the channel units in its dual-digroup shelf (AB or CD) for their 16-bit PCM words. Each TRU time division multiplexes the 16-bit words from each channel unit in a digroup together with the null time slots (every fourth time slot) to produce a 4.096-Mb/s PCM stream. The two 4.096-Mb/s streams from the TRU carrying the standby timeslot interchanger (TSI) are fed to the TRU carrying the active TSI through the TRU faceplate cable.

For non-ISDN calls, the TRU with the active timeslot management channel (TMC) examines the ABCD signaling bits from the channel unit to detect the on-hook/off-hook state. If a state change occurs, the active TMC processor sends the appropriate Q.931 message over the TMC to the local digital switch (LDS). For ISDN calls, Q.931 messages originating from the ISDN customer premises equipment are sent to the LDS over the D-channel. With dynamic time slot assignment of VF channels and ISDN B-channels, the LDS makes time slot assignments and deassignments over the TMC. With "fixed" time slot assignment of ISDN D-channels and nailed-up B-channels, the LDS makes the time slot assignments over the embedded operations channel (EOC). On the basis of these time slot assignments, the TSI on the TRU with the active TSI makes the necessary interchanges in the 4.096-Mb/s PCM stream it feeds to each LIU. The LIU converts the bit stream into a 1.544-Mb/s DS1 signal using the ESF/ndl format. The DS1 signal is transmitted over the transmission facility.

In the receive direction, an LIU frames on the DS1 input from the transmission facility and converts it into a 4.096-Mb/s PCM stream it sends to the TRU with the active TSI. The TRU with the active TSI demultiplexes the streams and distributes the 16-bit PCM words to the channel units. Non-ISDN channel units reconstruct the VF signals from these PCM words. ISDN channel units divide the PCM word into two B-channels (B1 and B2). In addition, the ISDN channel unit extract 2-bits from the appropriate bit positions in the appropriate null time slot to support the D-channels.

(Continued on next page)

FP303 System Operation (Continued)

Data link operation

In FP303, the active and standby embedded operations channel (EOC) and the timeslot management channel (TMC) are sent in DS0 time slots 12 and 24 on both the A and C line interface unit (LIU) DS1 facilities. For both the EOC and TMC, one of the two 64 kb/s channels is active and the other is standby; the active EOC and TMC can be on different facilities. These channels carry operations messages and call processing messages (for example, time-slot assignments) between the switch and RT. The EOC processor is on the bank control unit (BCU); however, the TRU extracts and inserts EOC messages into the bitstream for the BCU. Each TRU has a TMC processor. For DS1 protection switching, the DS1 carrying the active TMC has priority over the DS1 facility carrying the standby TMC and active EOC.

Common Units

Description

The choice of common circuit packs depends on the system operating mode [Series 5 enhanced FPB, Feature Package C (FPC), FPC with AutoCut (FPC/AC), FP303, or INA-RT], circuit testing arrangement, the type of line interface (T1 or DS1), and whether protection switching is provided. The transcoder unit (TCU) is used only in a Mode III INA-RT. *For quantities of common units required for various equipment arrangements, refer to the Series 5 ordering guide (363-205-000).*

Bank controller functions

The BCU and ADU make up the microprocessor-based bank controller for the Series 5 system. In general, the bank controller provides the following:

- internal performance monitoring and fault diagnosis
 - channel testing as requested by the pair gain test controller (PGTC)
 - T1 or DS1 line protection switching (when used)
 - central office and remote alarm outputs (COT only)
 - ACO (alarm cut off) (COT and INA-RT only).
-

Bank controller functions with FPB or FPC systems

In enhanced FPB or FPC systems, the bank controller also provides:

- channel unit provisioning and alignment testing using the craft interface unit (CIU)
 - nonvolatile backup of provisioning information
 - channel unit and end-to-end channel testing through the extended test controller (XTC) as requested by the Mechanized Loop Testing (MLT) System or Switched Access Remote Testing System (SARTS)
 - system number identification for provisioning and testing.
-

(Continued on next page)

Common Units (Continued)

Bank controller functions with an INA-RT

In the INA-RT, the bank controller provides the following:

- internal performance monitoring and fault diagnosis
 - remote alarm outputs
 - ACO (alarm cut off)
 - channel unit provisioning and alignment testing using the CIU
 - nonvolatile backup of provisioning information
 - system number identification for provisioning and testing.
-

Bank controller functions in FP303 systems

In FP303 systems, the bank controller provides:

- Channel unit provisioning and alignment testing using the craft interface unit (CIU)
 - Internal performance monitoring and fault diagnosis
 - System options and system identification switches
 - EOC data link path protection switching
 - TR-303 EOC ASN.1 CMIP-91 message support
 - Per line circuit testing control
 - System alarms.
-

Provisioning memory

In systems that allow provisionable channel units, programmable memory is used for storing channel unit provisioning values (from the CIU or BCU). There are at least three copies of this provisioning memory in different common units in the system. These copies provide nonvolatile back up of the provisioning information.

In the enhanced FPB RT and INA-RT, the copies are in the RT BCU, ADU, and LIUs (or TCUs). In FPC and FPC/AC, the provisioning memory is contained in the COT BCU, the COT ADU, and in the RT BCU. These copies must agree with each other to avoid losing provisioning information. When any of these units is removed and reinstalled or replaced, its memory is checked against the other copies. If it does not agree with the other copies, the memory is overwritten by a copy of the memory from one of the other units. This process maintains the backup of the provisioning information.

(Continued on next page)

Common Units (Continued)

Provisioning memory (continued)

In the FP303 RT, data objects necessary to support service are stored in electronically erasable programmable memory (EEPROM). To ensure data integrity, duplicate copies of this data are stored on the BCU and ADU, and a checksum is stored on the TRU. This data is divided into two partitions referred to as provisioning memory (partition I) and administrative memory (partition II). Partition I stores analog, ISDN line, ISDN path, and DS0 channel termination data. Partition II stores DS1 and DSL performance monitoring (PM) thresholds, PM freeze and channel diagnostic schedules, call processing data, and other data. Provisioning of the RT is done through the 5ESS switch. To maintain the integrity of the data, the switch reprovisions the RT daily.



CAUTION:

Replacing common units containing provisioning memory should be done one unit at a time in the order specified in the task oriented practices (TOPs). Failure to do this can result in complete loss of provisioning information that would require reprovisioning all CIU-provisionable channel units in the system.

Transmit/receive units (TRUs)

The TRU provides the interface between the A/B or C/D shelf (two digroups of channel units) and the digital facility interface [LIUs or TCU and line switch unit (LSU)]. It synchronizes all units serving a 48-channel shelf to the DS1 signal. When the office timing unit (OTU) is installed in the COT, it provides external synchronization to the TRU for the channel units.

In FP303, the time slot interchanger (TSI) on the TRU allows any channel in any digroup in a system to be connected to any available time slot on any DS1 facility.

Channel test units (CTUs)

One CTU serves both systems in the dual channel bank. The CTU provides metallic access to the customer drop beyond the RT for the remote test center and allows the PGTC to test the derived channel between the COT and the RT. In addition, the AUB5 and AUB25 CTUs provide the following:

- Metallic test access on one channel unit in either system
- Digital testing on one channel in a system by the XTC or CIU
- CIU test access (metallic and digital) on one system and metallic test access for the XTC on one channel in the other system.

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Common Units (Continued)

Channel test units (CTUs) During a channel test, the RT CTU provides channel unit terminations and connects the DC test pair to the metallic drop beyond the channel unit. The AUB25 RT CTU also provides local test access (digital and metallic) for the CIU when the digital test unit (DTU) pair (AUA18 and AUA19) is installed at the RT.

Digital test unit (DTU) The DTU pair, DTU-L (AUA18) and DTU-R (AUA19), serves both systems in a dual channel bank. The DTU provides access to the bit stream between the TRUs and the channel units for the CIU at the RT. The DTU is optional at either end of the system; however, it is required if the CIU will be used in testing special service channels. The DTU-L and DTU-R must be equipped as a pair.

Line interface units (LIUs) Three different LIUs are used with Series 5: the AUA61-type, AUA62-type, and AUA64-type. Each type may be referred to as C-Series or D-Series depending on the suffix letter. The D-Series LIUs are backward compatible with the C-Series LIUs and supersede previous LIU versions. The D-Series LIUs are required for enhanced FPB Mode 2 and INA-RT Mode 1 applications. Refer to the enhanced FPB RT and INA-RT tables in the Common Units section in this chapter.

The AUA61-type is the DS1 LIU. The AUA62-type is the line-powering LIU and the AUA64-type is the power looping LIU. The line-powering LIU may be used at the RT (for back-powering) as well as at the COT. The power looping LIU is used at the RT, and the DS1 LIU interfaces with a DSX-1 at either the COT or the RT.

LIU options The LIUs have an option switch for selecting the line code. The AUA61-type LIU has selectable equalization. The AUA62-type and AUA64-type LIUs have pad options for selecting transmit and receive attenuation. The AUA61D LIUs have a switch to enable or disable the remote loopback capability. Chapter 7 lists the options that must be specified on the work order. For details on setting equalization and transmit and receive pad options, refer to 915-710-115 and the data sheets for each LIU.

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Common Units (Continued)

AUA71 transcoder unit (TCU)

The AUA71 replaces two LIUs for INA-RT Mode III for operation equivalent to *SLC 96* carrier Mode III. It codes two digroups over one DS1 line (without using adaptive differential pulse code modulation - ADPCM). The TCU-AB replaces LIU-A and LIU-B (in the B slot) for coding digroups A and B; TCU-CD replaces LIU-C and LIU-D (in the D slot) for coding digroups C and D. See also INA-RT Common Units - Mode III.

AUA73B DS1 line switch unit (LSU)

The AUA73B LSU is an optional plug-in used only when protection switching is desired. It provides the 4:1 (or 2:1 in FPB Mode 2) (service:protection lines) protection switching feature of the Series 5 system. Switches on the faceplate of the AUA73B may be used to force or deny manually the protection LIU to the system. Actually, the switch to protection is done by the TRUs under the command of the bank controller.

AUA74 DS1 line switch unit (LSU)

The AUA74 LSU provides an optional 2/3/4:1 facility line switching capability for the DS1 line interface units (C series and later) and supports the facility protection line switching requirements for FP303.

System power and fuse units

The AUA11C power converter unit (PCU) converts the -48 V input to the dual bank to the +5 V and -5 V supplies required by the channel bank circuits. The PCU is used on the digroup and facility shelves. Two channel fuse units (CFUs) (39E or AUA114) are used in every dual channel bank, one in the blue system and one in the white system. One line fuse unit (LFU) (39F or AUA115) is required for each dual channel bank. The CFU provides fusing for the -48 V power and -20 or -30 Hz ringing to channel unit digroups A/B and C/D and for the -48 V power to the common units. The LFU provides fusing for the -48 V power to all the LIUs. With any multiplexer other than the DDM-1000, the LFU should be removed to prevent false alarms at the multiplexer.

Enhanced FPB Common Units

Table The table below lists the common circuit packs required for the enhanced FPB RT* in a universal or integrated system.

System	Mode	BCUs	ADUs	TRUs	LIUs	CTUs	LSUs
FPB/SS/U/M1 FPB/SS/I/M1	Mode 1	MC97776A1()	AUB27()	Any*	Any	AUB22, AUB25 [†]	AUA73B
FPB/SS/U/M2 FPB/SS/I/M2	Mode 2	MC97776A1()	AUB27()	AUA105()	D-Series [‡]	AUB22, AUB25 [†]	AUA73B
FPB/U/M1 FPB/I/M1	Mode 1	MC97776A1()	AUB24	Any*	Any	AUB22, AUB25 [†]	AUA73B
FPB/U/M2 FPB/I/M2	Mode 2	MC97776A1()	AUB24	AUA105()	D-Series [‡]	AUB22, AUB25 [†]	AUA73B

* AUA22B, AUA105(), or AUA109 TRUs

† AUB22 is recommended

‡ AUA61D, AUA62D, or AUA64D LIUs

* For SLC-2000 MSDT applications the BCU-MC97779A1, the ADU-AUB27, the TRU-AUA15 and the LIU-AUA61D or AUA62D or AUA64D are required.

FPC Common Units

Table The common units required for a universal FPC or FPC/AC or FPF system are listed in this table.

System	COT/ RT	BCUs	ADUs	TRUs	LIUs	CTUs	LSUs
FPC/ AC or FPF	RT	MC97776A1() [*] MC97779A1 [†]	AUB27()	AUA105(), AUA109	D-Series [‡]	AUB22, AUB25	AUA73B
FPC	COT	MC97755A1() [§]	AUB6	AUA1	Any	AUB2B, AUB5	AUA73B
FPC	RT	MC97756A1 [*]	AUB24	Any [¶]	Any	AUB22, AUB25	AUA73B

* MC97776A1B is required to support BRITE II applications.

† MC97779A1 is required to support FPF, Fiber in the Loop (FITL) configurations.

‡ AUA61D, AUA62D, or AUA64D LIUs

§ MC97755A1B is required to support BRITE II applications.

¶ AUA21B, AUA105(), or AUA109 TRUs

Feature Package 303 Common Units

Table The following table lists the common circuit packs required for the FP303 system.

BCUs	ADUs	TRUs	LIUs	CTUs	LSUs
MC97777A1B [*]	AUB27()	AUA112 [†]	C-Series D-Series	AUB22 AUB25	AUA74 [§]
MC97796A1 [†]	AUB27()	AUA112B [‡]	C-Series D-Series	AUB22 AUB25	AUA74 [§]

^{*} The MC97777A1B BCU is required for FP303 Release 2.0 applications.

[†] The MC97796A1 BCU is required for FP303 Release 3.0 applications.

[‡] 993A TRU faceplate cable is required to connect TRUs.

[§] For systems with DS1 protection switching.

INA-RT Common Units

Table This table lists the common circuit packs required for INA-RT.

Mode	BCUs	ADUs	TRUs	LIUs/TCUs	CTUs	LSUs
Mode I	MC97769A1	AUB27()	Any*	D-Series LIUs	AUB22, AUB25	AUA73B
Mode III	MC97769A1	AUB27()	Any*	AUA71 TCUs	AUB22, AUB25	AUA73B

* The AUA21B is recommended.

Mode I INA-RT described

Four line interface units (LIUs) and four DS1 digital facilities serve up to 96 subscriber circuits or the equivalent of two D4 banks with one half of a Series 5 dual channel bank assembly.

The Mode I INA-RT may be optioned as two distinct systems (a maximum of four systems per RT dual channel bank) by assigning two bank identification numbers to the ADU.

If the two system (bank) identification numbers are...	The system(s) are referred to as ...
identical	a Mode I (96) system
different	Mode I (48) systems

Mode III INA-RT described

Two AUA71 transcoder units (TCUs) are used to achieve operation equivalent to SLC 96 carrier Mode III. The TCUs are used only to rearrange time slots for maximum use of the DS1 bandwidth. No ADPCM (adaptive differential pulse code modulation) is used. Two DS1 facilities are used to transmit 48 DS0 channels generated by up to 48 special service channel units.

Common Units for Feature Package Conversion

Feature package summary table

The feature packages are summarized in the following table. Any system equipped with enhanced FPB can be converted to FPC with testing capabilities provided by the PGTC or the XTC.

Feature	Enhanced FPB	FPC/AC	FP303	INA-RT
Services, Special Features	Basic Telephone Service	FPB Services with Advanced Circuit Testing, AutoCut	Basic Telephone Service	Designed Special Services
	Designed Special Services	ISDN	ISDN	Integrated Network Access (D4 interface)
	Concentration, DCLU or SLC® 96 Carrier System	FITL	Full TR-303 capabilities	
	COT Interface FITL		Special Services	
	ISDN			
Series 5 Channel Units*	POTS	POTS	POTS	DID
	POTS w/Derived Chan Alm (DCA)	POTS with DCA	SPOTS Units	E SPOTS Units
	SPOTS® Units	SPOTS Units	Coin	Dual Ring Rptr
	M SPOTS Units	M SPOTS Units	Multiparty	PLAR
	Coin	Coin	DID	4W Spl Srv
	Multiparty	Multiparty	ISDN UDSL	Dataport
	FSR	FSR	E SPOTS Units	T-BRITE
	DID	DID	4W Spl Srv	
	E SPOTS Units	E SPOTS Units	Dataport	
	Dual Ring Rptr	Dual Ring Rptr	PLAR	
	PLAR	PLAR	Dual Ring Rptr	
	4W Spl Srv	4W Spl Srv	FSR	
	Dataport	Dataport	M SPOTS Units	
	T-BRITE	BRITE II		
BRITE II				

* Refer to 363-205-000, Series 5 ordering guide for codes of current channel units.

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Common Units for Feature Package Conversion (Continued)

Feature package summary table (continued)

Feature	Enhanced FPB	FPC/AC	FP303	INA-RT
Circuit Maintenance Interface*	PGTC† or Test Bus Control Unit for Testing	PGTC or XTC for Testing	Test Bus Control Unit	CIU at the RT
Switch Support	Universal System: All Analog and Digital Switches Integrated System: Any TR-08 Digital Switch	Universal System: Same as FPB	Integrated System: Any TR-303 Digital Switch	All Analog and Digital Switches
Special Assignment Rules	Integrated: Services Depend on Switch Generic Mode 2: Special Service and ISDN Restrictions	None	None	Special Service and ISDN Restrictions

* PGTC tests POTS, *SPOTS* and M *SPOTS* units, coin, multiparty, and FSR. The XTC tests POTS, *SPOTS* and M *SPOTS* units, coin, 2-wire special service (AUA42/43), 4-wire special service, and dataport. The XTC equipped with the MC97761A1 control unit (XCU) and AUB63B data link unit (XDLU) can test multiparty, DID, and FSR. The dual ringing repeater channel unit (AUA45B) and 2W PLAR channel unit (AUA75) do not have test relays for PGTC or XTC testing.

† Or XTC operating as a PGTC.

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Common Units for Feature Package Conversion (Continued)

Feature package equipment and common apparatus table

Feature package associated equipment and common apparatus are listed in the table below.

Equipment or Apparatus (Note 1)	Enhanced FPB (Note 3)		FPC (Note 3)	INA-RT	FP303	
Facility:	DS1 or T1 Lines Per 96-Line System					
	(Mode 1)	(Mode 2)		(Mode I)	(Mode III)	
Unprotected	4	2	4	4	2	2 to 4
Protected	5	3	5	—	—	3 to 5
COT Frames:	J1C182D, J1C182E, J1C182F					
Channel Banks:	J1C182AD (COT), J1C182AE (RT), J1C182AF (E&M RT)					
BCUs: COT	—		MC97755A1()	—	—	
RT	MC97776A1()		MC97756A1	MC97769A1	MC97777A1 MC97796A1 (FP303 Release 3)	
ADUs: COT	—		AUB6	—	—	
RT	AUB27()		AUB26	AUB27()	AUB27()	
LIUs: COT	—		AUA61-type	—		
	—		AUA62-type	—		
RT			AUA61-type, AUA62-type, AUA64-type			

(Continued on next page)

Common Units for Feature Package Conversion (Continued)

Feature package equipment and common apparatus table (continued)

Equipment or Apparatus (Note 1)	Enhanced FPB (Note 3)	FPC (Note 3)	INA-RT	FP303
LSU	AUA73B	AUA73B	—	AUA74
TCU	—	—	AUA71	—
TRUs: COT	—	AUA1	—	—
RT	AUA22B, AUA109, AUA105()	AUA21B	AUA21B	AUA112 AUA112B (FP303 Release 3)
OTU (COT)	—	AUA3	—	—
CTUs: COT	—	AUB2B (PGTC), AUB5 (XTC)	—	—
RT	AUB22 AUB25	AUB22 (PGTC), AUB25 (XTC)	AUB22 AUB25	AUB22 AUB25
DTU	AUA18&19	AUA18&19	AUA18&19	AUA18&19

Notes:

1. In addition to selecting the correct plug-ins for a feature package, the common units have option switches which must be included in the system engineering and set according to the installation procedures in the TOPs.
2. 933a TRU faceplate cable is required.
3. For SLC-2000 MSDT applications the BCU-M97779A1, the ADU-AUB27, TRU-AUA105, and the LIU-AUA61D or AUA62D OR AUA64D are required at the remote terminal (RT).

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Common Units for Feature Package Conversion (Continued)

FPC AutoCut

To enable the AutoCut option in an FPC system, the RT must be pre-equipped with the following common units:

- MC97776A1() BCU
- AUB27() RT ADU
- AUA105() or AUA109 RT TRU
- C-series or D-series LIUs

The AUA105() TRU and D-series LIUs are recommended for AutoCut, since these units will operate in enhanced FPB Mode 1 or Mode 2. Converting from FPC/AC to enhanced FPB Mode 1 will interrupt service for a short time (to transfer the DS1 lines from the COT to the switch at the central office). With the appropriate switch settings on the RT ADU, the cutover can be done without sending personnel to the RT site. After integrating, the RT automatically operates as an enhanced FPB Mode 1 RT. The AutoCut option also allows conversion from an enhanced FPB Mode 1 RT to an FPC/AC RT.

FPB to enhanced FPB conversion

Converting an FPB RT to an enhanced FPB Mode 1 RT with CIU provisioning capability, requires the following common circuit packs:

- MC97776A1() BCU
 - AUA22B, AUA109, or AUA105() TRU
 - AUB27() ADU
-

(Continued on next page)

Common Units for Feature Package Conversion (Continued)

Enhanced FPB Mode 1 to FPB/SS/ U/M2 or FPB/SS/I/ M2 conversion

Converting an enhanced FPB RT to an enhanced FPB Mode 2 RT depends on whether CIU provisioning capability is required. If CIU capabilities are desired, the following common circuit packs are required:

- MC97776A1() BCU
- AUA105() TRU
- AUB27() ADU
- AUA61D, AUA62D, or AUA64D LIU

FPC AutoCut to enhanced FPB/SS/ U/M1 or FPB/SS/I/ M1 conversion

This feature allows automatic conversion of an FPC/AC RT to an integrated or universal FPB Mode 1 system. An FPC/AC RT operates with the extended superframe (ESF) format with D4 counting. The AutoCut feature provides conversion to enhanced FPB Mode 1 with the TR-08 interface and D1D counting. The FPC AutoCut feature also works in reverse, converting an enhanced FPB Mode 1 system to an FPC/AC system.

The FPC RT must be equipped with the following circuit packs to enable automatic conversion:

- AUB27() ADU
- MC97776A1() BCU
- AUA105() or AUA109 TRU
- AUA61D, AUA62D, or AUA64D LIU. An AUA61C, AUA62C, or AUA64C LIU may be used if a future Mode 2 conversion is not expected.
- AUB22 or AUB25 RT CTU
- AUA18 and AUA19 DTU.

To convert an FPC RT to enhanced FPB Mode 1 or Mode 2 without using the AutoCut feature, refer to 363-205-401, Series 5 RT turnup procedures, Issue 5 or later.

(Continued on next page)

Common Units for Feature Package Conversion (Continued)

Enhanced FPB to FP303 conversion

Converting an enhanced FPB RT to FP303 requires the following common circuit packs:

- MC97777A1 BCU
 - MC97796A (FP303 Release 3) BCU
 - AUA112 TRU
 - AUA112B (FP303 Release 3) TRU
 - AUB27() ADU
 - AUA74 LSU (if equipped with optional protection switching)
 - 993A TRU Faceplate Cable.
-

Circuit pack dimensions

The dual channel bank circuit packs come in several families of apparatus codes: AUA, AUB, AUG, MC, and miscellaneous numeric. The nominal dimensions are as follows:

- The AUA-coded circuit packs and 39-coded fuse units are 3.6 inches high. The channel units, TRU, LSU, PCU, and FCU circuit packs and LFU and CFU fuse units are 0.7 inches wide. The LIUs and LIU-size adapters (AUA78, AUA80, and the 505A) are 1.4 inches wide. The 52A test extender is 4.5 inches high, 4.5 inches wide, and 21.8 inches long. The 950A test set is 4.2 inches high and 2.6 inches wide.
 - The AUB-coded (AIU, ADU, ADU/ASU and CTU) and MC-coded (BCU) circuit packs are 7.5 inches high and 0.7 inches wide.
 - All circuit boards are about 10 inches long (except for the 52A test extender and the 950A test set).
-

SLC-2000 MSDT Feature Arrangement

Introduction

The *SLC-2000* MSDT feature supports a full range of narrowband services, from POTS to special services, for a wide range of applications. It is deployed as a feature of a Series 5 system and the *SLC-2000* Access System.

With the introduction of the *SLC-2000* MSDT feature, local exchange carriers can deploy fiber in their distribution network today and meet the cost and feature parity of digital loop carrier systems using copper in their distribution networks.

Feature Package F (FPF) is used to configure a *SLC* Series 5 RT to be used as a Host Digital Terminal (HDT) to support the *SLC-2000* Multi Services Distant Terminal (MSDT) feature. In addition to the common circuit packs that are required in a FPF RT bank (see the Common Units section of this chapter), a J1C182PA Optics Shelf must be equipped with the following circuit packs:

- AUA402 Alarm/Fan control Unit
- AUA406 or AUA408 MSDT Server
- AYB1B MSDT Optical Unit.

Refer to 363-205-004, *SLC-2000 MSDT User/Service and Ordering Manual* for additional information describing MSDT equipment.

Physical description

The *SLC-2000* MSDT equipment and plug-ins are housed in a pedestal type enclosure 22 inches high, 16 inches deep, and 10 inches wide. The versatility of the *SLC-2000* MSDT allows it to be mounted in any one of six physical configurations as follows:

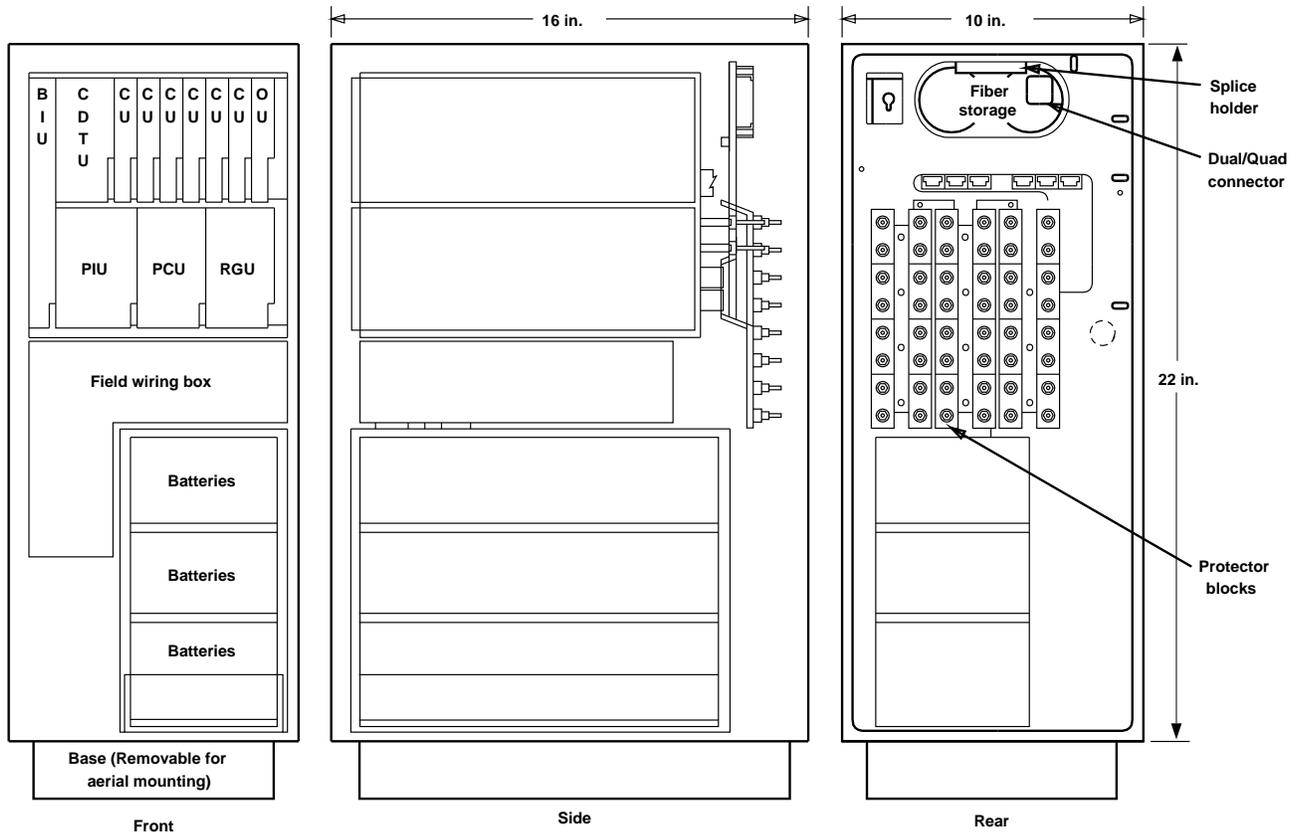
- pedestal (pad and stake mounting)
 - pole
 - wall (customer location)
 - strand (aerial)
 - underground
 - relay rack (23 inch).
-

(Continued on next page)

SLC-2000 MSDT Feature Arrangement

Physical arrangement

This figure shows a typical SLC[®]-2000 (ED-7C712-30) physical arrangement.



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(Continued on next page)

SLC-2000 MSDT Feature Arrangement (Continued)

Equipment and plug-ins

The *SLC-2000* MSDT contains various equipment and plug-ins as follows:

- BYB1B optical unit (OU)
- MC97780A1 or MC97789A1 backplane interface unit (BIU)
- Series 5 system or *SLC-2000* system channel units
- AUA414, AUA415, AUA416, or AUA426 power interface unit (PIU)
- AUA412, AUA417, AUA427 power converter unit (PCU)
- AUA413 or AUA423 ringing generator unit (RGU)
- AUA411 channel and drop test unit (CDTU)
- Battery shelf equipped with heaters
- Fiber storage unit
- Field wiring box (FWB)
- Fan unit
- Tip and ring terminal block and optional protectors
- Door alarms (optional).

The data sheets for the *SLC-2000* MSDT units are listed the Circuit Packs section of this chapter. Refer to 363-205-003, *SLC-2000 MSDT Applications, Planning, and Ordering Guide*, for additional information describing MSDT equipment.

Channel Units

Description

The channel units for Series 5 system applications and *SLC-2000* MSDT applications are described in Chapter 6, *Channel Units*.

Power Units

Load distribution unit (LDU)

The ED-7C613-30, G3 LDU is used in each J1C182BA power shelf in distributed power arrangements. The LDU disconnects the system from the –48 V bus if needed to prevent damage to the batteries (excessive discharge). If the ringing generator fails in the power shelf, the LDU connects a protection 3C1 or 3B1 ringing generator to the ringing loads in the associated dual channel banks. The LDU also provides faceplate access to order wire tip and ring, fault-locating lines, and adjustable order wire resistance. It has a separate board (ED-7C613-30, G2) for order wire build-out resistance that plugs into the LDU through an opening in the faceplate.

336A1 power unit and AUG11 bank fuse unit (BFU)

With bulk powering, one BFU serves each RT dual bank; up to three BFUs can be installed in the J1C182BB bulk power shelf. When distributed power is used, two 336A1 power units (rectifiers) and one BFU are installed in the J1C182BA power shelf for each RT dual channel bank (the power shelf can supply two RT dual channel banks).

The 336A1 rectifier converts commercial AC power to a nominal –48 V DC regulated output for the RT and provides input-output isolation. Rectifier outputs are applied in parallel to a common bus to support the load up to a maximum of the combined rating of all equipped rectifiers. If load exceeds this maximum, the excess is supplied from the batteries. All rectifiers are continuously monitored for normal operation. A thermal switch on each rectifier turns the fans on when the temperature in the rectifier exceeds the operating limit.

The BFU provides fusing for the –48 V distribution to both blue and white systems and to the fan unit (2B or 2C) at the RT. Blown fuses in the BFU can be identified and replaced through the faceplate.

(Continued on next page)

Power Units (Continued)

337A1 battery charger

The battery charger plugs into the battery shelf (181A apparatus mounting) for most applications. It is not required when bulk power is used. In the 51A cabinet, it plugs into the J1C182BA power shelf. The 337A1 battery charger/controller connects the batteries to the -48 V power bus when AC power fails or when additional power is required. The batteries are disconnected when AC power is restored or the load returns to normal. The 337A1 battery charger sends a command to the LDU to disconnect the batteries when the charge gets low to prevent damage to the batteries from complete discharge. A thermal switch on the battery charger turns the fans on when the temperature in the battery charger exceeds the operating limit.

This unit trickle charges the batteries to keep them in a fully charged state. After a period of discharge the 337A1 high-rate charges the batteries to about 90% of their rated capacity within 24 hours, then trickle charges them to full capacity.

The power shelf circuit packs are AUG-coded and miscellaneous numeric-coded. The faceplates of three of the power shelf units are shown in the Circuit Pack section of this chapter. The nominal dimensions of the power shelf plug-in units are provided in the following table.

Power shelf plug-in units	Nominal dimension
all units	7.2 inches high
ED-7C613-30 LDU AUG2 RSU	2.8 inches wide
336A1 rectifier 337A1 battery charger	2.1 inches wide
AUG1 PRU	1.4 inches wide
AUG11 BFUs	0.7 inches wide
3B1 and 3C1 ringing generators	3.5 inches wide
all units	10 inches long

Ringling Units

Ringling generators Two 3C1 ringling generators are mounted in the J1C182BA power shelf, J1C182BB bulk power shelf, or J1C182BC ring shelf (see Chapter 5). The one in the left-hand position is the main ringling generator. The other ringling generator provides protection if the main ringling generator fails. When the main ringling generator is restored, service automatically switches back to the main ringling generator. When J1C182BB bulk power shelf is used, one ringling generator normally supplies two dual channel banks, and the other ringling generator supplies the other dual channel bank.

The 3C1 ringling generator supplies the –20 Hz ringling current for the subscriber lines. The 3B1 ringling generator supplies –30 Hz ringling current. The ringling generators have fused –48 V input supplied by the rectifiers, bulk power shelf, or control and distribution panel (80E bulk power cabinet). A thermal switch on the ringling generator turns the fans on when the temperature in the ringling generator exceeds the operating limit.

AUG1 positive ringling unit (PRU) The AUG1 PRU provides positive 20-Hz ringling current for multiparty service. Each AUG1 and 3C1 ringling generator serves up to four systems (two dual channel banks) from the J1C182BA or J1C182BB power shelf. The J1C182BB bulk power shelf provides space for two AUG1 PRUs. The second AUG1 PRU is required when the bulk-powered RT frame is equipped with three dual channel banks. The AUG1 PRU is not used in the 80E bulk power cabinet (the AUG3 ring control unit provides positive ringling when required).

The AUG1 has two DC-to-DC converters (main and protection). The output of the main converter is applied in series with the output from the 3C1 ringling generator to provide positive ringling. If the output from the main converters fails, the other converter is switched in automatically.

AUG2 ring switch unit (RSU) The RSU is used only in RT frame bulk power applications. One RSU is installed in each J1C182BB bulk power shelf. If a ringling generator or its –48 V input fails, the RSU connects the other ringling generator to all three dual channel banks. The RSU generates minor or major ringling alarms, depending on whether one or both ringling generators has failed, and transmits a PMN alarm when the bulk power plant has conditions such as loss of AC power or rectifier failure.

(Continued on next page)

Ringling Units (Continued)

AUG3 ring control unit (RCU)

The J1C182BC ring shelf circuit packs are the AUG3 RCU and the 3C1 ringing generator. In addition to input and output fusing protection, alarm indications, and alarm outputs, the AUG3 RCU provides the following:

- controls the output of the ringing generators to feed two separate loads
- connects both ringing loads to the working ringing generator and transmits a minor alarm if a ringing generator fails

The RCU contains two positive ringing supplies used for multiparty service to 4 or more parties. These supplies feed the two separate loads. The RCU also provides backup for the positive ringing supply; if one fails, both loads are connected to the other supply.

Fuses are 80G type, 0.5 amps, and provide output protection. These fuses are accessible from the faceplate for replacement. An RMN (ringing minor alarm) indicator (yellow) lights when an internal failure has caused a switch of the output load to the protection source. An RMJ (ringing major alarm) indicator lights when one or more ringing outputs have failed (could be caused by dual circuit failures or a blown output fuse). The faceplate jack provides convenient test access to the +20 Hz ringing sources.

Miscellaneous Units

**AUA3 office
timing unit (OTU)
(COT)**

The OTU is required with FPC when dataports are used. The OTU interfaces the external clock used to synchronize the dataport channel units. The OTU converts the external clock source into the 8- and 64-kHz clocks required by the dataport channel units. It also frequency-locks the 4.096-MHz bank clock to the incoming composite clock for synchronizing the TRU.

**AUB3B alarm
interface unit
(AIU) (COT)**

The AIU provides the interface between the blue and white system bank controllers and the central office and remote alarm reporting systems. The AIU provides two sets of system alarm closures for reporting to two different remote sites. The AIU also reports alarms during bank controller failures and power failures. The alarm cut off (ACO) on the AIU may be operated locally or remotely.

**AUB4 alarm
suppressor unit
(ADU/ASU) (COT)**

The ADU/ASU is used in the COT to suppress alarms associated with an unequipped system in the dual channel bank. When only one system is equipped, the ADU/ASU is used in the unequipped system in the slot normally occupied by the COT ADU.

**AUA24 fan control
unit (FCU) (RT)**

Two AUA24 FCUs are required in each RT dual channel bank. The FCU senses the temperature adjacent to the PCUs and contains two thermal switches for controlling the fans in the fan unit. The first switch has temperature settings for maximum system reliability when the system is powered from AC power. The second switch has temperature settings to maximize battery reserve time while keeping the system within acceptable temperature limits.

When the system switches to battery power, the PMN alarm from the power shelf causes the FCU to select the second switch for controlling the fans. When the air temperature around the FCU reaches the switch turnon setting, the switch signals the fan unit to turn the fans on. When the air temperature falls below the switch turnoff setting, the switch opens and the fan unit turns the fans off. Fan operation can be tested with the FAN TEST button.

(Continued on next page)

Miscellaneous Units (Continued)

AYK1 and AYK2 circuit packs (80E bulk power)

These two circuit packs plug into the ED-83114-30 control and distribution panel. Together, the AYK1 and AYK2 control the off-line switching (OLS) rectifiers and battery strings in the 80E bulk power plant. A minor alarm is sent when the AYK1 or AYK2 is removed from the control and distribution panel. The AYK1 has three on-board connectors for the control cables from each of the three rectifiers; all other external electrical connections are through the backplane connector. The AYK2 has four reset pin switches on the front; these switches isolate the control circuits from the -48 V bus.

The AYK1 provides a low voltage disconnect circuit that disconnects the batteries from the load to protect the batteries from cell reversal. The low voltage disconnect circuit automatically reconnects the batteries when the charge bus reaches a voltage allowing stable operation. When the AYK1 receives an RFA (rectifier failed alert) alarm from a rectifier, it sends a minor alarm.

The AYK2 provides several control functions as follows:

- When the battery bus voltage exceeds the high limit, it sends a selective high voltage shutdown signal to each rectifier.
 - When an RFA is received, a remote start signal is automatically sent to all rectifiers. This signal is held for 5 minutes; if the rectifiers shut down again, no further attempt is made to restart them.
 - When the bus voltage drops below the lower limit, the battery on discharge circuit lights the BAT ON DISCHARGE indicator and sends a power minor alarm.
 - During an open battery test, with the rectifiers shut down and batteries on discharge, a test circuit inhibits operation of the battery on discharge indicator and the power minor alarm.
-

RT Batteries

Functional description

The RT batteries provide reserve power for the RT under heavy loads or when the primary source fails. Batteries may be provided in RT frames and cabinets using the 181-type apparatus mounting (battery shelf). Each battery shelf holds one battery string. The bulk power plant used in the 80E cabinet has a separate battery arrangement (see Chapter 5).

The battery string for the battery shelf consists of four connectorized KS-21906, L4 12 V battery packs. Three battery strings provide about 8 hours of reserve for two dual channel banks with an average load (POTS). See the Series 5 ordering guide (363-205-000) for the number of batteries required for various RT arrangements. These batteries should be tested initially within 6 months of installation, and annually thereafter. The projected life of the battery is 4 to 5 years; however, it is likely that they could last as long as 6 to 8 years. See 157-627-101 for more information on the KS-21906, L4 batteries.

The Intelligent Reserve (IR) series battery is a valve-regulated, lead acid battery that is a direct replacement for the KS-21906, L4 battery. The IR series battery will be maintenance free and will provide slightly more reserve than the KS-21906,L4 battery. Features of the IR series battery include leak-proof post seals for improved safety, recessed bolt-type terminals, and a standby use of more than 8 years.

Surge Protection

Description

The 307-type connectors with protector units provide voltage protection, current protection, testing, identification of special circuits, and disconnection of the outside cable pair from the remote terminal equipment.

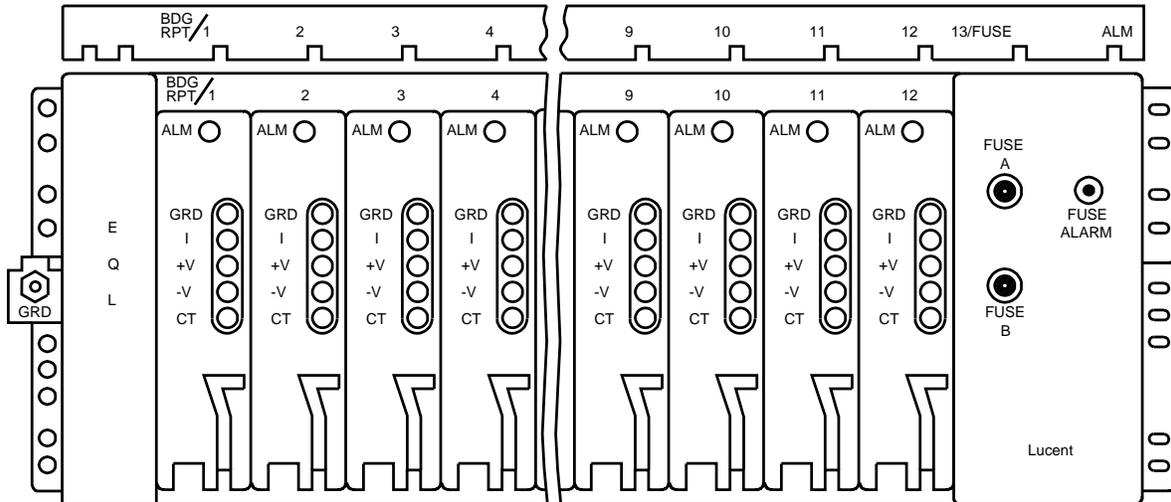
The 3B3E protector units (red) provide surge protection for transmit and receive pairs for the digital line. The 3C1E protector units (black) provide surge protection and test access for miscellaneous and derived pairs. All standard plug-in protector units are equipped with four gold-plated tip and ring pins and a solder-plated ground pin. The 3-type protector units are described in *3-, 4-, and 5-Type Protector Units, Description, Use, Maintenance, and Test Procedures* 636-300-050 (outside plant applications) or 201-208-100 (central office applications). See the Series 5 ordering guide (363-205-000) for specific codes of protector units used with Series 5 RT cabinets and enclosures.

The 307C2-100 connector holds the 3-type protector units and is terminated in eight 710 connectors. Four of the 710 connectors mate with intermediate cables from the Series 5 systems, and the other four connectors mate with the outside plant cables. For more information, see 636-330-107, *307-Type Connectors, Description, Use, Installation, and Repair Procedures*.

Small Cross-Section Office Repeater Shelf (SXSS)

J98725CA SXSS illustrated

The J98725CA SXSS is 6.46 inches high, 21.25 inches wide, and 12.0 inches deep. It is shown in the figure below.



J98725CA SXSS description

All input and output pairs, and power and ground buses terminate on the plug-in connectors located at the back of the SXSS shelf. The transmission and power cables can be accessed from the front at the top of the shelf, where they may be connectorized. The shelf is fully compatible with standard 23-inch wide bay frames.

(Continued on next page)

Small Cross-Section Office Repeater Shelf (SXSS) (Continued)

J98725CA SXSS description (continued)

The SXSS can be powered either from an external fuse and alarm panel or via the optional ART1 fuse circuit pack or the ART3 fuse and alarm circuit pack. Shelf position 13 is factory-wired to accept either a repeater or the ART1 fuse circuit pack. The SXSS can be optionally equipped with either the ART1 fuse circuit pack, the ART2 alarm circuit pack, both, or the ART3 fuse and alarm circuit pack.

The alarm circuit packs contain circuitry for detecting blown fuses in the fuse circuit pack or in any of the repeaters installed in the shelf. The alarm circuit pack reports a major alarm for any blown fuses and provides a FUSE ALARM indication.

With the ART1 or ART3 fuse circuit pack, the shelf is equipped with a cover that contains two -48 volt feeder fuses labeled FUSE A and FUSE B, as shown in the previous figure. These feeders supply power and ground to the shelf: Feeder A (FUSE A, 5.0 amperes) supplies power to repeater positions 1 through 6; Feeder B (FUSE B, 5.0 amperes) supplies power to repeater positions 7 through 13. This dual-power feed limits the number of repeaters affected by fuse failures or shorts, etc. Each individual repeater also contains an internal fuse in its -48 V battery supply path.

The SXSS contains an equalizer (EQL) card at the left that contains 13 equalizers for equalizing the cable between repeater outputs and the cross-connect.

Repeater cards are located to the right of the equalizer card. The shelf provides housing for up to 13 regular T-carrier office repeaters. Only 12 repeaters can be used in the shelf when the fuse circuit pack (ART1) is installed. When the ART3 circuit pack is used, 13 repeaters can be used in the shelf.

For loop applications, a fully equipped shelf will accept a maximum of 13 office repeaters arranged as follows:

- 13 — T1 low-power DC-DC converter type office repeaters or
- 13 — T1 low-power current regulator type office repeaters or
- 12 — office repeaters with a bridging repeater in position 1.

(Continued on next page)

Small Cross-Section Office Repeater Shelf (SXSS) (Continued)

J98725CA SXSS description (continued)

The -48 volt current drain is 6.3 amperes for a fully equipped shelf of 231G, 231H, 231M, or 231N T1 repeaters and 1.9 amperes for a fully equipped shelf using 231A or 231D T1 repeaters. There is an additional 11 mA current drain associated with the ART2 alarm circuit pack or ART3 fuse and alarm circuit pack (for the alarm relay).

A ground jack for use as an electrostatic discharge (ESD) is provided on the left side of the shelf. A grounded wrist strap must be worn when handling the circuit packs.



CAUTION:

An electrostatic discharge wrist strap with a minimum resistance of 250K Ohms should be worn when handling SXSS circuit packs to prevent possible damage to the circuit packs. Before using the wrist strap, check it for opens, shorts, and minimum resistance value. If the strap does not pass these checks it should not be used. At the Series 5 RT, to avoid possible personal injury while using the wrist strap, do not connect it to the power shelf or adjacent portions of the RT frame. Connect the wrist strap only to the GRD jack on the SXSS shelf or the fan unit, if present. If grounding jack is not present, connect wrist strap to bare-metal section of the frame well away from the power shelf.

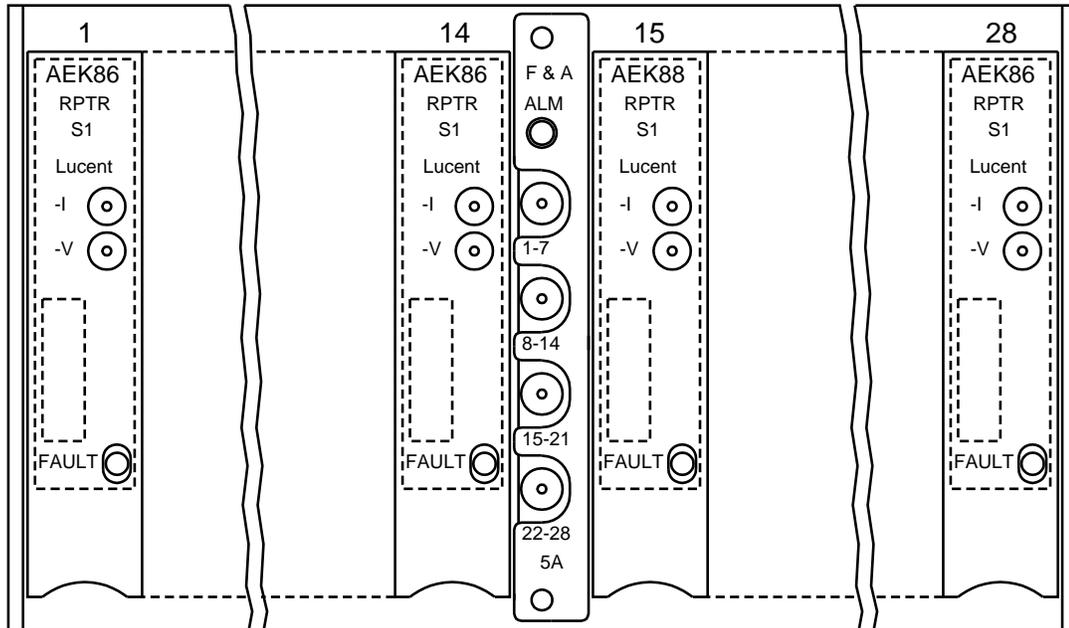
SXSS engineering information

For engineering and other details on the SXSS, see 365-200-106, *Small Cross-Section Office Repeater Shelf, Description, Installation, and Maintenance, T1 Digital Line, Digital Transmission Systems*.

DS1 Extension Shelf

J98725DA DS1 extension shelf illustrated

The DS1 extension shelf is 4.19 inches high, 21.375 inches wide, and 12 inches deep and can be mounted and accessed from the front to simplify installation and maintenance in the outside plant. With allowance for front access cabling, the total mounting height is 6 inches. It is shown in the figure below.



J98725DA DS1 extension shelf physical description

The J98725DA DS1 extension shelf requires only –48 volt battery and will accommodate up to 28 AEK-type DS1 circuit packs and one fuse and alarm circuit pack. No provisions are made for a T1 bridging repeater. The fuse and alarm circuit pack provides fusing for the –48 volt shelf power and displays an alarm if any shelf power fuse operates (blows) or the simplex power loop current associated with a circuit pack fails.

(Continued on next page)

DS1 Extension Shelf (Continued)

J98725DA DS1 extension shelf physical description (continued)

Transmission pairs are connected to the shelf via 710 connectors and terminate on the circuit pack connectors located on the backplane. The high-level electrical output wiring is separated from the low-level input wiring to minimize cross talk. The -48 volt battery and ground are connected to the shelf via a power cord that terminates on the fuse and alarm connector.

Components provided with the DS1 extension shelf

The components provided with the DS1 extension shelf, J98725DA, List 1 are as follows:

- the basic shelf with a printed wiring backplane with wiring for 28 DS1 circuit pack positions and a fuse and alarm circuit pack position
- a fuse and alarm circuit pack, ED-8C723-30
- 710 connectorized input and output cables
- a connectorized power cable
- four separate fault-locating outputs that are accessible at terminals on the backplane.

The circuit packs must be ordered separately.

(Continued on next page)

DS1 Extension Shelf (Continued)

Fuse and alarm circuit pack

The fuse and alarm circuit pack provides four –48 volt feeders, A, B, C, and D, each fused for 5.0 amperes, which provide power to shelf positions 1-7, 8-14, 15-21, and 22-28, respectively. The maximum load fuse required for the shelf is 10 amperes. The DS1 extension shelf is not designed to be powered from a separate fuse and alarm panel.

The alarm circuit of the fuse and alarm circuit pack detects the operation of any of the four power feeder fuses and/or the failure of the simplex power loop current associated with any of the T1 circuit packs. The fuse and alarm circuit pack detects any of these conditions and operates a relay that provides two contact closures for initiating MAJOR alarms. The ALM indicator on the faceplate of the fuse and alarm circuit pack also lights when any fuse operates. Four terminals are provided on the backplane of the shelf for connecting the MAJOR alarm outputs to the appropriate alarm interface equipment.

T1 and DS1 transmit and receive lines

The pairs carrying the T1 line receive and transmit signals and the DS1 receive and transmit signals are connected to the 28 positions of the shelf via four 28-pair connectorized cables. No equalization of the DS1 transmit signals or external buildout of the T1 line signals is required.

In the receive direction with respect to the T1 line, the AEK-type office repeater provides secondary surge protection, automatic line buildout (cable equalization), signal regeneration, and a line driver that provides a 3.0 volt peak DS1 output pulse and a fault-locating signal. No equalization of the DS1 output pulse is provided. In the transmit direction toward the T1 line, the AEK-type office repeater provides only secondary surge protection. No line buildout of the transmit signal is provided.

The AEK86 T1 office repeater equalizes and regenerates T1 line signals affected by cable losses ranging between 0 and 35 dB at 0.772 MHz. It contains a DC-DC converter that supports low-power (60 mA) T1 power loop designs where the maximum voltage drops do not exceed 130 volts. Only bidirectional operation is permitted with the AEK86.

The AEK88 T1 office repeater performs the same functions as the AEK86 but supplies 60 mA for a maximum line voltage of 18 volts only. This repeater is intended for short loop applications.

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DS1 Extension Shelf (Continued)

Protection

The maximum –48 volt battery current drain is 0.27A per AEK86 repeater and 7.60A per fully equipped shelf (28 AEK86 repeaters). These current drains are based on a minimum battery voltage of –42.5 volts and a maximum power loop resistance of 2100 ohms. When the DS1 extension shelf is located in an 80-type outdoor cabinet, the available –48 volt battery current may be limited by the battery reserve. If the power loop resistance of the DS1 extensions are at the maximum, it may be necessary to limit the number of DS1 extensions per shelf to satisfy the maximum current limitations of the 80-type battery reserve.

An electrostatic discharge (ESD) plug is provided on the right side of the shelf for connecting the wrist strap that should be worn whenever handling any circuit pack. A ground lug for wiring to frame ground is provided on the left side of the shelf.



CAUTION:

An electrostatic discharge wrist strap with a minimum resistance of 250K Ohms should be worn when handling DS1 extension shelf circuit packs to prevent possible damage to the circuit packs. Before using the wrist strap, check it for opens, shorts, and minimum resistance value. If the strap does not pass these checks it should not be used. At the Series 5 RT, to avoid possible personal injury while using the wrist strap, do not connect it to the power shelf or adjacent portions of the RT frame. Connect the wrist strap only to the ESD plug on the DS1 extension shelf or the GRD jack on the fan unit, if present. If grounding jack is not present, connect wrist strap to bare-metal section of the frame well away from the power shelf.

Engineering information

For engineering T1 extensions and other details on the DS1 extension shelf, see 365-200-107, *DS1 Extension Shelf, Description, Installation, and Maintenance, T1 Digital Line, Digital Transmission Systems*.

DDM-Plus

Description

The DDM-Plus is available in the following housings:

- extension shelf
 - wall distant terminal.
-

Engineering and ordering information

Refer to 363-206-150, *DDM-Plus User/Service Manual*, for engineering and ordering information.

DDM-Plus extension shelf

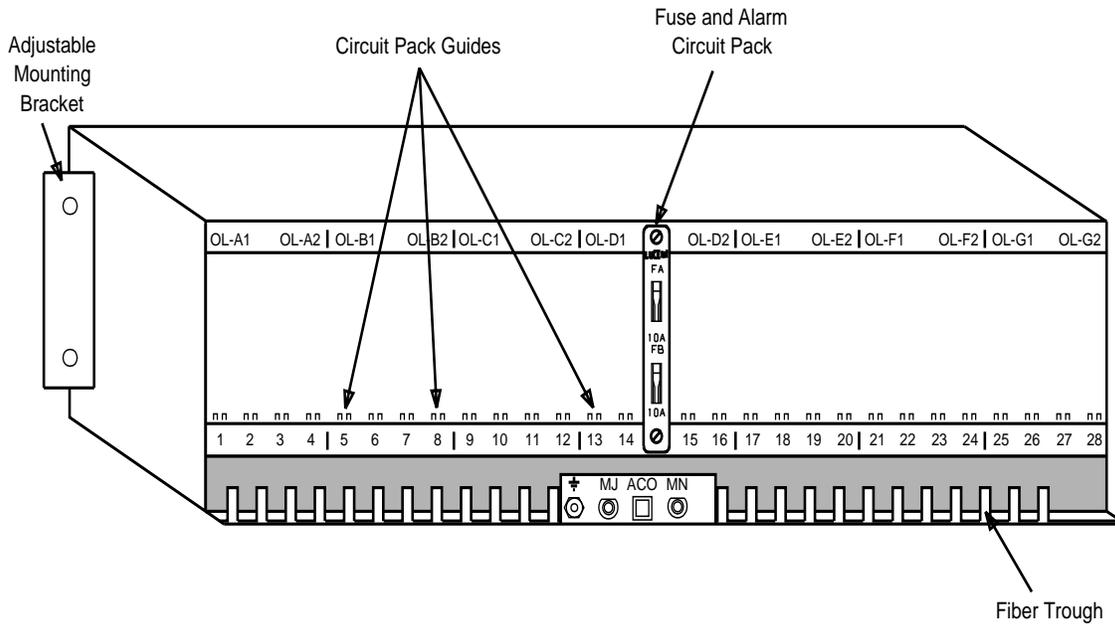
The DDM-Plus extension shelf is the largest capacity housing for the optical line interface unit (OLIU) circuit packs. It is used primarily in central offices, controlled environment vaults (CEVs), and medium-to-large capacity cabinets. It mounts in a standard 23-inch equipment rack and has a total capacity of 28 DS1s. It provides the flexibility of carrying 28 DS1s either on copper using the T1 Carrier System or on fiber using either the 25A OLIU or 25F OLIU. The extension shelf has a fiber trough along the lower front portion of the shelf to provide a convenient method of routing and managing the fiber. A removable cover gives the DDM-Plus extension shelf an attractive appearance and provides additional electromagnetic protection.

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DDM-Plus (Continued)

DDM-Plus extension shelf illustrated

The DDM-Plus extension shelf is 23 inches wide, 12.0 inches deep and 5.0 inches high. These dimensions include the fiber routing trough that extends down and forward from the front edge of the shelf's bottom plate. The figure below shows the DDM-Plus J98725DB extension shelf.



tpa 789774/01

(Continued on next page)

DDM-Plus (Continued)

Circuit pack arrangement

Provisioning of optical DS1 service from the DDM-Plus extension shelf is done in groups of four DS1s. The AEK-type T1 repeater circuit packs and the OLIU circuit packs cannot be mixed within a group. For example, **do not** install two AEK-type T1 repeater circuit packs and one OLIU circuit pack into group A, attempting to transport two DS1s on copper and the other two within the same group on fiber. This does not work because the OLIU and the AEK-type T1 repeater circuit packs would be trying to use the same DS1 signals, causing a dual-feed condition that will corrupt the data on those DS1s. All four of the DS1s in each group must be dedicated to either copper or fiber and not mixed.



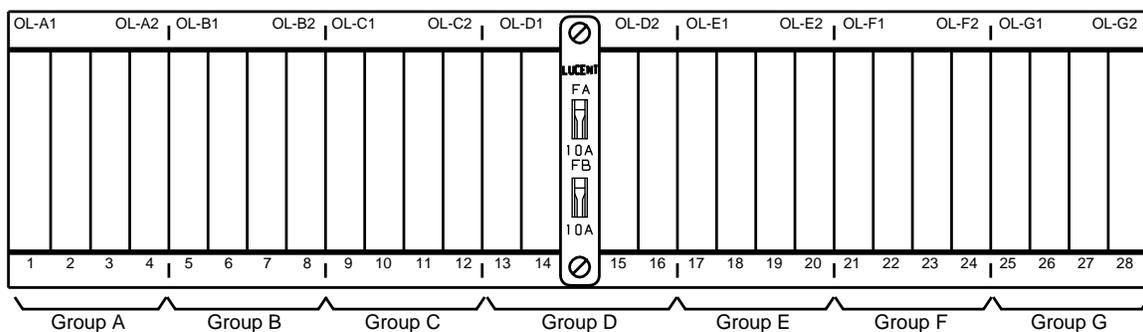
NOTE:

It is recommended that when an OLIU is operated in an unprotected mode that two AEK39 BP1 circuit boards be placed in the unused slots to prevent accidentally inserting an AEK-type repeater.

The AEK-39 BP1 circuit board is used also by the DDM-1000 multiplexer to cover unused DS1 positions.

Circuit pack groups

As the figure below shows, the shelf is divided into seven groups, denoted **OL-A**, **OL-B**, through **OL-G**. Each group consists of four slots that will support four DS1 inputs. Each group can be equipped with up to four AEK-type T1 repeater circuit packs or up to two OLIU circuit packs, but not both at the same time. The OLIU circuit pack occupies two slots. The OLIU circuit packs within a group are denoted as **1** or **2**. The circuit pack on the left is **1** and the circuit pack on the right is **2**.



(Continued on next page)

DDM-Plus (Continued)

Circuit pack groups (continued)

Each slot location follows this notation:

OL-*<letter><number>*

OL — optical line
letter — denotes the group: A,B,C,D,E,F, or G
number — denotes the OLIU position within the group: 1 or 2

A typical OLIU slot location might be marked as follows:

OL-C2

OL — optical line
C — third group from the left
2 — second OLIU in optical group C

The DDM-Plus extension shelf can be used to transport 28 DS1s on either copper or fiber as long as only one type of circuit pack is used in each of the 7 groups.



NOTE:

If a group of four DS1s is incorrectly provisioned by mixing an AEK-type T1 repeater circuit pack with an OLIU, no damage will be done to either circuit pack. However, the DS1 transmission will be corrupted.

Fusing

The DDM-Plus extension shelf has two 10 Amp fuses. Fuse **FA** powers the odd numbered slots through bus A. Fuse **FB** powers the even numbered slots through bus B. These fuses are located on the fuse and alarm circuit pack. This circuit pack is built into the shelf but can be pulled out by removing the screws. See the extension shelf illustration presented earlier in this section. When a fuse operates (blows), a red indicator pops up and a major alarm is sent.

The OLIU occupies both odd and even numbered slots; it selects either bus A or B, and switches to the alternate if one bus fails. The T1 repeater occupies only one slot, connected to either bus A or B. If the bus supplying the T1 repeater loses power, the T1 repeater drops service.

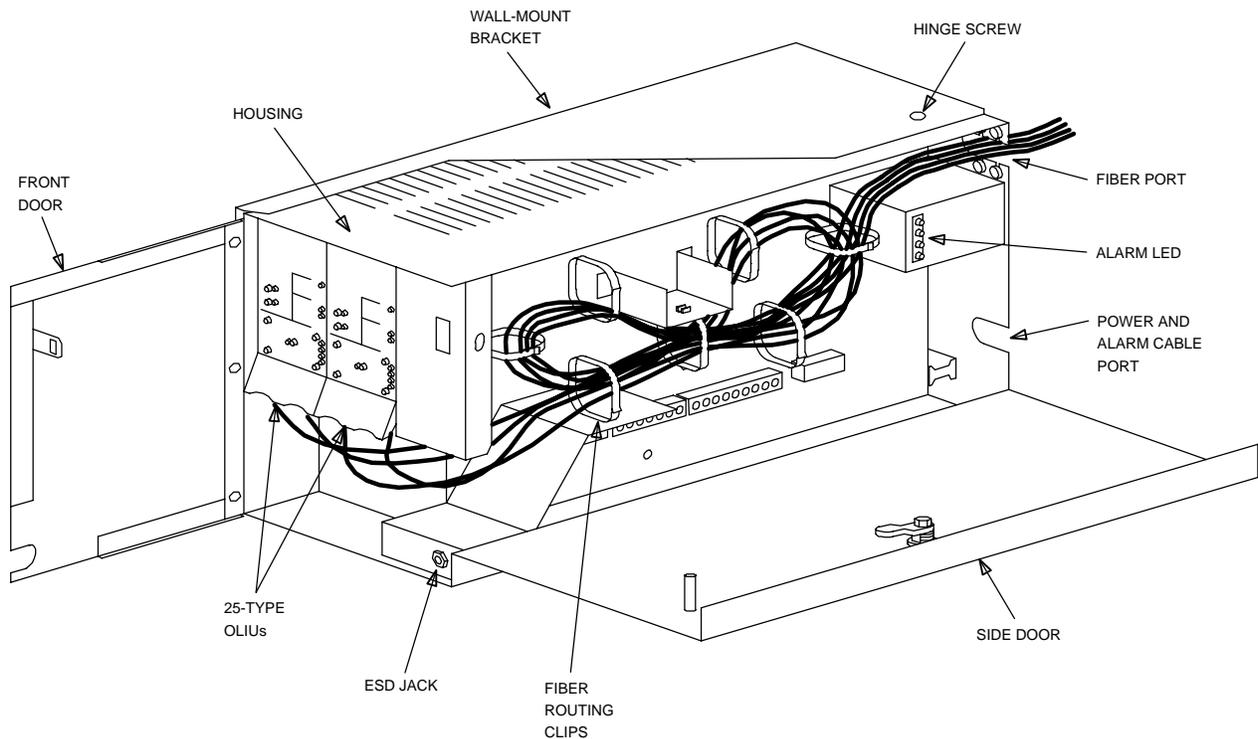
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DDM-Plus (Continued)

Fiber management The DDM-Plus extension shelf has a fiber trough along its front bottom edge. This trough allows quick and easy management of the optical fibers that travel from the bottom of the OLIU circuit pack faceplate, through the trough, to the fiber interconnection equipment. Optical fibers connecting OLIUs in the left side of the extension shelf (slots 1 through 14) are routed out the left side of the fiber trough. Optical fibers connecting OLIUs in the right side of the extension shelf (slots 15 through 28) are routed out the right side of the fiber trough.

DDM-Plus wall distant terminal illustrated

This figure shows the DDM-Plus wall distant terminal.



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(Continued on next page)

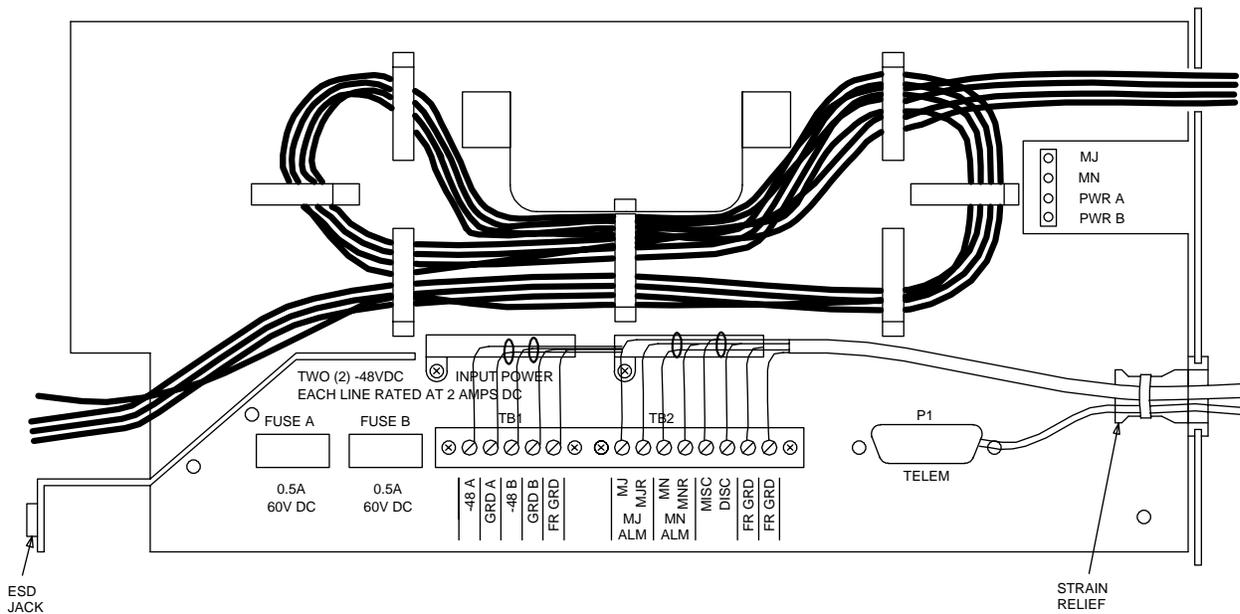
DDM-Plus (Continued)

DDM-Plus wall distant terminal described

The DDM-Plus wall distant terminal (DT) housing is designed for use at a customer location. It has the capacity for one DDM-Plus system (four DS1s) and an attractive appearance. The DT housing can be mounted on a wall or set on a table or desk. A specially designed mounting bracket, as shown in the previous illustration, allows easy installation and clear access even in crowded equipment rooms.

Access doors

The wall DT contains one or two standard OLIU circuit packs and provides transport for four DS1s. It has a left hinged front door that opens to access the circuit packs. The door is normally closed and has a window for the user to observe the indicators on the OLIU faceplate. The wall DT housing also has a hinged door on its right side (as viewed from the front) that opens to access a fiber storage area, power connections, alarm connections, telemetry connections, and fuses. These doors can be locked so that access to circuit packs, power connections, fusing, alarm connections, and fiber is available only to appropriate personnel. The front door must be closed before the side door can be locked. The side door fuse and connector panel is shown below.



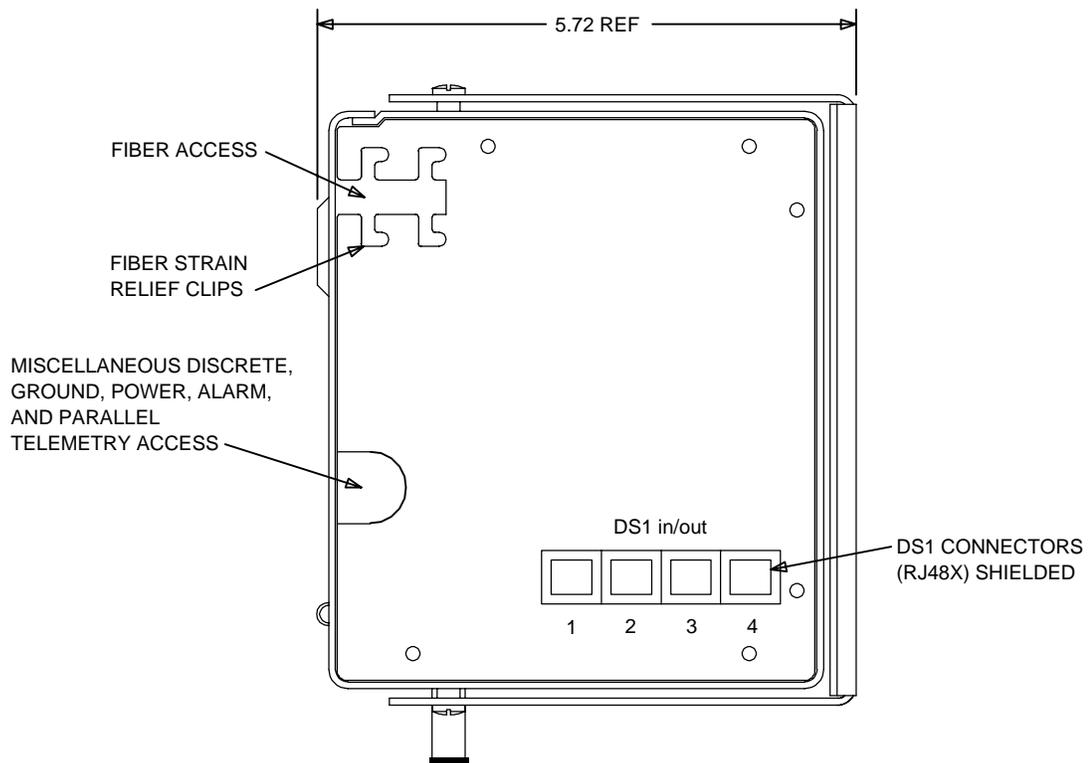
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DDM-Plus (Continued)

Rear panel

The rear of the wall DT provides access to all the DS1 input signals through four RJ48X connectors and to a ground jack for connecting wrist straps. Grounding screws also are equipped to ground the DS1 dangler cables. Power, alarm parallel telemetry cables, and fibers enter the wall DT through access holes in the rear panel of the housing, as shown in the figure below.



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(Continued on next page)

DDM-Plus (Continued)

Housing dimensions

The DDM-Plus Wall DT is 5.75 inches wide, 15.5 inches deep, and 7.3 inches high. These dimensions include the mounting bracket.

Circuit pack arrangement

The DDM-Plus wall DT can be used only to transport four DS1s on fiber. Therefore, the AEK-type T1 repeaters cannot be used in the wall DT.

Wall distant terminal interfaces

The wall DT housing has the following interfaces:

- four 2-way DS1 electrical signals (Equipment side of interface; DSX-1 compatible through four RJ48X jacks)
- two office alarm closures (major, minor) (Screw type terminal strip)
- two –48 V DC power buses (Screw type terminal strip)
- seven parallel telemetry interface points (DB15 connector).

All interfaces to the DDM-Plus wall DT are connectorized. Power, office alarms, parallel telemetry, and fuses are accessible from the side (see the access door illustration), and DS1 interfaces are accessible from the rear of the wall DT (see the rear panel illustration).

DS1 equipment interfaces

The DDM-Plus wall DT provides four 2-way DS1 equipment interfaces through four RJ48X jacks located on the rear panel of the housing. The DS1 equipment interfaces supply and accept American National Standards Institute standard DS1 signals. A ground screw is provided for each of the DS1 interfaces to ground DS1 dangle cables.

Wall distant terminal housing powering

The DDM-Plus wall DT is powered by two –48 V DC power buses. Connections to these buses are available through a screw terminal block located behind the side door of the housing. The –48 V DC can be supplied by any –48 V DC power source found in telephone equipment rooms. A 120 V AC to –48 V DC converter is available to operate the DDM-Plus equipment from a standard 120 V AC power source. Alternate methods of powering the DDM-Plus from 120 V AC are listed in 363-206-150, *DDM-Plus User/Service Manual*.

(Continued on next page)

DDM-Plus (Continued)

Fusing

The DDM-Plus wall DT housing has two 0.5A fuses. Fuse A powers the odd numbered slots through bus A. Fuse B powers the even numbered slots through bus B. These fuses are located on the fuse and connector panel on the right side of the wall DT behind the side door. When a fuse operates (blows), a red indicator pops up and a major alarm is sent.

The OLIU occupies both odd and even numbered slots; it selects either bus A or B, and switches to the alternate if one bus fails.

Fiber management

The DDM-Plus wall DT housing has a fiber management area on its side for the storage of excess fiber and fiber test jumpers. This area is accessible by opening the side door on the right side of the wall DT. Behind the door are several fiber clips for coiling excess fiber and test jumpers. These clips are placed so that the proper bend radii are maintained on the fibers. Fiber from the OLIU faceplate is routed to the storage area, onto the storage clips, and out through the back of the housing.

DDM-1000 Multiplexer

Description

DDM-1000 multiplexer can be configured as an electrical (M13) or optical multiplexer as required. The electrical assembly provides two complete muldems (multiplexer/demultiplexer) that are connected to higher rate transmission systems via a DSX-3 cross-connect panel. The 90 Mb/s optical assembly provides two complete muldems connected internally to a 90 Mb/s optical transmission system with optional 1:1 protection. The 180 Mb/s optical assembly uses two shelf assemblies to provide up to four equivalent DS3 electrical signals in a single 1:1 protected 180 Mb/s optical bit stream.

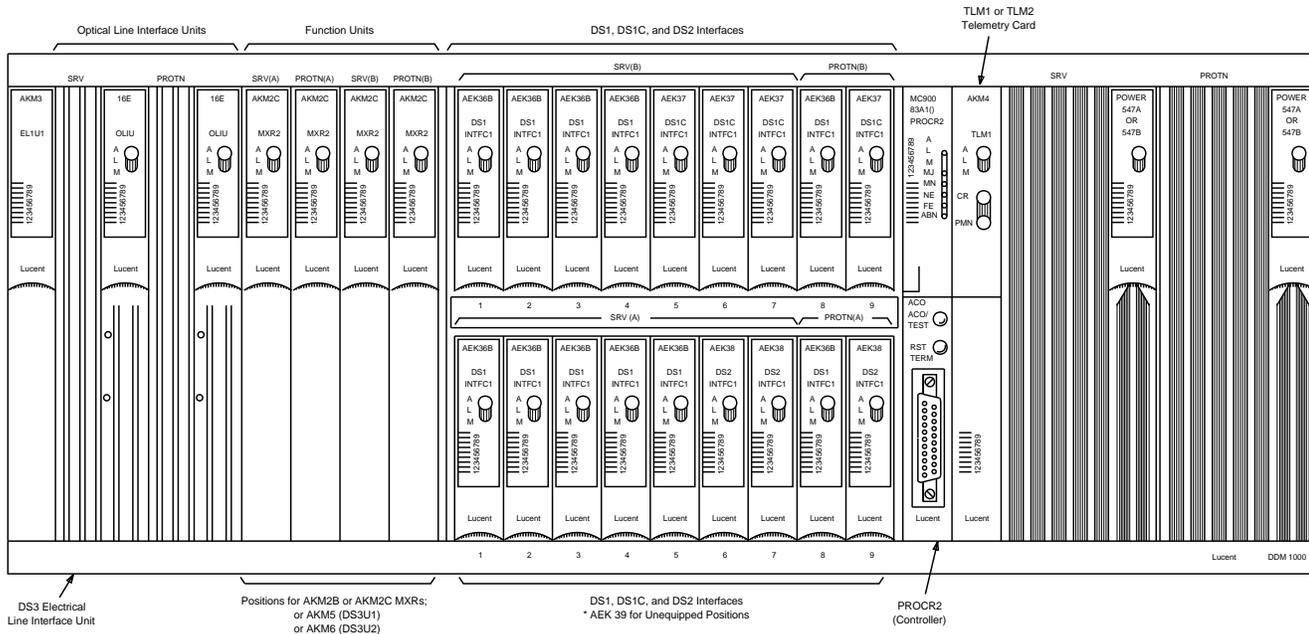
Any of the DS3 muldems can be fully or partially equipped. The muldems can also be configured to accept externally generated M13 compatible DS3 bit streams from the low-speed side for multiplexing onto the fiber (an M13 compatible DS3 signal is one that can be demultiplexed by an M13 multiplexer.) In addition, in the 90 Mb/s optical transmission mode one muldem may be configured to allow a single, bidirectional DS3 clear channel capability for applications requiring non-M13 formatted DS3 transport.

(Continued on next page)

DDM-1000 Multiplexer (Continued)

**DDM-1000
multiplexer
assembly
illustrated**

This figure shows the DDM-1000 multiplexer assembly.



(Continued on next page)

DDM-1000 Multiplexer (Continued)

Single-shelf DDM-1000 assembly

The single-shelf DDM-1000 assembly, shown below, has two muldem's that share high-speed interfaces, power, and a controller.

If the DDM-1000 is configured for ...

Then ...

DS3 electrical terminations on the high-speed side

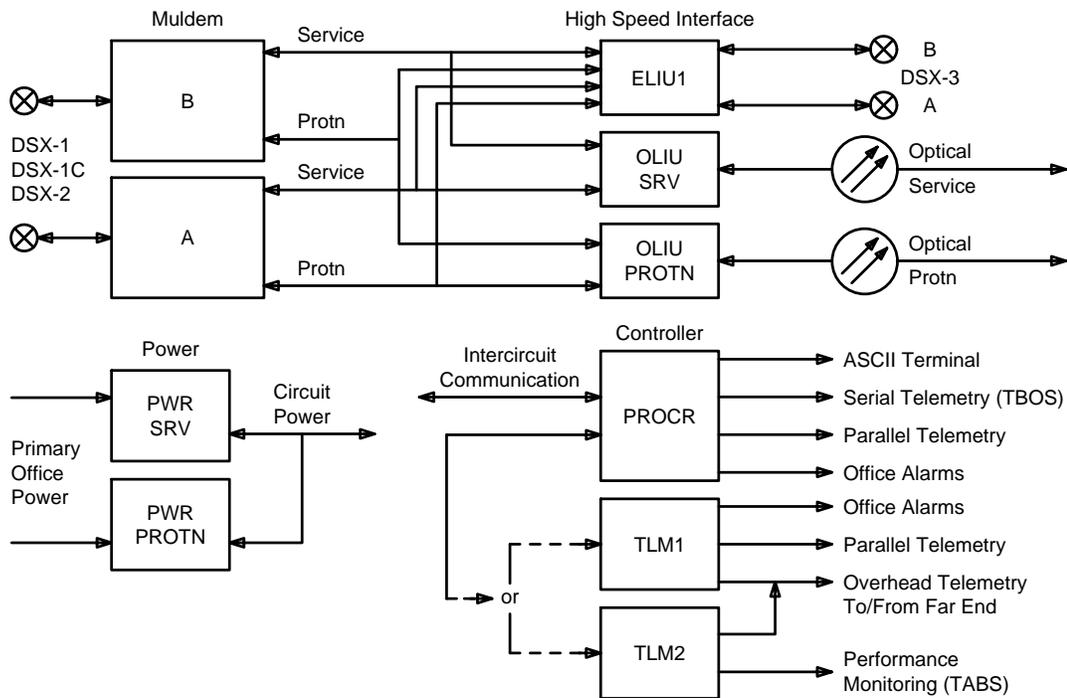
each muldem operates independently of the other

optical terminations and one muldem is equipped with a DS3U1 pack

the muldem without the DS3U1 is synchronized to the muldem with the DS3U1

optical terminations and no DS3U1 is installed

Muldem B is synchronized to Muldem A to provide an economical 90 Mb/s optical system



(Continued on next page)

DDM-1000 Multiplexer (Continued)

DDM-1000 180 Mb/s operation

The DDM-1000 provides 180 Mb/s operation. Two shelves can be connected together to provide up to four equivalent DS3 muldems. Any of the four DS3 muldems can be fully or partially equipped providing added flexibility should unexpected growth occur. If only one or two DS3s are needed initially, the DDM-1000 can operate at 90 Mb/s and be upgraded in service to 180 Mb/s when required. The two DDM-1000 assemblies are connected together with two cables on the backplane.

For 180 Mb/s operation, two 20-type optical line interface units (OLIUs), one service and one protection, are installed in one assembly (called the OLIU assembly). In the other assembly (the non-OLIU assembly), the OLIU locations are left empty. The backplane cables cause the non-OLIU assembly to operate as if it contained a service (SRV) and a protection (PROTN) OLIU. The system is installed, accepted, and maintained as if 16-type OLIUs were installed in both assemblies.

User information source

Refer to 363-205-100, *DDM-1000 User's Manual*, for descriptive, engineering, and procedural information for the DDM-1000 multiplexer assembly.

DDM-2000 OC-3 Multiplexer

Physical design

The DDM-2000 OC-3 multiplexer, shown in the following figure, is a single shelf assembly equipped with circuit packs. The shelf measures 8.5 inches high by 20.5 inches wide by 12 inches deep, and fits in a standard 23-inch wide bay. Each shelf is a stand-alone entity with its own fiber cabling, DSX-1, and office power interfaces. The default configuration provides rear access cabling. Front access (through dangler cables) is also available. Optical connectors are accessible from the front for shelf loopback and fiber tests. These connectors are mounted on the optical line interface unit (OLIU) circuit pack faceplate.

The basic shelf consists of 36 circuit pack slots and a user panel: twenty-six 4-inch slots and ten 8-inch slots. At the far left, two 4-inch slots are reserved for service and protection synchronous timing generator (TGS) circuit packs.

The next two 8-inch slots are reserved for the main OLIU circuit packs (service and protection). The next six 8-inch slots are for the function units. These slots are divided into three groups marked A, B, and C.

The function unit slots can be equipped interchangeably by group, with each group 1:1 protected. These slots can be equipped with DS3 and STS1E low-speed circuit packs, multiplexer (MXR), or OLIU circuit packs, depending on the application. Each group functions independently.

The next section of the shelf is reserved for the low-speed interface circuit packs. These slots are also divided into three groups (A, B, and C) that correspond to the function unit groups. Each group consists of eight 4-inch slots for service and protection DS1 circuit packs (1:7 protected).

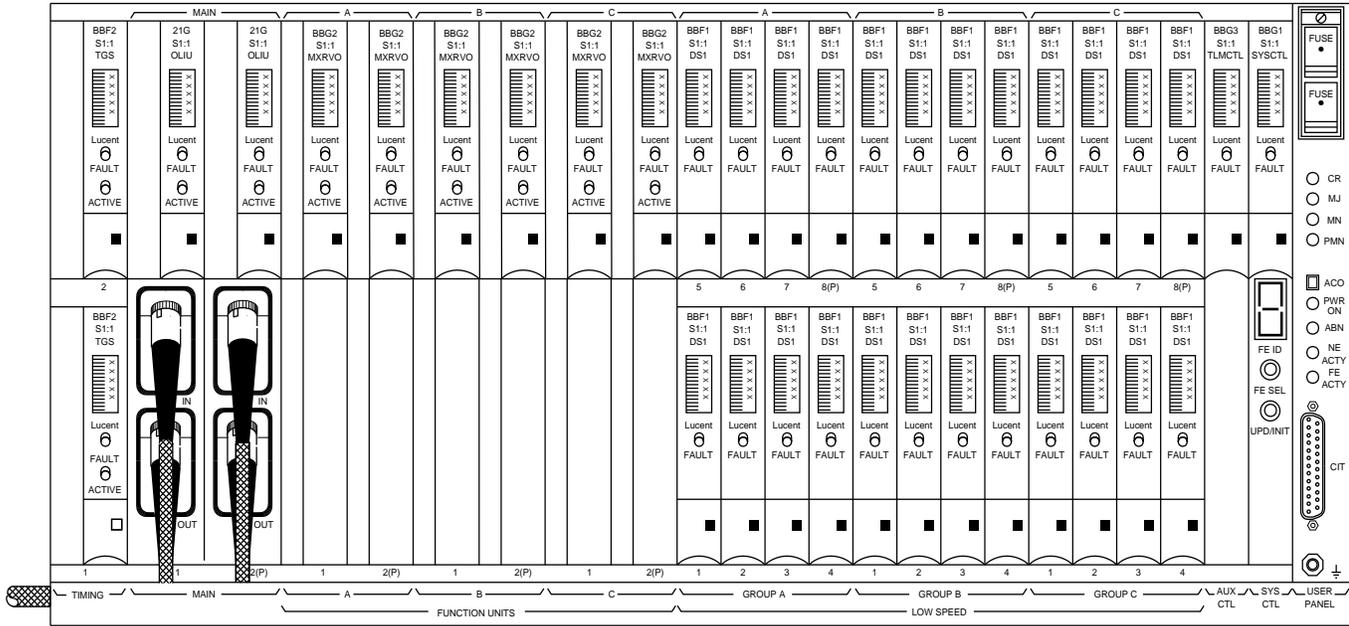
Following this section are two 8-inch slots reserved for control circuit packs. The first slot, labeled AUXCTL, is reserved for a parallel telemetry controller (TLMCTL) or overhead controller (OHCTL) circuit pack. The second slot is reserved for the system controller (SYSCTL) circuit pack. The factory-installed user panel is mounted near the right flange of the shelf.

Circuit pack keying prevents same-size circuit packs from being accidentally inserted in incorrect slots. The fuses, status/alarm LEDs, electrostatic discharge (ESD) jack, and the craft interface terminal (CIT) port are mounted on the user panel. The OC-3 multiplexer shelf has a front cover that provides electromagnetic compliance (EMC) protection. If the shelf needs to be accessed for maintenance activities, the cover is hinged and can easily be removed.

(Continued on next page)

DDM-2000 OC-3 Multiplexer (Continued)

Illustration This figure illustrates the DDM-2000 OC-3 multiplexer.



(Continued on next page)

DDM-2000 OC-3 Multiplexer (Continued)

Transmission interfaces and multiplexing

The DDM-2000 OC-3 multiplexer supports DS1 and DS3 low-speed interfaces and an OC-3 high-speed interface. The DS1 and DS3 interfaces accept any DSX-1 or DSX-3 compatible signal (clear channel interfaces) and can be mixed on a per-STS-1 basis.

Application and user information sources

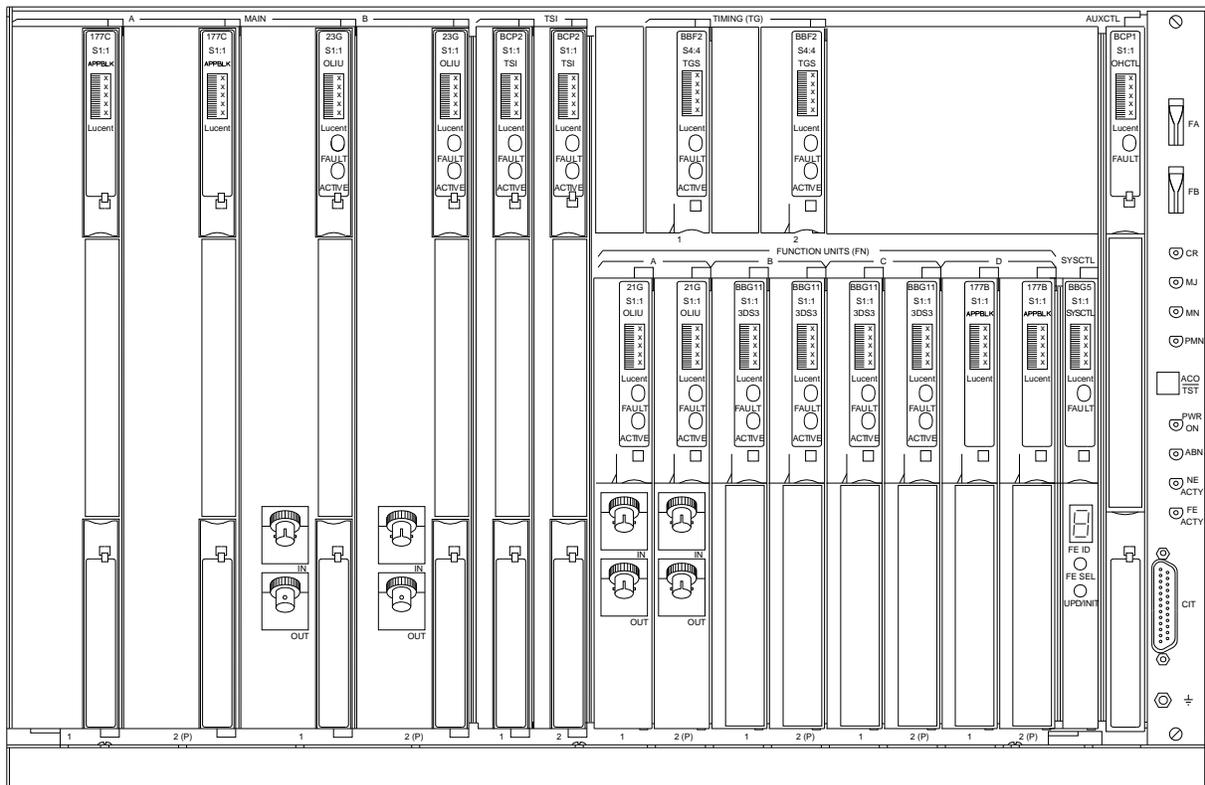
For additional information on DDM-2000 multiplexer applications, refer to 363-206-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*. For a detailed description of commands and reports and for operations and maintenance procedures, see 363-206-202, *DDM-2000 OC-3 Multiplexer User/Service Manual*.

DDM-2000 OC-12 Multiplexer

Physical design

The DDM-2000 OC-12 Multiplexer, shown below, is a single shelf SONET digital multiplexer. A single 12-inch shelf supports a mix of digital signal 3 (DS3) and optical carrier level 3 (OC-3) signals and multiplexes them into a SONET standard 622 Mb/s optical carrier level 12 (OC-12) rate.

The OC-12 and OC-3 optical lines, all transmission-affecting circuit packs, and the -48 V DC power feeders may be optionally protected. The shelf can be equipped to serve many diverse network applications and supports a variety of operations interfaces for current and evolving network operations needs.



(Continued on next page)

DDM-2000 OC-12 Multiplexer (Continued)

Applications

The DDM-2000 OC-12 Multiplexer is designed for loop, interoffice, and customer location applications. The DDM-2000 OC-12 Multiplexer starts with many of the proven features of DDM-1000 and DDM-2000 OC-3 Multiplexers and extends into the future with the flexibility of the SONET standard.

Installation, operations, and maintenance

The DDM-2000 OC-12 Multiplexer is designed for easy installation and operation. Installation is simplified with automatic turnup tests and default provisioning. Centralized operation is supported by a full set of single-ended control and maintenance features. Built-in maintenance capabilities support both installation and continuous system operation. A DDM-2000 OC-12 Multiplexer can be fully tested and installed without using external test equipment. Most tasks can be performed using faceplate light-emitting diode (LED) displays and controls, while an optional craft interface terminal (CIT) gives access to sophisticated maintenance, provisioning, and reporting features.

Transmission interfaces and multiplexing

The DDM-2000 OC-12 Multiplexer has a phased release plan. Release 1 supports DS3, interconnect signal level 3 (IS-3), and OC-3 interfaces. Applications include OC-12 point-to-point, OC-12 hubbing and optical interworking with the DDM-2000 OC-3 Multiplexer. Release 2 supports OC-3/OC-12 open systems interconnections (OSI) interworking, an OC-3c (STS-3c) interface using the 21G optical line interface unit (OLIU), synchronization messaging, and 1550 nm operation using the 21H OLIU. Future releases will support electrical carrier signal level 1 EC-1 (STS-1) interfaces, drop, add/drop, and rings.

The OC-12 Regenerator extends the span length of the DDM-2000 OC-12 Multiplexer and is supported in both unbalanced and balanced modes. Diverse routing is supported in either mode, allowing one line to travel over a longer route than the other. The OC-12 Regenerator uses the same shelf and some of the same circuit packs as the OC-12 Multiplexer.

Application and user information sources

For additional information on DDM-2000 multiplexer applications, refer to 363-206-200, *DDM-2000 Multiplexer, Applications, Planning, and Ordering Guide*. For a detailed description of commands and reports and for operations and maintenance procedures, see 363-206-207, *DDM-2000 OC-12 Multiplexer User/Service Manual*.

Test Equipment

Types described Various different types of specialized test equipment are used in installation and maintenance of the Series 5 system.

The craft interface unit (CIU) is a portable minicomputer used for provisioning channels in a Series 5 system. Other test equipment includes T1 line maintenance adapters and channel unit test extenders. The pair gain test controller and extended test controller are equipment shelves/bays that provide coordination between the Series 5 system and the test/maintenance systems used by the telephone companies.

Craft interface unit (CIU) The CIU is a special-purpose portable (22 pounds) computer used for provisioning and testing the special service channel units (except *SPOTS*[®] units, DID, ringdown, or dual ringing repeater channel units). It provides local test access to both sides (line and drop) of a channel unit for channel alignment testing. The CIU can be used at the COT to test the COT and RT channel units and for end-to-end testing to the customer location. With the CIU, testing can be done from the CO and the customer location; no dispatching to the RT is needed. It can also be used at the RT for testing in TR-08 system. Also, access may be provided at a DACS II.

The CIU keyboard is used to enter commands for provisioning and testing. The group of switches and jacks labeled TEST ACCESS located to the right of the keyboard controls the CIU test functions. A transmission test set or the equivalent may be connected to these jacks for channel unit and circuit testing. The SIGNALING CONTROL section is used to set and monitor the signaling states for testing. The *CIU User Guide* (Select Code 500-206) provided with the CIU details the use of the keyboard and display for various system operations and includes signaling state tables for provisionable channel units. The CIU is described in 363-205-101, *Craft Interface Unit Description*.

(Continued on next page)

Test Equipment (Continued)

950A test set (for testing ISDN channel units)

The 950A test set is designed to test the operation of ISDN channel units as follows:

- AUA90 T interface basic rate interface transmission extension (T-BRITE) channel unit (Series 5 RT or INA-RT)
- AUA92 BRITE II (U interface) channel unit (Series 5 COT)
- AUA93 BRITE II (U interface) channel unit (Series 5 RT)
- AHG13, S2 BRITE (U interface) channel unit (D4 channel bank or *SLC* 96 COT)
- AHG18 BRITE II (U interface) channel unit (D4 channel bank or *SLC* 96 COT)
- AHG28 BRITE II (U interface) channel unit (D4 channel bank or *SLC* 96 RT)

The 950A test set can be used by itself or with other test sets for maintenance on an ISDN circuit. The KS-20908 receiver and KS-20909 transmitter data test sets and/or the 946A test set may be used with the 950A test set.

Depending on the channel units in the circuit, the 950A test set provides test features as follows:

- Check the condition of remote access loops (up to five channel units beyond the channel unit connected to the test set).
- Set up 2B+D loopback tests.
- Insert pseudorandom data patterns into the customer's data channels (B1 or B2).
- Monitor channel unit slips (momentary loss of synchronization in data transmitted to/from a BRITE II channel unit).

Once the appropriate switches are set and the test set is activated, a loopback connection can be established in the ISDN channel unit connected to the test set or in any other ISDN channel unit in the circuit. The loopback allows data transmitted from the test set to be sent back to the test set and checked for errors. Also, the 950A test set has status indicators that can show various conditions in the circuit (the test set indicators are interpreted differently for BRITE II tests than for BRITE or T-BRITE tests).

(Continued on next page)

Test Equipment (Continued)

950A test set (for testing ISDN channel units) (continued)

The 950A can be inserted into any vacant slot in the Series 5 dual channel bank and connected to any AUA90 or AUA93 channel unit (within reach of the connectorized cable). The test set should be used fully seated in a channel unit slot so that it is grounded through the backplane connector (ground pin). The 950A test set will operate in a common unit slot but cannot be seated fully (into the backplane connector). When the test set is not grounded through the backplane connector, an ESD wrist strap should be worn for protection.

The 950A test set can generate pseudorandom data patterns and display resulting errors during loopback testing. The data test sets should be used with the 950A test set to check low (displayed) error rates or when the customer complains of errors that are not easily diagnosed using only the 950A test set.

Refer to ...	For information on ...
363-005-238	the 950A test set and the various test and status indicators, control switches, and faceplate jacks (for connecting other test sets)
363-205-106	procedures using the 950A test set
363-205-107	procedures using the 950A test set
365-170-503	how to use the 946A test set
107-600-100	transmitter data test sets
107-601-100	receiver data test sets

197A1 test set (for testing RT batteries)

The 197A1 (battery load) test set is used to field test the RT batteries (KS-21906, L4) that provide standby power for the Series 5 remote terminals. It is contained in a carrying case that is 16 inches wide, 12 inches deep, and 10 inches high. The 197A1 test set tests the batteries by monitoring the terminal voltage of the battery during a constant current, high-rate discharge test. A battery string (four KS-21906, L4 batteries) can be tested in 20 minutes or less without removing the batteries from the mounting. For additional information on the operation of the 197A1 test set, see 100-101-401.

(Continued on next page)

Adapters

AUA78 fault-locating test adapter (FLTA)

The AUA78 fault-locating (FL) test adapter plugs into the LIU slot in the COT or RT for fault-locating a T1 digital line. The FL test adapter can be used with the J98725AD Fault-Locate Test Set, the Sierra 315B or 415A-2 test set, or the equivalent. The AUA78 provides line powering or power looping as required, in addition to test access to the T1 line. For more information, see 363-005-231 data sheet (on the AUA78).

AUA80 line test adapter

The AUA80 is a passive test adapter used in an LIU slot at the COT or RT. The AUA80 provides test access for measuring insertion loss on the digital line pairs. This adapter serves the same function as the ED-7C351-30 plug-in adapter used in the *SLC* 96 Carrier System. For more information, see 363-005-233 data sheet (on the AUA80).

505A line loss measuring adapter

The 505A is a passive test adapter used in an LIU slot in the COT or RT for measuring pair loss on the digital lines. This adapter serves the same function as the 326B plug-in adapter used in the *SLC* 96 Carrier System. For more information, see 363-005-234 data sheet (on the 505A).

Extenders

52A channel unit test extender

The 52A test extender is used to test channel units in the Series 5 system. Faceplate mounted 310-compatible jacks allow monitoring access to T/R, T1/R1, E/M, and SG/SB leads on the backplane. Splitting access jacks for T/R, T1/R1, E/M, and SG/SB allow testing of the drop or a channel unit installed in the extender. Active circuitry is included to provide battery feed (normal and reverse) and a hold function to condition the signaling for testing 2-wire and 4-wire channel units. For more information, see 363-005-235 data sheet (on the 52A).

Pair Gain Test Controller (PGTC)

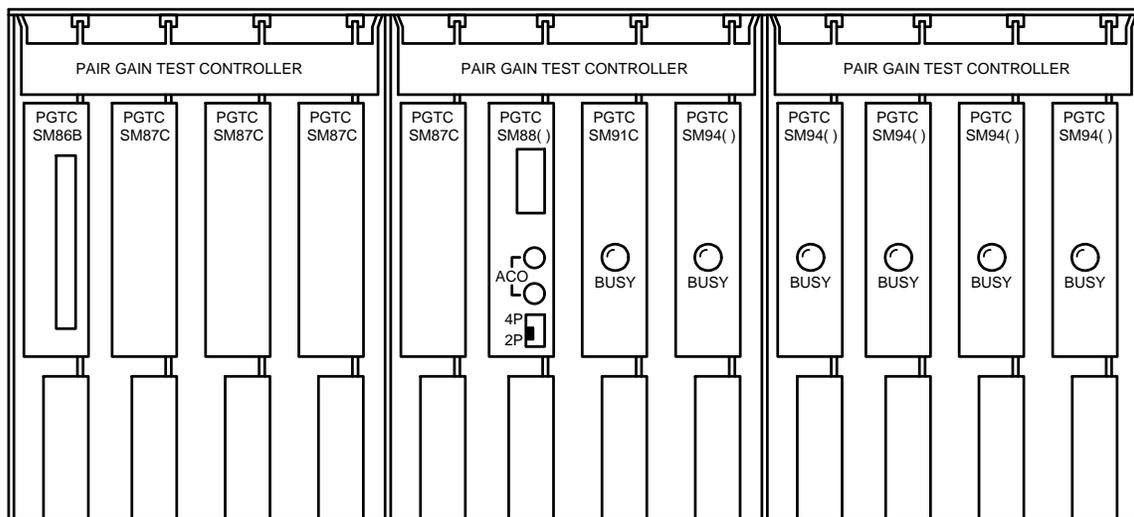
Description

The equipment arrangement for the PGTC consists of one J1C142A-(), L1 control shelf (always required) plus up to four J1C142A-(), L2 expansion shelves depending on the number of test trunks to be served. Both types of shelves are designed to be miscellaneously mounted in 23-inch wide frames. Each shelf is 8 inches high. If expansion shelves are required, they should be mounted in the same frame as the control shelf.

The J1C142A-(), L1 control shelf may be equipped with circuit packs to accommodate all common control functions and up to 12 test trunks. Each J1C142A-(), L2 expansion shelf can be equipped to accommodate up to 20 additional test trunks. Optional trunk unit circuit packs may be used in the control shelf. The control shelf and the expansion shelf are powered from the -48 V DC supply. The ringing voltages supplied to the control shelf must correspond to the ringing applied at the channel bank (AC-DC, negative superimposed, positive superimposed, or AC-only).

Control shelf illustrated

This is an illustration of the J1C142A(), L1 PGTC control shelf.



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Pair Gain Test controller (PGTC) (Continued)

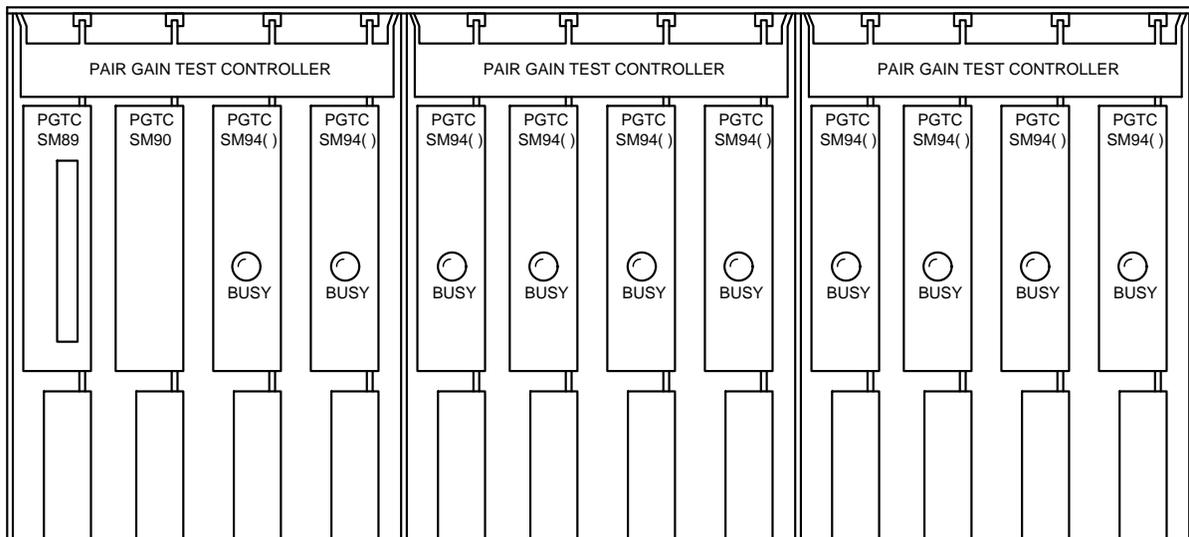
Control shelf circuit packs

The control shelf may contain one or more of the following circuit packs:

- SM86B control shelf power unit
 - SM87C tester unit
 - SM88C ocntrol unit
 - SM91C dedicated trunk unit
 - SM94C 2x4 trunk unit.
-

Expansion shelf illustrated

This is an illustration of the J1C142A(), L2 PGTC expansion shelf.



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Pair Gain Test Controller (PGTC) (Continued)

Expansion shelf units

The expansion shelf contains one or more of the following units:

- SM89 expansion shelf power unit
 - SM90 fanout extender unit
 - SM94C 2x4 trunk unit.
-

PGTC details and ordering

Details on the PGTC are given in 363-202-300, *Pair Gain Test Controller and Test Bus Control Unit, Description and Installation, Loop Transmission Systems*. Ordering for the PGTC equipment is provided in the Series 5 ordering guide (363-205-000) and in the *SLC 96* ordering guide (363-202-000).

Compatibility

The PGTC is compatible with step-by-step (SXS), crossbar [that is, No. 5 Cross-Bar (No. 5X-BAR)] and *ESST*[™] switches as follows:

- in SXS offices using a No. 3 LTC, No. 14 LTD, or No. 16 LTD; a test distributor control circuit must be used to provide sleeve lead control (see SD-31349)
 - in SXS offices using incoming trunk circuits, refer to SD-31401 or SD-31245-01
 - in No. 5X-BAR offices using incoming trunk circuits, refer to SD-26136 or SD-25708
 - in ESS switch offices using incoming trunk circuits, refer to SD-1A186, SD-2H109, or SD-3H520-01 (3 ESS switching equipment)
 - in ESS switch offices, trunks from a distant building must be equipped with the properly optioned test trunk ringing circuit to provide secondary lightning protection (see SD-96474-01.)
-

Capabilities

A PGTC containing four tester units permits simultaneous testing of four different *SLC* Series 5 Carrier Systems or *SLC 96* Carrier Systems, provided they do not share the same bypass pair (DC test pair). The number of tester units required (one to four) is determined by traffic blocking considerations. The PGTC can interface up to 92 test trunks (a maximum of 12 per control shelf and 20 per expansion shelf). Additional information on the PGTC is contained in 363-202-300.

Extended Test Controller (XTC)

Description

An XTC consists of XTC shelves and, if MLT/LTD testing is required, PGTC shelves. The XTC shelves consist of one control shelf (J1C182XA,L1) and two expansion shelves (J1C182XA,L2 and L3). The control shelf is always required for an XTC installation. The expansion shelves are installed only as needed to provide additional tester units and fanout units for servicing additional Series 5 systems. The control shelf is equipped with circuit packs as listed in the following table.

The XTC control shelf and both expansion shelves are 12 inches high, 23 inches wide, and 11 inches deep. The shelves are designed for front mounting in a 23-inch wide framework. The recommended mounting arrangement includes all shelves in the same bay (including the PGTC shelves if required). The XTC control shelf should be installed in the middle of the equipment frame. The PGTC expansion shelves may be added to the bay below the XTC control shelf.

Control shelf circuit packs

The XTCJ1C182XA, L1 control shelf houses a maximum of 28 circuit packs. These circuit packs are listed in this table.

Code	Function	Max. Number Per Shelf
AUB60	Power Converter Unit (XPCU)	1
MC97734A1 or MC97761A1	Control Unit (XCU)	1
AUB62	Alarm Display Unit (XADU)	1
AUB63B	Data Link Unit (XDLU)	2
MC97745A1 2	Tester Unit D (XTUD)	4
AUB66	Fanout Unit (XFOU)	10
AUB67	Tester Unit C (XTUC)	4
AUB68 Series 2	Tester Unit B (XTUB)	4
AUB69	Composite Clock Unit (XCCU)	1

(Continued on next page)

Extended Test Controller (XTC) (Continued)

Control shelf circuit packs (continued)

The control shelf may be equipped with circuit packs to provide common control and test functions for up to 60 Series 5 dual channel banks equipped with AUB5 (COT) and AUB25 (RT) CTUs. It can also support Series 5 systems equipped with AUB2B (COT) and AUB22 (RT) CTUs and *SLC* 96 Carrier Systems.

All circuit packs (except XPCU) in the control shelf measure about 8.0 inches high, 0.7 inch wide, and 10.0 inches long. The XPCU measures about 8.0 inches high, 2.0 inches wide, and 10.0 inches long.

Control shelf fuses

The baffle assembly located at the bottom of the control shelf contains four TEST pin jacks (+20HZ, -20HZ, GND, and -48V), two 0.5A and three 5A fuses, and a red FAIL indicator. The following table contains the XTC J1C182XA, L1 control shelf fuses.

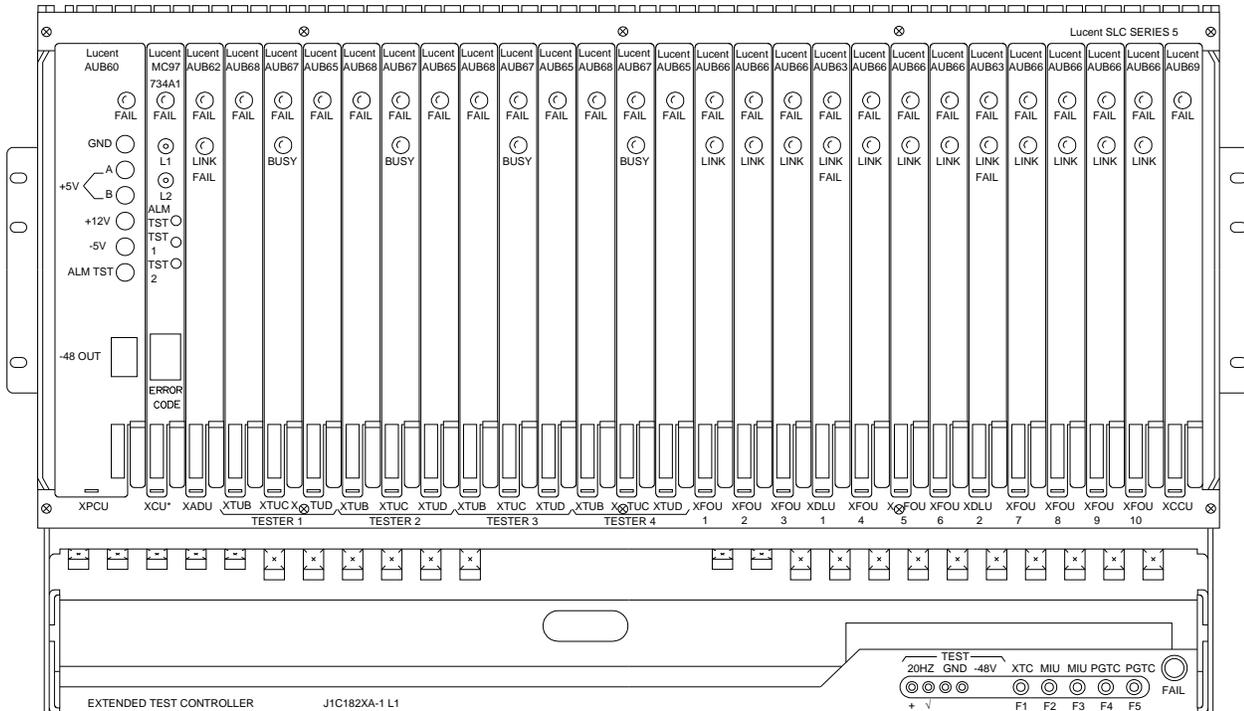
<u>Fuse Designation</u>	<u>Fuse Type</u>	<u>Ampere Rating</u>	<u>Indicator Color</u>
XTC F1	80D	5	Green
MIU F2	80G	0.5	Red
MIU F3	80G	0.5	Red
PGTC F4	80D	5	Green
PGTC F5	80D	5	Green

(Continued on next page)

Extended Test Controller (XTC) (Continued)

J1C182XA, L1 control shelf illustrated

The XTC J1C182XA, L1 control shelf is illustrated below.



* XCU can be MC97734A1 or MC97761A1.
XDLU Position 1 can be an AUB63 or AUB63B (for SARTS applications).
XDLU Position 2 for COP applications only, and must be an AUB63B.

(Continued on next page)

Extended Test Controller (XTC) (Continued)

XTC expansion shelf

The J1C182XA,L2 and J1C182XA,L3 expansion shelves house a maximum of 25 and 19 circuit packs, respectively. Each XTC expansion shelf can be equipped to support up to 60 Series 5 system dual channel banks equipped with AUB5 (COT) and AUB25 (RT) CTUs.

Expansion shelf circuit packs

The circuit packs contained in the J1C182XA, L2 and L3 expansion shelves are listed in in the following table.

<u>Code</u>	<u>Designation</u>	<u>Max. No. / Shelf</u>	
		<u>List 2</u>	<u>List 3</u>
AUB60	Power Converter Unit (XPCU)	1	1
—	Data Link Unit*	2	2
MC97745A1 2	Tester Unit D (XTUD)	4	2
AUB66	Fanout Unit (XFOU)	10	10
AUB67	Tester Unit C (XTUC)	4	2
AUB68 Series 2	Tester Unit B (XTUB)	4	2
—	XTKU*	—	9
—	XDAUL*	1	—
—	XDAUR*	1	—
—	XIFU*	1	—

* For future enhancement.

(Continued on next page)

Extended Test Controller (XTC) (Continued)

Expansion shelf fuses

The baffle assembly located at the bottom of the expansion shelves contains four TEST pin jacks (+20HZ, -20HZ, GND, and -48V), two 0.5A and three 5A fuses, and a red POWER FAIL indicator. The following table contains the XTC J1C182XA, L2 and Lc expansion shelf fuses.

<u>Fuse Designation</u>	<u>Fuse Type</u>	<u>Ampere Rating</u>	<u>Indicator Color</u>
XTC F1	80D	5	GREEN
MIU F2	80G	0.5	RED
MIU F3	80G	0.5	RED
SPARE F4	80D	5	GREEN
SPARE F5	80D	5	GREEN

(Continued on next page)

Extended Test Controller (XTC) (Continued)

XTC power

The XTC control shelf and expansion shelves are powered from the –48 V DC supply. The ringing voltages supplied to the control shelf must correspond to the ringing applied at the channel bank (AC-DC, negative superimposed, positive superimposed, or AC-only). The TEST jacks on each shelf provide access to check ringing and the –48 V input. Fuse F1 provides fusing for the power being supplied to the XPCU circuit pack. Fuses F2 and F3 protect the power being supplied to the SARTS metallic interface units (MIUs). On the XTC control shelf, fuses F4 and F5 protect power supplied to PGTC shelves if required.

On the XTC control shelf, the FAIL indicator will light if a fuse or circuit pack in the XTC control shelf or either of the XTC expansion shelves fails. On the XTC expansion shelves, the POWER FAIL indicator will light on the affected expansion shelf. The POWER FAIL indicator also lights when the XPCU circuit pack fails. These indicators will extinguish when the fault is cleared or when the ACO button on the XADU circuit pack is pressed.

Details and ordering

Details on the XTC are given in 363-205-300, *Extended Test Controller, Description, Turnup, and Maintenance*. Ordering for XTC equipment is provided in the Series 5 ordering guide (363-205-000).

Remote Terminal Cabinets and Enclosures

5

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Introduction

Mounting arrangements

The Series 5 remote terminal (RT) equipment and apparatus may be mounted in two different arrangements:

- an outside plant cabinet
The RT cabinets are designed to serve a specific area with capacities ranging from one dual channel bank (2 systems) to 8 dual channel banks (16 systems).
 - miscellaneous frames in an enclosure (an above- or below-ground building).
The RT enclosures serve a general area with capacities ranging from 16 dual channel banks (32 systems) to 36 dual channel banks (72 systems).
-

RT Cabinets

80-type community service cabinet

The 80-type community service cabinet can enclose various combinations of Series 5 systems and an optional feeder distribution interface. The figure below shows an 80-type cabinet equipped with the Series 5 RT, power shelf, battery shelves, DDM multiplexer, digital signal cross-connect (DSX) tie block, and lightguide interconnection equipment.



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RT Cabinets (Continued)

51A type cabinet

The 51A cabinet (similar to the 36-type cabinet used for *SLC*[®] 96 carrier) may be mounted on a pedestal or pole and houses two 96-line systems (one Series 5 dual channel bank assembly).

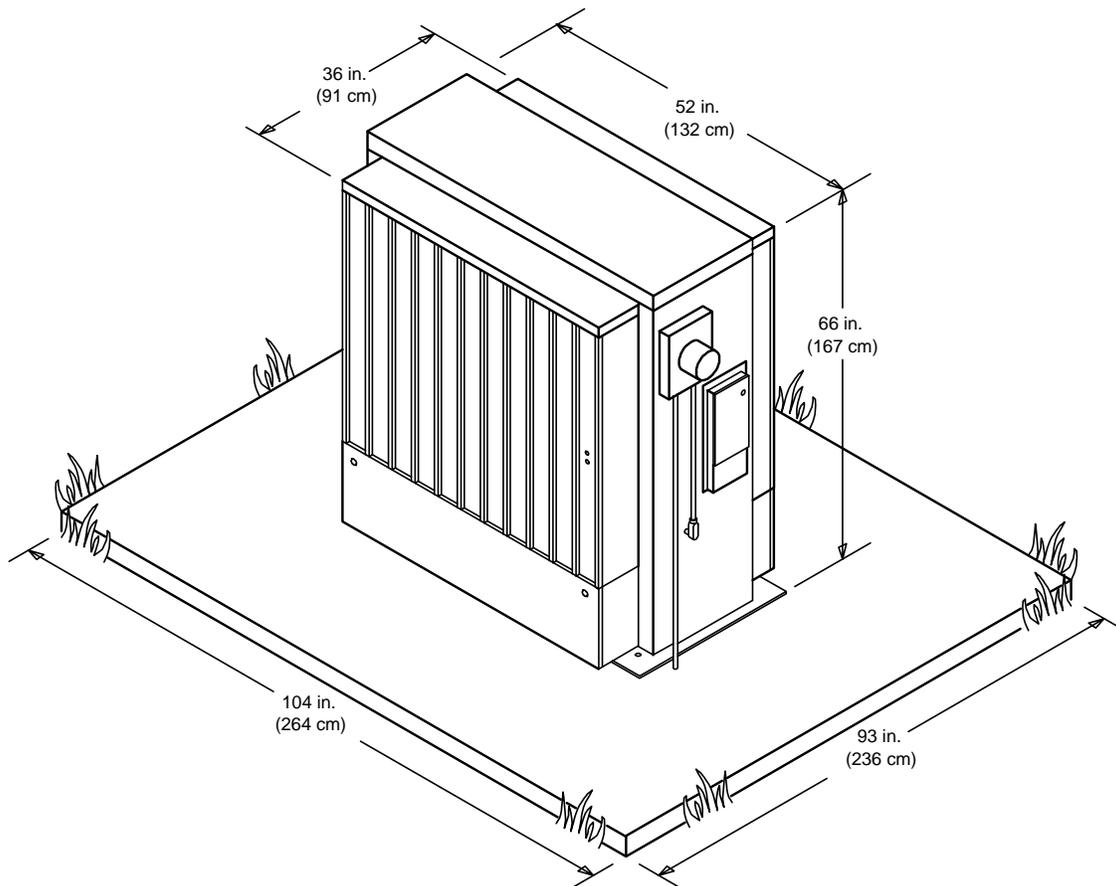
90-type business remote terminal

The 90-type business remote terminal is a cabinet designed for customer locations that contains the required DDM-2000/DDM-1000 multiplexer equipment and/or Series 5 systems for a wide range of business customer network services.

80A Cabinet

Description

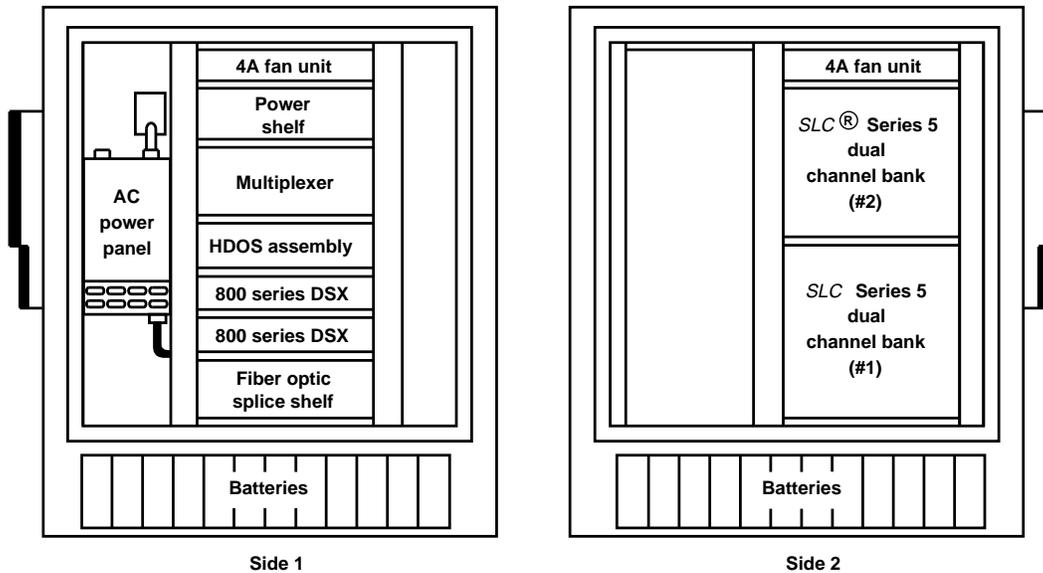
The 80A bulk power (BP) (ED-7C711-30) cabinet and foundation pad with dimensions is shown below. The capacity of the 80A is between that of the 51A and 80D cabinets. The 80A is factory assembled and completely prewired. The 80A cabinet is designed to house digital loop carrier systems, including various combinations of *SLC* Series 5 dual channel banks (DCBs), multiplexers, DS1 and DDM-Plus extension shelves, and feeder distribution interfaces (FDIs). A model equipped with a heat exchanger (80A-HX) is available.



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80A Cabinet (ED-7C711-30) (Continued)

80A-BP cabinet The 80A-BP cabinet model equipped for Fiber in the Loop (FITL) using *SLC-2000* MSDT is shown below.



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80A cabinet features

Several attractive features of the 80A are:

- side splicing access design which aids installation and provides a larger splicing area
- bulk power system which was developed to increase the capacity and range of options available with the cabinet
- batteries housed in a separate area below the electronics which extends battery life and efficiently utilizes cabinet space.

(Continued on next page)

80A Cabinet (ED-7C711-30) (Continued)

80A cabinet construction

The cabinet is constructed of heavy gauge aluminum and finished with a baked-on polyester finish. The cabinet color is beige and chocolate brown. The 80A is weather, fire, and vandal resistant, and it complies with all applicable provisions of Bellcore TR-TSY-000487. The 80A is also suitable for earthquake-prone areas, complying with applicable provisions of Bellcore TR-EOP-000063 NEBS (Network Equipment Building Systems) requirements for Zone 4 earthquake resistance (earthquake resistance is not currently specified in Bellcore TR-TSY-000487).

Configuration and powering information resources

Refer to the following documents for additional configuration and powering information on the 80A cabinet:

- 363-205-000, *SLC Series 5 Carrier System Ordering Guide*.
 - 631-600-247, *80A-BP RT Cabinet Description and Ordering Information*.
 - 631-600-251, *80A-HX RT Cabinet General Description and Ordering Information*.
-

80D Cabinet

Description

The 80D community service cabinet is an outside plant enclosure designed for Series 5 RT equipment with or without a DDM multiplexer. The 80D cabinet can be used as a commercial sign by attaching logos or lettering to the sides of the cabinet. These cabinets provide an aesthetically pleasing installation at the RT site.

Construction

The cabinet structure consists of an aluminum frame with a horizontal top beam, a bottom beam, and two legs. The legs both have the same cross-sectional shape as the top. The cabinet is 66 inches high, 84 inches wide, and 27 inches deep. A 7-inch collar is mounted on both sides of the frame to make the inside deep enough for the feeder distribution interface (FDI) and/or Series 5 apparatus. Two doors hinged along the outside edge of the collar provide access to the Series 5 system and/or FDI apparatus. A 216B tool and an Allen key-wrench (Part No. 840841324) are required to open the cabinet doors.

Cable entrance holes are provided in the base of the cabinet. The telephone cables enter on one side of the cabinet and the power cables enter on the other side. An outlet is provided on the underside of the cabinet to connect a portable generator if desired for emergency power. Both distributed power (DP) and Bulk Power (BP) models are available. A heat exchanger version (80D-HX) is also available with bulk powering.

80D cabinet configurations

The following documents give a complete description of the various combinations available in the 80D cabinet:

- 363-205-000, *SLC Series 5 Carrier System Ordering Guide*.
 - 631-600-249, *80D-BP Cabinet General Description and Ordering Information*.
 - 631-600-254, *80D-HX Cabinet General Description and Ordering Information*.
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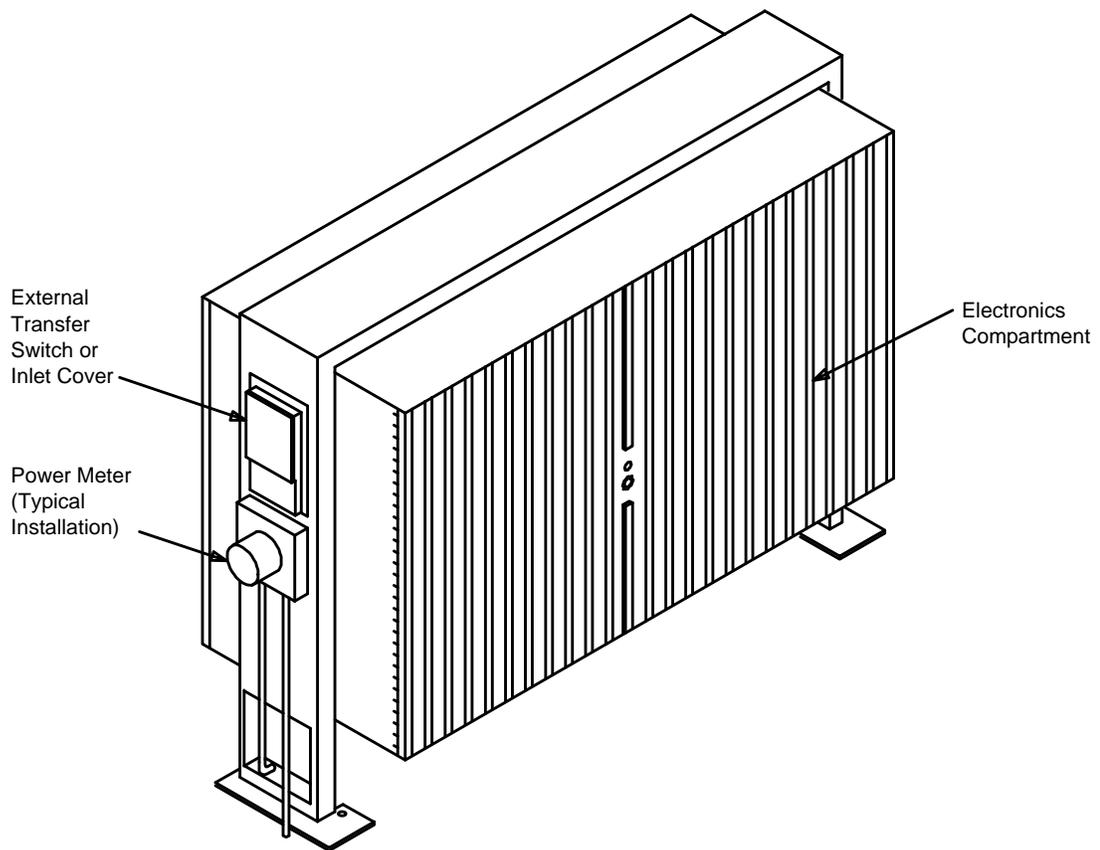
80E Cabinet

Description

The 80E community service cabinet is available in distributed and bulk power arrangements. These arrangements provide 50 to 100 percent more system capacity than the 80D cabinet. This cabinet includes various combinations of the DDM-2000 multiplexer, DDM Plus, and Series 5 systems.

80E-DP cabinet

An 80E-DP cabinet arranged for distributed power is shown below.

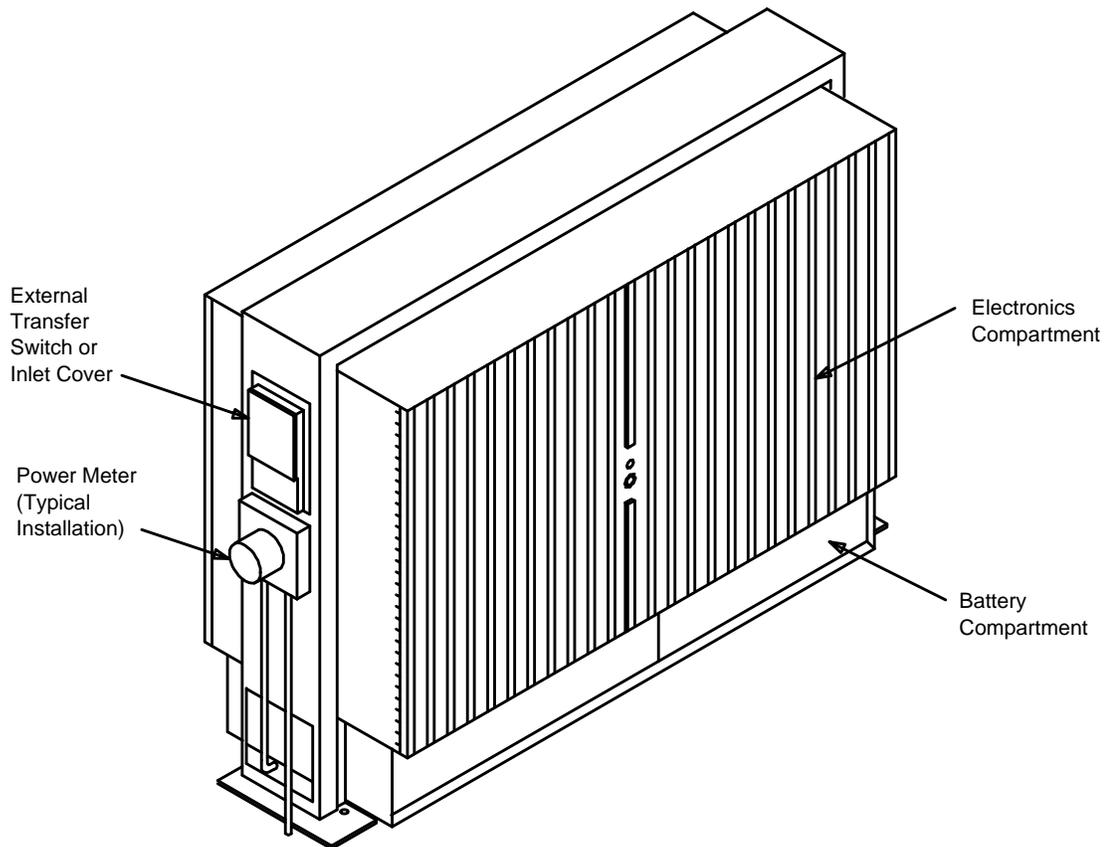


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80E Cabinet (Continued)

80E-BP cabinet

An 80E-BP cabinet arranged for bulk power is shown in below.

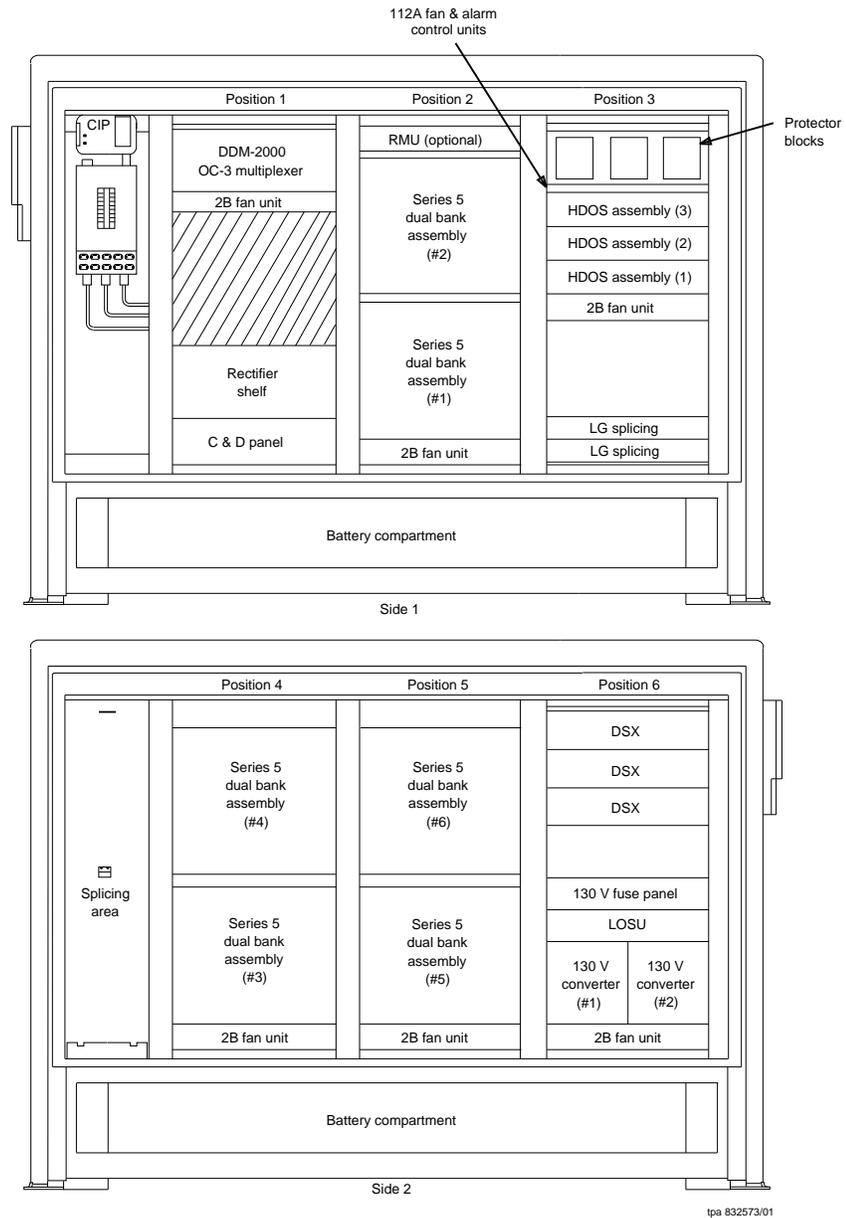


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80E Cabinet (Continued)

80E-BP cabinet (continued)

An 80E-BP cabinet equipped for FITL (SLC-2000 MSDT interface) with central powering equipment is shown in the following figure.



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80E Cabinet (Continued)

Configuration and powering information resources

Refer to the following documents for additional configuration and powering information:

- 363-205-000, *SLC Series 5 Carrier System Ordering Guide*.
 - 631-600-243, *80E-BP Cabinet General Description and Ordering Information*.
-

80E cabinet bulk power plant

The 80E cabinet bulk power plant has three principal components:

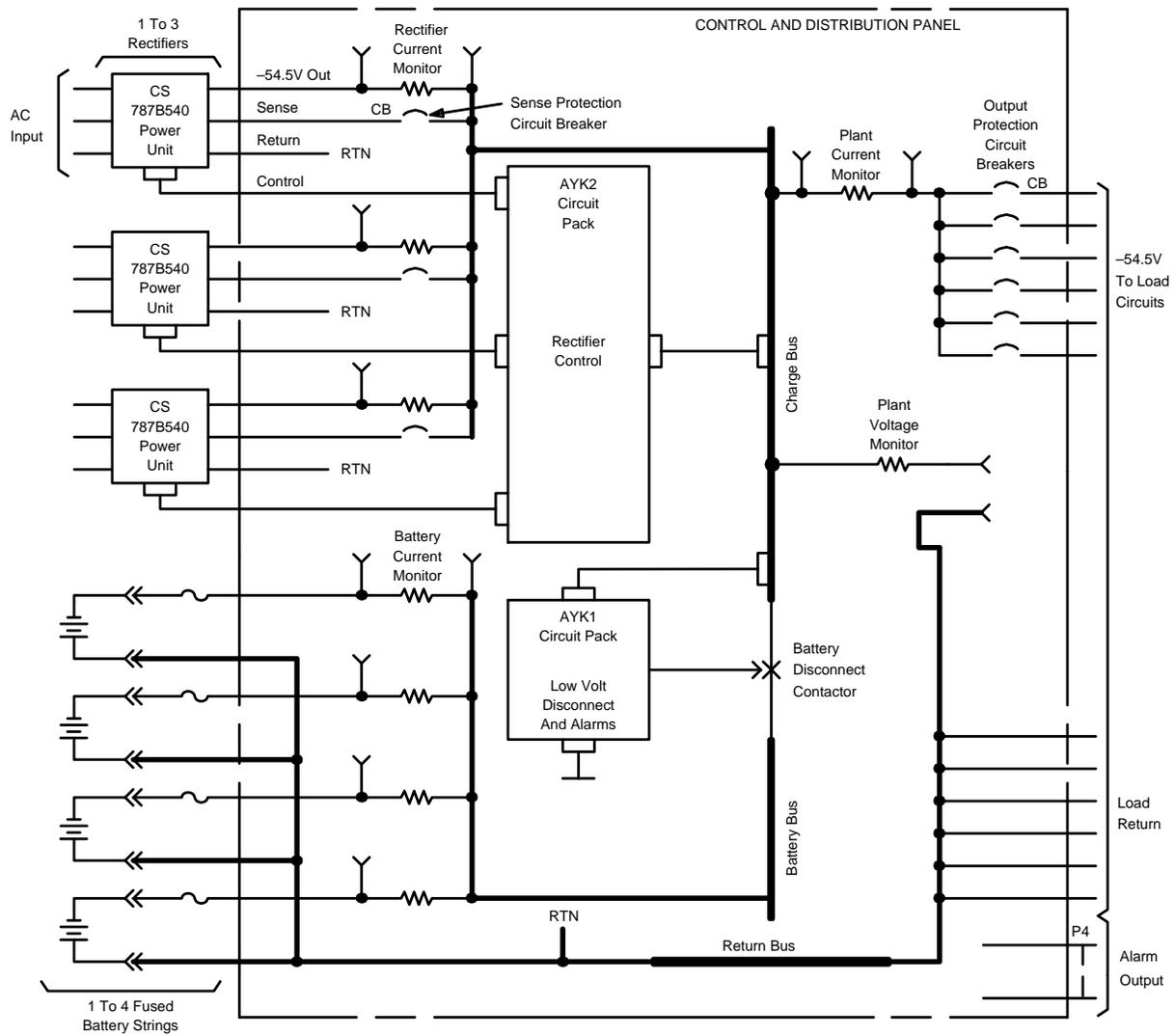
- rectifier plant
- control and distribution panel
- batteries.

The rectifiers, batteries, and load circuit breakers are connected to a common bus such that the batteries start supplying load current when the bus drops below the open circuit battery voltage. No switching is required.

(Continued on next page)

80E Cabinet (Continued)

Block diagram This is a block diagram of the 80E bulk power plant.



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80E Cabinet (Continued)

Power units

The rectifier plant consists of three plug-in, 25-amp, off-line switching (OLS) rectifiers placed on the rectifier shelf. The OLS rectifiers use high-frequency switching to allow the use of smaller and lighter weight components that results in a rectifier that is about one fourth the weight of the ferroresonant rectifiers. The OLS rectifier is 11.5 inches high by 5 inches wide by 8 inches deep.

Rectifier shelf

The ED-7C704-30,G1 rectifier shelf provides the mounting for the OLS rectifiers. The shelf is constructed from stamped sheet metal and has a front cover that folds down to provide a shelf to aid in the installation of the rectifiers. Three sets (one set for each rectifier) of connectorized cable assemblies (each set has three cables) are provided with the shelf.

Rectifiers

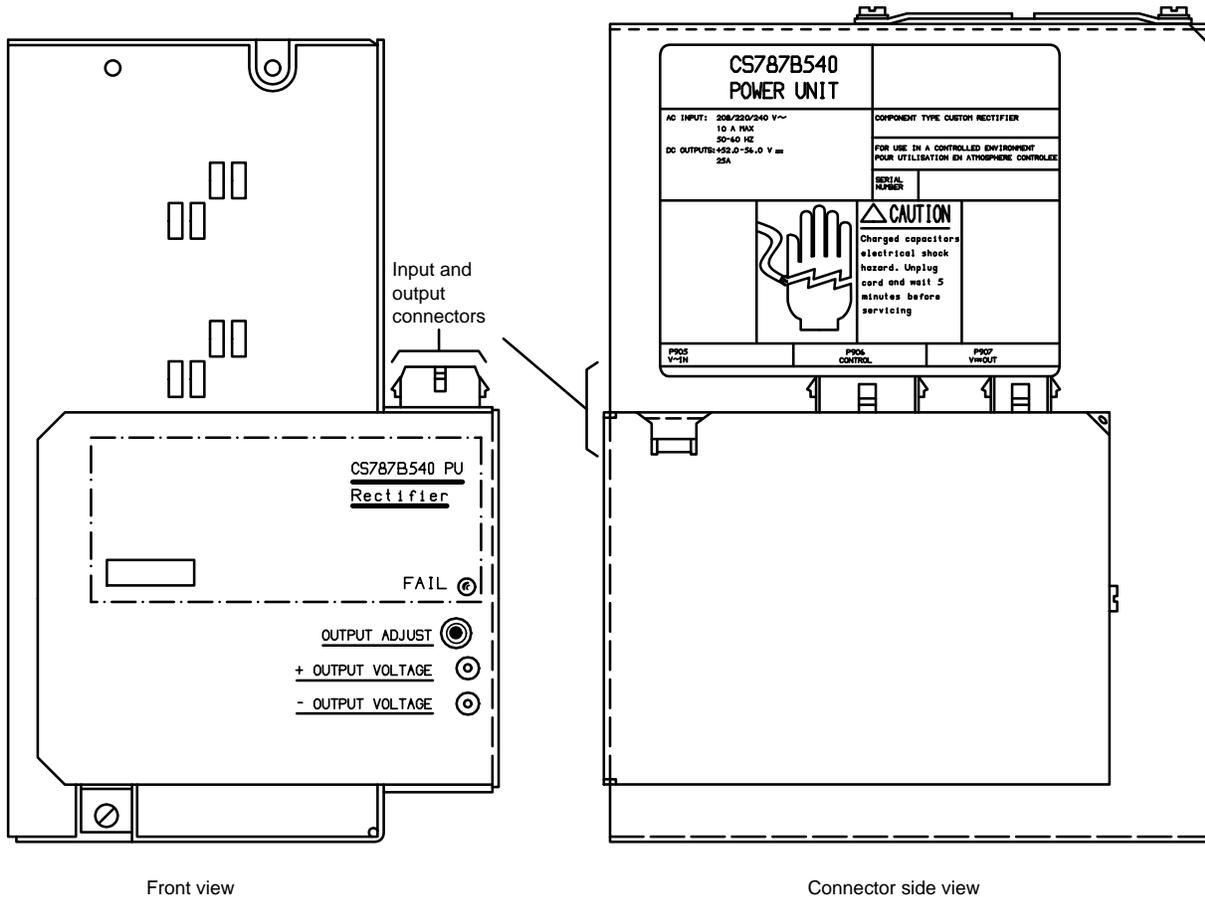
The rectifiers do not plug into a backplane. Each rectifier has panel-mounted connectors on the side of the unit, shown in the following figure, for plugging in the rectifier shelf cables. The cable assemblies connect the AC power input to the rectifier, control signals to/from the control and distribution panel, and DC power output from the rectifier to the bus in the control and distribution panel. A FAIL indicator on the front of the rectifier lights when the rectifier fails (because of low output voltage, fan failure, high output voltage shutdown, or loss of input AC power). On the front of the rectifier, a pair of OUTPUT VOLTAGE jacks allows the rectifier output voltage to be monitored. Refer to 363-005-227 data sheet for more detailed information.

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80E Cabinet (Continued)

Power unit illustrated

The figure below shows the 80E bulk power plant.



Front view

Connector side view

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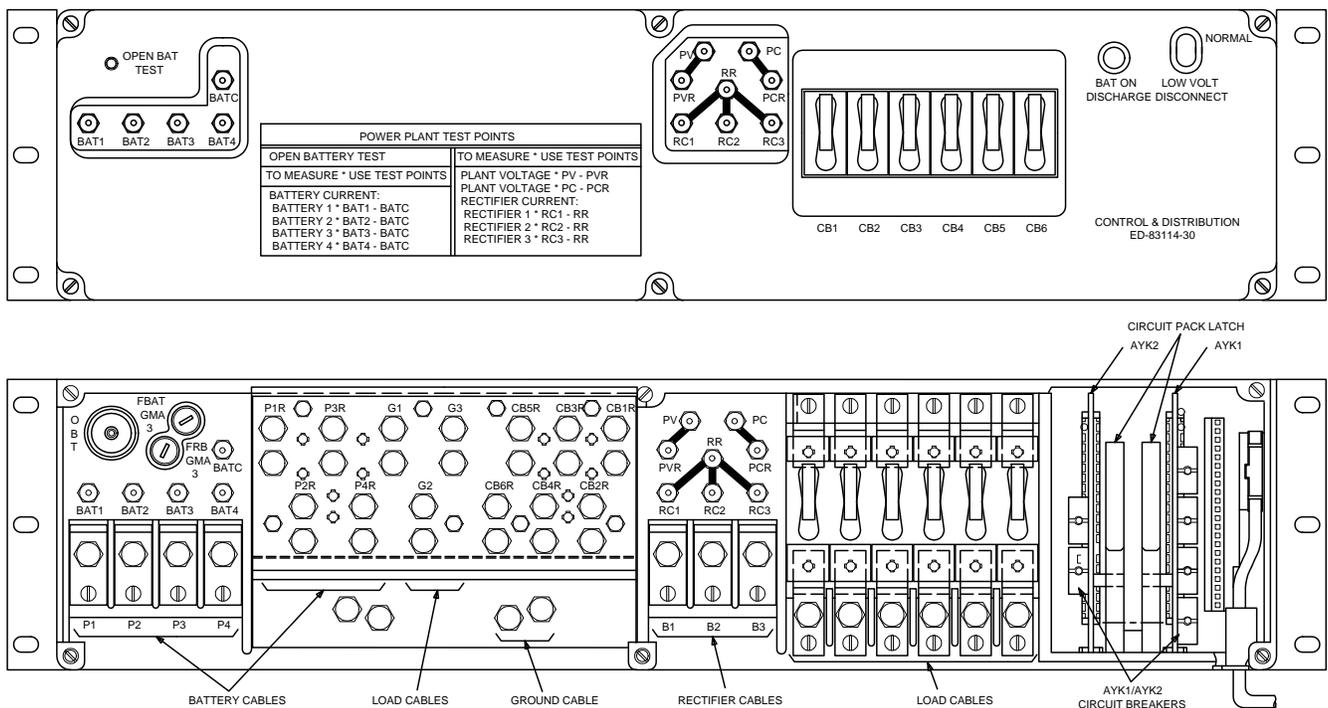
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80E Cabinet (Continued)

Control and distribution panel

The ED-83114-30,G1 control and distribution panel, shown below, is the heart of the bulk power system. It provides load termination and load circuit breakers, control of the rectifiers, displays and transmits alarms, and provides test jacks, battery termination, low-voltage battery disconnect, and an open battery test. The test jacks, indicators, and open battery test pushbutton are accessible through the panel cover. The panel cover may be opened for access to the control circuit packs and the rectifier cable and battery cable connections.

The AYK1 and AYK2 control circuit packs generate the minor and power minor alarms [see Chapter 4 and 363-005-224 (AYK1) and 363-005-225 (AYK2) data sheets for details on these circuit packs]. The alarms are sent via a connectorized cable to the 80E cabinet central interconnection panel (CIP) where they are distributed to the equipment bays.



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80E Cabinet (Continued)

Panel indicators

The indications displayed on the control and distribution panel are as follows:

NORMAL: This indicator (green) is lighted when the power plant is operating normally (no alarms).

BAT ON DISCHARGE: This indicator (yellow) is lighted when the power bus voltage drops below -51.5 volts (power minor alarm).

LOW VOLT DISCONNECT: This indicator (yellow) is lighted when the low-voltage disconnect contactor is released (minor alarm).

The test jacks allow monitoring of the following:

- Current to or from each battery string
- Plant current (the total current provided to the loads)
- Current provided by each rectifier
- Plant voltage.

The panel will terminate up to four battery strings. The battery supply and return cables with 125-amp in-line fuses are provided with the 80E-BP cabinet. The panel also has six 30-amp load circuit breakers.

The low-voltage battery disconnect feature will disconnect the batteries from the bus when the bus voltage drops below -42.5 volts. This prevents the batteries from being damaged by a deep discharge.

The open battery test ensures that each battery string is connected to the plant and can provide current to the plant. When the OPEN BAT TEST pushbutton is depressed, the rectifiers are turned off (internally using electronic control) as long as the button is held in. This causes all load current to be provided by the batteries, and the current from each string can be measured using the battery test jacks.

Battery plant

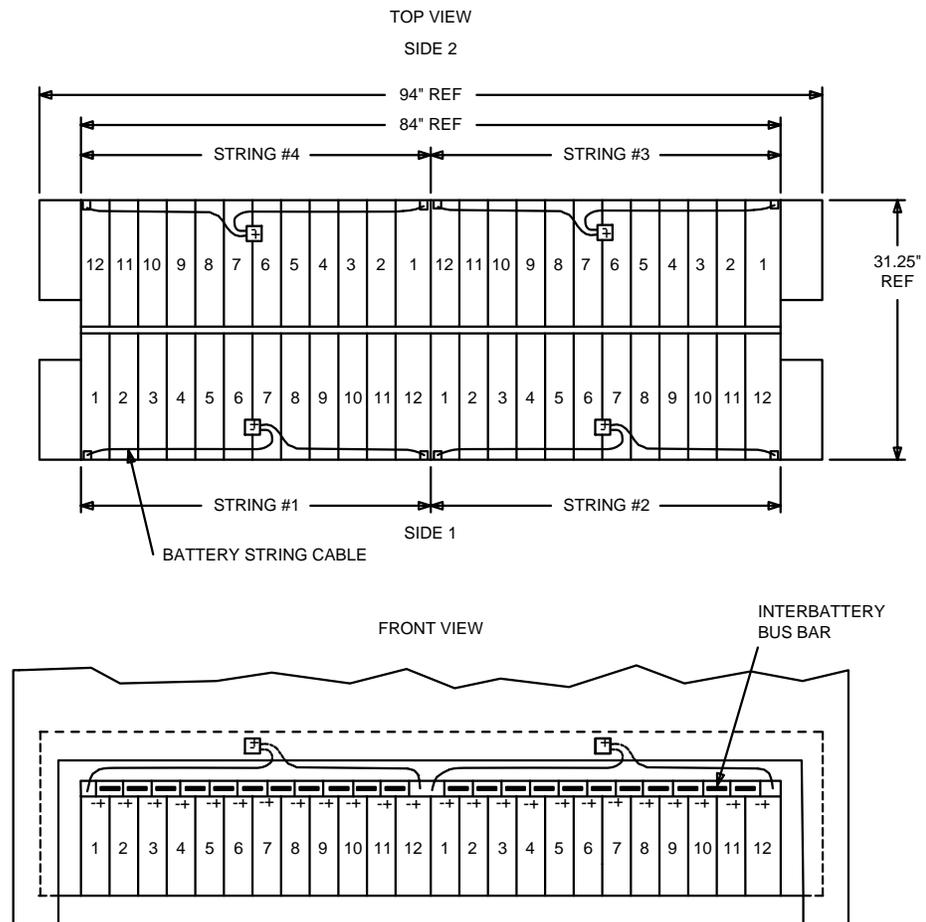
Up to 440 or 400 amp-hours of battery reserve (4 battery strings), in 110 or 100 amp-hour increments (in each string), may be installed in the 80E cabinet battery compartment. The battery string may be ordered with either the Lucent Technologies' Lineage 2000 VR series batteries or *CHLORIDE* 3VB11 batteries. An advantage of the Lucent Technologies' battery arrangement is that the battery terminals are in the front and easily accessible for installation and maintenance.

(Continued on next page)

80E Cabinet (Continued)

Lineage 2000 VR series batteries

The Lucent Technologies Lineage 2000 VR series batteries are 4 volt, 110 amp-hour (nominal) modules. There are twelve batteries in a -48 volt, 110 amp-hour battery string. The layout of the Lineage 2000 VR series battery is shown in the figure below. Adjacent batteries are connected with intermodule straps (or bus bars).



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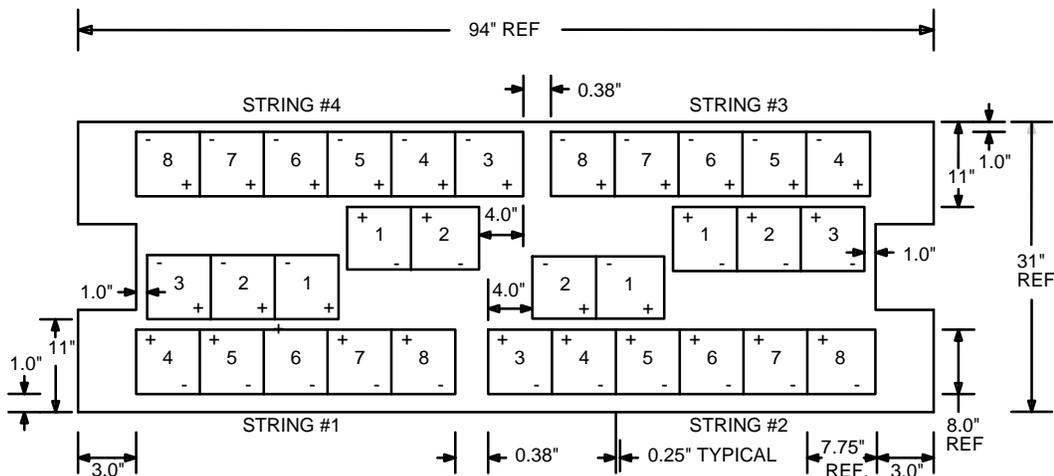
80E Cabinet (Continued)

CHLORIDE 3VB11 batteries The *CHLORIDE 3VB11* batteries are 6-volt, 100 amp-hour modules, with eight batteries in a -48 volt battery string. Adjacent batteries are connected with cable assemblies (part of Group 62). During installation, a battery cable assembly is installed on each terminal of the *CHLORIDE* battery. These cable assemblies allow the *CHLORIDE* batteries to be connected easily and safely after they are installed in the battery compartment.

A battery string cable (part of Group 62 or 63) is used to connect the entire battery string to the control and distribution panel. The connector on the cable is heavy enough to withstand the current surge that normally occurs when a partially discharged battery string is connected to an operating power plant.

Initially, if the cabinet is partially equipped, minimum equipment for powering may be ordered. When the cabinet is fully equipped, a rectifier and additional battery strings may be ordered to complete the power plant.

CHLORIDE 3VB11 battery layout This figure shows the layout of the *CHLORIDE 3VB11* batteries.



NOTE: DETAILS NOT SHOWN FOR CLARITY.

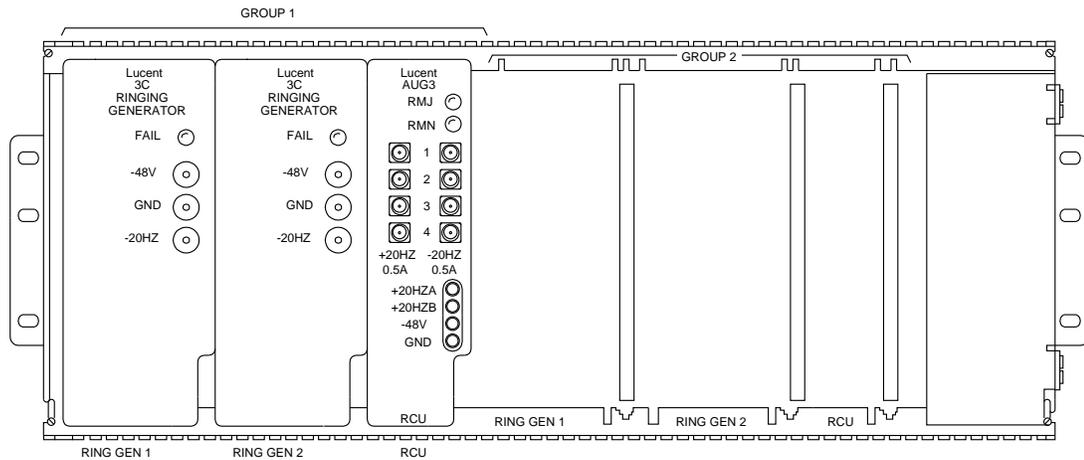
80E Cabinet Bulk-Ringing Arrangements

Description

A common ringing plant (developed for the 80E bulk power cabinet) allows the entire cabinet to be served by two ringing generators or optionally four ringing generators. It consists of the J1C182BC ring shelf, up to four 3C1 ringing generators, and up to two AUG3 ring control units (RCUs).

J1C182BC ring shelf

The ring shelf has two identical ringing systems, GROUP 1 and GROUP 2, shown in the figure below. Each group is equipped with two ringing generators and an AUG3 RCU (these units are detailed in the equipment description in Chapter 4).



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80E Cabinet Bulk-Ringing Arrangements (Continued)

Ringling arrangements

Ringling for the cabinet can be arranged two different ways at the customer's option. The arrangements are not part of a cabinet configuration; they are made by the customer by adding (or removing) circuit packs, changing connections to the ring shelf, and cutting (or adding) a strap on the central interconnection panel.

Ringling Capacity per Bellcore Specification TR-TSY-000057 — To meet Bellcore specifications, both groups of the ring shelf are equipped, and the connectors at the side of the shelf are installed (or moved) so that four dual channel banks are fed from each half of the shelf. Under normal conditions in this arrangement, a single ringling generator supports two dual channel banks or up to 384 lines.

This conservative specification assumes the following:

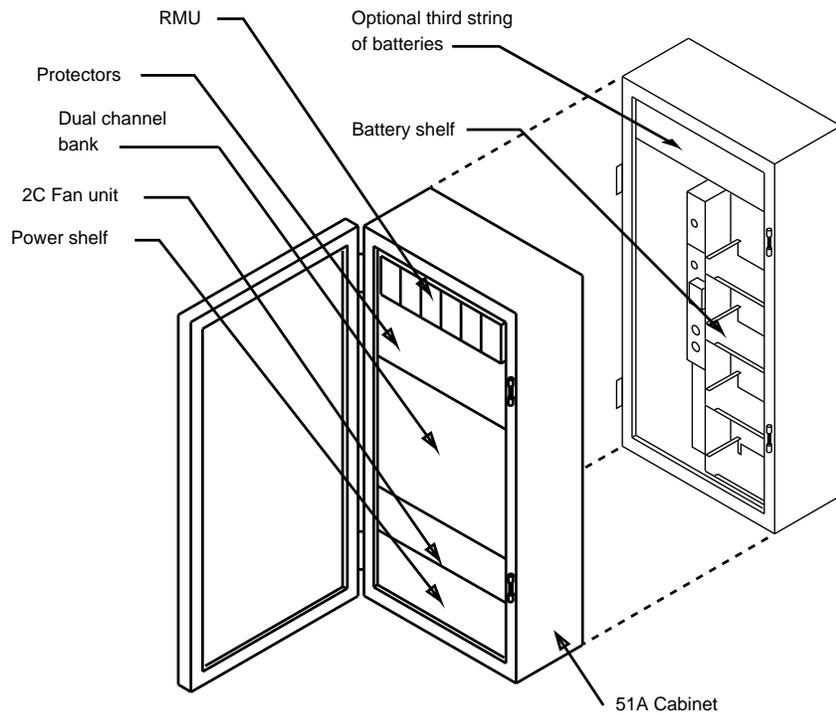
- call activity is 9 hundred call seconds/hour (CCS)
- probability of blocked ringling is 0.005
- each line has a 5 ringer equivalence number (REN) load
- average loop is 0 ohms
- no phased ringling at the central office.

Economical Arrangement for Ringling — For more economical operation, only the GROUP 1 side of the shelf is equipped so that two ringling generators support the entire cabinet. This is also a conservative arrangement, based on all assumptions in TR-57 except for the assumption that there is no phased ringling at the central office. Since most central offices use phased ringling to reduce peak ringling loads and since telephone numbers are assigned randomly, the economical arrangement should be suitable for most applications. If this arrangement does not provide enough ringling capacity, simply moving a connector plus equipping the other half of the shelf will provide the necessary capacity. A strap is cut on the CIP to provide the correct alarms for full ring shelf operation. See Chapter 4, *Equipment Description*, for a description of the ring shelf plug-ins.

51A Cabinet

Description

The 51A cabinet ED-7C601-30 consists of a weatherproof housing with framework for a Series 5 dual channel bank. The 51A cabinet, as shown below, has a front door, electronics section, and battery section. The sections are opened with the standard loop electronics Allen key-wrench (Part No. 840841324). A stub cable enters the cabinet through a cable entrance in the bottom of the utility section. Commercial AC power terminates on a control box that is part of the utility section. The cabinet has external dimensions of 29.0 by 20.5 by 48 inches and is available in green or beige/brown.



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51A Cabinet (Continued)

Configurations

The 51A cabinet holds one Series 5 dual channel bank (two systems) and associated equipment. The dual RT channel bank assembly, power shelf, protector block assemblies, protector units, fan unit, and 181A/181B apparatus mountings are connectorized and factory mounted in the cabinet. An additional 181A/181B apparatus mounting may be ordered for a third battery string. This cabinet requires a separate interface closure (feeder distribution interface or site interface unit).

Items that must be ordered separately

The Series 5 ordering guide lists various equipment and apparatus items that must be ordered separately. These items include:

- the load distribution unit (LDU)
 - 336A1 power units
 - 337A1 battery chargers
 - 3B1/3C1 ringing generators
 - battery packs
 - channel bank plug-in circuit packs.
-

Mounting arrangements

The cabinet is pole mounted using AT-8783 metal crossarms or is mounted directly to a pole with a channel hanger supplied with the cabinet. The AT-8783B crossarm will mount one 51A cabinet and the AT-8783C will mount three 51A cabinets. In addition, the cabinet can be pedestal mounted on a concrete pad using an AT-8812B pedestal base. The concrete pad must be contracted locally and built per ED-1T210-01 and ED-1T212-01 (38-Y-4055).

Powering

The 51A cabinet is available in a distributed power arrangement that includes the power shelf and battery shelves.

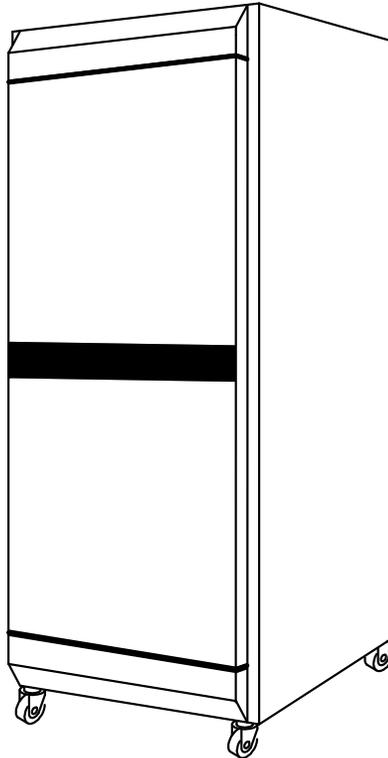
90-Type Business Remote Terminal

Description

The 90-type cabinets house Series 5 components and the DDM-2000 or DDM-1000 multiplexer to provide both digital loop carrier and fiber multiplexer capabilities.

The 90A business remote terminal (BRT) (ED-7C699-30) is *UL* recognized and designed to be placed at the customer's location. It provides a convenient way to bring all the DDM-1000/DDM-2000 multiplexer and Series 5 system features directly to the customer's location.

The cabinet, shown in the figure below, has dimensions of about 77 inches high (including castors), 29 inches wide, and 30 inches deep. Access is through lockable front and rear doors. The AC power is supplied to the cabinet via one 20-amp, 120-volt AC power National Electrical Manufacturers Association (NEMA)-type extension cord. The 90A cabinet contains 66-type connecting blocks that provide a termination point for overhead telemetry and alarm pairs.



(Continued on next page)

90-Type Business Remote Terminal (Continued)

Information resources

Refer to the following documents for additional information:

- 363-205-000, *SLC Series 5 Carrier System Ordering Guide*.
 - 626-500-115, *90-Type Cabinets (Satellite and Hub) Coding Scheme and Ordering Information*.
-

RT Enclosures

Housings for Series 5 RT bays

The controlled environment vault (CEV) and concrete hut are used to house Series 5 RT bays.

AC-powered RT equipment arrangements

With distributed power (AC-powered RT frames), the following equipment arrangements may be used:

- ED-7C630-30 concrete hut
 - ED-7C631-30 equipment platform for 16-foot CEV
 - ED-7C632-30 equipment platform for 24-foot CEV
 - ED-7C633-30 electronic equipment enclosure (EEE).
-

DC-powered RT equipment arrangements

With bulk (DC) powering, equipment arrangements are as follows:

- ED-7C681-30 concrete hut
- ED-7C682-30 equipment platform for 16-foot CEV
- ED-7C683-30 equipment platform for 24-foot CEV
- ED-7C684-30 EEE.

The drawings listed above for bulk power include metallic and fiber arrangements. Line capacity depends on the enclosure and the arrangement. A bulk power arrangement usually accommodates more systems per frame than the distributed power arrangement. The Series 5 ordering guide describes the available options and lists the Lucent Technologies' documents for RT enclosures.

(Continued on next page)

RT Enclosures (Continued)

Capacities table



NOTE:

The system capacity listed in the table is the maximum number of Series 5 96-line systems for the enclosure. Numbers in parentheses reflect capacity using bulk power.

Type of Enclosure	Metallic T1			Lightguide		
	Dual Channel Banks	Systems	Lines	Dual Channel Banks	Systems	Lines
51-Type Cabinet	1	2	192	—	—	—
80A-BP [†] Cabinet	3	6	576	2	4	384
80D-DP Cabinet	4	8	768	3	6	576
80D-BP [†] Cabinet	—	—	—	1 [†]	2 [†]	192 [†]
	(6)	(12)	(1152)	(5)	(10)	(960)
80E-DP Cabinet	6	12	1152	5	10	960
80E-BP Cabinet	(8)	(16)	(1536)	(7)	(14)	(1344)
90A Cabinet	2	4	384	1	2	192
	—	—	—	2	4	384
Concrete Hut	16	32	3072	14	28	2688
	(18)	(36)	(3456)	(15)	(30)	(2880)
Controlled Environment Vault (CEV) 16-foot	20	40	3840	18	36	3456
	(22)	(44)	(4224)	(21)	(42)	(4032)
Controlled Environment Vault (CEV) 24-foot	30	60	5760	28	56	5376
	(39)	(78)	(7488)	(34)	(68)	(6528)
Electronic Equipment Enclosure (EEE)	36	72	6912	36	72	6912
	(39)	(78)	(7488)	(39)	(78)	(7488)

[†]Also available with heat exchanger (HX).

[†]Capacity of an 80D-DP cabinet equipped with a DDM-2000 lightwave multiplexer. Other configurations with additional dual channel banks are available.

Controlled Environment Vault (CEV)

Description

The CEVs are precast concrete enclosures designed for below ground installation. Their function is to provide an environmentally controlled facility to house the ED-7C631-30 and ED-7C632-30 equipment platforms (for distributed power), ED-7C682-30 and ED-7C683-30 equipment platforms (for bulk power), and cable associated with the Series 5 system.

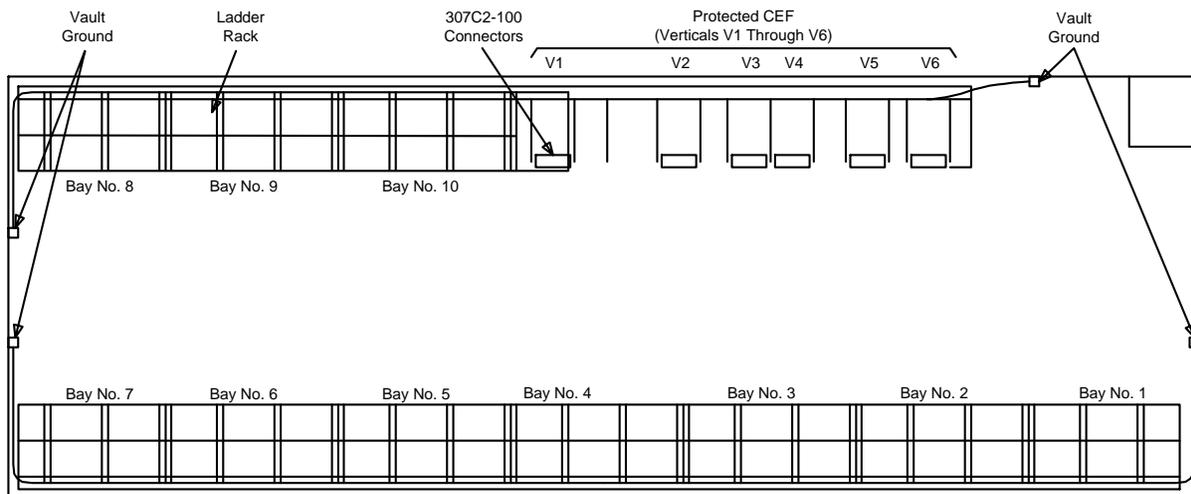
The 16-foot CEV may be ordered as the KS-23038 CEV. The description, installation, and operation and maintenance of the CEV are covered in 622-506-050, 622-506-050, 622-506-225, and 622-506-226.

Equipment platform described

The equipment platform is a preassembled modular unit that is shipped to the site of a CEV installation and placed in the CEV using a crane. The floor of the platform is a structural section on which 7-foot equipment bays may be mounted. The bays are joined together with structural members to form a modular unit that can be shipped by truck and handled with a crane or forklift.

Equipment platform illustrated

This figure provides a top view of the CEV equipment platform (CEP) ED-7C631-30 form distributed power.



(Continued on next page)

Controlled Environment Vault (CEV) (Continued)

Equipment platform configurations

There are two sizes of platforms: the 16-foot ED-7C631-30 and ED-7C682-30, and the 24-foot ED-7C632-30 and ED-7C683-30. The 16-foot platform is capable of housing up to 40 Series 5 system remote terminals (10 frames with up to 4 systems per frame). The 24-foot platform is capable of housing up to 60 Series 5 remote terminals (15 frames with up to 4 systems per frame). The platform provides fully connectorized cabling from the channel banks to the outside plant cables.

363-205-000, provides ordering information for the equipment platforms. The description, installation, operation and maintenance of the equipment platform are covered in 640-250-251, 640-250-248, and 363-205-100.

Powering

The CEV enclosure may be configured for distributed power or bulk power depending on the equipment platform.

Electronic Equipment Enclosure

Description

The maxi-hut is a 10-foot by 20-foot transportable building used to house *SLC 96* and/or Series 5 RT equipment. It is insulated and environmentally controlled. It can house twenty 2-foot 2-inch by 7-foot equipment bays. The maxi-hut can be precabled for up to 72 Series 5 systems. It uses the AT-9049 protector and cable enclosures with 307-type connectors to provide cable entrance and outside plant protection.

Heater option

The maxi-hut has an optional heater. This heater should be ordered for areas having possible outside ambient temperatures below 15° F. The hut heater is needed to maintain the minimum battery temperature and is an alternative to powering each individual battery heater on the 181A/181B apparatus mounting.

Information resources

Refer to ...	For information on ...
ED-97982-01	building transportation, site preparation, and building installation
ED-7C671-01	foundation plan for the maxi-hut
363-205-000	ordering information
363-099-028TD (CIR)	additional information

Concrete Hut

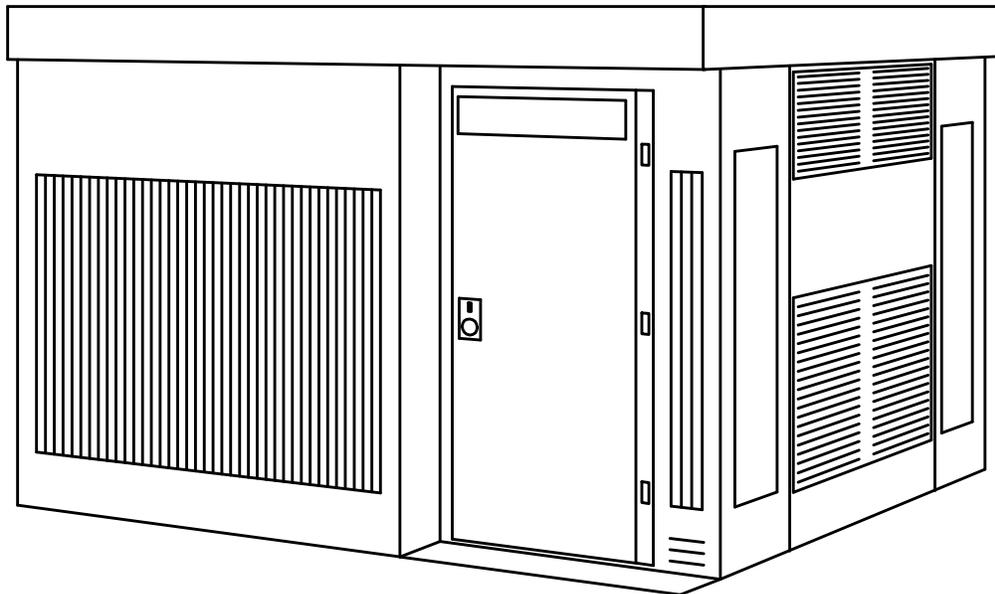
Description

The concrete hut is capable of housing 32 Series 5 frame-mounted remote terminals (8 frames - four 96-line systems per frame). The concrete hut enclosure is a building 8 feet high, 6-3/4 feet wide, and 12 feet long. It is factory assembled and placed over a previously constructed foundation of crushed rock.

The concrete hut may be ordered from the Series 5 ordering guide as a completely preassembled unit equipped to accept Series 5 systems. For applications not covered by the ordering guide, KS specifications can be used to order the unequipped concrete enclosure in simple form as the KS-22942 concrete enclosure (basic hut). For additional information on the concrete hut, see 622-500-235, 622-506-235, 802-001-190, and 915-700-100.

Illustration

The ED-7C630-30 concrete hut is shown in the figure below.



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Introduction

Chapter organization

The information in this chapter is organized as follows:

- End-to-end channel unit compatibility — gives end-to-end compatibility of the Series 5 channel units with other Series 5 channel units (in universal Series 5 systems), *SLC*[®] 96 channel units [in enhanced Feature Package B (FPB) systems], and D4 channel units [in enhanced FPB systems and in the integrated network access - remote terminal (INA-RT)].
- Channel unit services and applications — provides a brief description of the features of various types of services. Channel provisioning is described in this section under designed special services.
- Integrated features — describes the switch-related features associated with services in an integrated system
- Channel unit description — describes the physical characteristics of the channel units including option switches, indicators, jacks, etc. (channel provisioning is described in the designed special services section.

(Continued on next page)

Introduction (Continued)

Chapter organization (continued)

- Channel units for *SLC-2000* multi-services distant terminal (MSDT) applications — describes applications and operation of the MSDT channel units.
 - Channel unit placement rules — describes channel slot restrictions on channel units in INA-RT, enhanced FPB Mode 2 systems, and integrated services digital network (ISDN) circuits.
-

Chapter resources

For additional information, see the following:

- Series 5 channel unit data sheets — give detailed channel unit operation and physical description.
 - 915-710-115, *SLC Series 5 Carrier System, Application Engineering, Facility Design Systems* — contains applications guidelines for using the POTS, *SPOTS*[®] and M *SPOTS* units, coin, multiparty, frequency selective ringing (FSR), and direct inward dial (DID) channel units.
 - 915-710-116, *SLC Series 5 Carrier System, Channel Unit Application and Prescription Setting* — contains engineering guidelines for the dual ringing repeater, 2-wire special service (AUA42, AUA43), 4-wire voice-frequency (VF) special service, and dataport channel units.
 - 363-099-107IR customer information release (CIR) — contains circuit design guidelines for the 2-wire private line auto ring (PLAR) channel unit.
-

Series 5 Channel Unit Data Sheets

Data sheet table The following table provides detailed operation and physical descriptions for the Series 5 channel units.

Unit Code (Note 1)	Description	End Use	Data Sheet (Note 2)	Application			
				FPB	FPC	FP303	INA-RT
AUA25()	M SPOTS® Unit	RT	124	X	X	X	
AUA26	POTS with Derived Channel Alarm	COT	127		X		
AUA27	POTS with Derived Channel Alarm	RT	128		X		
AUA33	Coin	COT	103		X		
AUA34()	DS0 Dataport	COT	104		X		
AUA35	Multiparty	COT	109		X		
AUA36()	DID [Dial Pulse Originate (DPO)]	COT	114		X		
AUA37()	Frequency Selective Ringing(FSR)	COT	121		X		
AUA38()	Single Party POTS	COT	118		X		
AUA39()	SPOTS Unit	COT	120		X		
AUA41()	4W1 4-Wire VF	COT/RT	105	X	X		X
AUA42()	E SPOTS Unit	COT/RT	106	X	X		X
AUA43()	E SPOTS Unit	COT/RT	107	X	X		X
AUA44	4CS 4-Wire VF	COT/RT	108	X	X	X	X
AUA45()	Dual Ringing Repeater	COT/RT	123	X	X	X	X
AUA52()	Office Channel Unit (OCU) Dataport	COT/RT	111	X	X	X	
AUA53	Coin	RT	112	X	X	X	
AUA54()	4EM 4-Wire VF	COT/RT	113	X	X		X
AUA55()	Multiparty	RT	116	X	X	X	
AUA56()	DID [Dial Pulse Terminate (DPT)]	RT	115	X	X	X	X
AUA57	FSR	RT	122	X	X	X	
AUA58()	Single Party POTS	RT	117	X	X	X	
AUA59()	Single Party POTS/SPOTS	RT	119	X	X	X	
AUA75	Private Line Auto Ring (PLAR)	COT/RT	132	X	X	X	
AUA90	ISDN T-BRITE (CCITT Std. T Interface)	RT	129	X			X
AUA92	ISDN BRITE II (ANSI Std. U Interface)	COT	130		X		
AUA93	ISDN BRITE II (ANSI Std. U Interface)	RT	131	X			
AUA94	ISDN UDSL (ANSI Std. U Interface)	RT	135			X	

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Series 5 Channel Unit Data Sheets (Continued)

Data sheet table (continued)

Unit Code (Note 1)	Description	End Use	Data Sheet (Note 2)	Application			
				FPB	FPC	FP303	INA-RT
AUA141	4W1 4-Wire VF	COT/RT	300	X	X		X
AUA142	E <i>SPOTS</i> Unit	COT/RT	301	X	X		X
AUA150	POTS and <i>SPOTS</i> Unit	RT	133	X	X	X	
AUA158()	POTS	RT	303	X	X	X	
AUA159()	<i>SPOTS</i>	RT	304	X	X	X	
AUA178	C-POTS Channel Unit	RT		X	X	X	
AUA179	ALIC5	RT	311	X			
AUA200	<i>Datapath™</i> Extension DPX	RT	313	X	X	X	
AUA232	RS232 DP	COT/RT	312	X	X	X	
AUA406	6 to 24 DS0 Channels	RT	273				SLC-2000 MSDT Server
AUA408	6 to 24 DS0 Channels	RT	274				SLC-2000 MSDT Server

Notes:

1. Refer to 363-205-000 Series 5 Ordering Guide for availability.
2. Series 5 data sheets are 363-005-101 through 363-005 302.

Channel unit service features

The Series 5 system offers a wide range of services with few channel units compared to other transmission systems (for example, a D4 channel bank).



NOTE:

Several channel units have options that must be set before service can be provided. Some units have manual option switches; the others are provisioned with the craft interface unit (CIU). See Channel Provisioning under Channel Unit Services and Option Setting under Channel Unit Description in this chapter.

(Continued on next page)

Series 5 Channel Unit Data Sheets (Continued)

Channel unit service features (continued)

Many of the VF channel units provide service in the carrier serving area (CSA) (see Chapter 7). These channel units may serve loops extending beyond the CSA, with possible performance limitations. The CSA concept is to deploy special services without extra transmission treatment. Channel units that take advantage of the CSA concept include *SPOTS* and M *SPOTS* channel units, DID, E *SPOTS* units, and ISDN basic rate interface transmission extension (BRITE II) channel units. Some VF channel units provide service beyond the CSA, including POTS, multiparty, FSR, coin, dual ringing repeater, PLAR, ISDN T interface basic rate interface transmission extension (T-BRITE), and the 4-wire VF special service channel units. Often, the 4-wire VF special service channel units are used in 2-wire applications requiring extended range.

End-to-End Channel Unit Compatibility

Compatibility between SLC-96 and Series 5 channel units

Compatibility of Series 5 special service channel units end-to-end (universal Series 5 system) is given in 915-710-116. The table below lists the *SLC* 96 channel units and the compatible Series 5 channel units for basic telephone service in universal enhanced FPB applications. Special services from the Series 5 enhanced FPB remote terminal (RT) are provided by installing compatible D4 channel units in the *SLC* 96 central office terminal (COT) at the other end of the system. These Series 5 channel units are compatible with D4 channel units for the functions listed in the table in the next section.

SLC-96 and Series 5 compatibility table

This table list the *SLC* 96 carrier COT channel units and compatible Series 5 RT channel units.

Function	SLC® 96 COT*	Series 5 RT
POTS	WP10()	AUA25() AUA27 AUA58() AUA59 AUA150 AUA151 AUA158() AUA159 AUA178 AUA179
Coin	WP12	AUA53
Multiparty	WP11	AUA55()
Frequency Selective Ringing	WP33	AUA57
SPOTS® Unit	WP36	AUA25() AUA150 AUA151 AUA159() AUA179
DID	WP42/43	AUA56

* D4 channel units are not listed here. See the next table.

(Continued on next page)

End-to-End Channel Unit Compatibility (Continued)

Compatibility between D4 and Series 5 channel units

The following table lists the D4 channel units and corresponding Series 5 channel unit function codes. The D4 channel units listed provide special services when paired with the proper Series 5 channel unit in INA-RT or enhanced FPB applications.

D4 and Series 5 compatibility table



NOTE:

Compatibility means that the D4 channel unit is in a distant terminal connected to the Series 5 terminal by a digital line (for example, in a SLC 96 COT; in a D4 bank connected to a Series 5 INA-RT.)

D4 Channel Unit	D4 Code J98726()	D4 CLEI Code	D4 Function	Series 5 Function Code
				AUA41 - FXS
4FXO	SC	D4CX6	4-Wire Foreign Exchange, Office End	
4TDM	SF	D4CE5	4-Wire Tandem	
2FXO	BE	D4CX2	2-Wire Foreign Exchange, Office End	
2FXO/LS	BL	D4CX8	2-Wire Foreign Exchange, Loop Start	
2FXO/GT	SK	D4CX4	2-Wire Foreign Exchange with Gain Transfer	

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End-to-End Channel Unit Compatibility (Continued)

D4 and Series 5 compatibility table (continued)

D4 Channel Unit	D4 Code J98726()	D4 CLEI Code	D4 Function	Series 5 Function Code
				AUA41 - DX4
DPO	BA	D4CD1	Dial Pulse Originate	
DPMO	BM	D4CD4	Dial Pulse Multifrequency Originate	
DPT	BB	D4CD2	Dial Pulse Terminate	
PLR	BN	D4CE7	Pulse Link Repeater	
SDPO	BH	D4CD3	Sleeve Dial Pulse Originate	
2DX/GT	SD	D4CE3	2-Wire Duplex with Gain Transfer	
2E&M	BJ	D4CE2	2-Wire E&M (900 Ohm)	
2E&M6	BT	D4CE6	2-Wire E&M 600 Ohm	
4DX	SE	D4CE4	Duplex	
4E&M	BC	D4CE10	4-Wire E&M	
4E&MER	BP	D4CE12	4-Wire E&M Extended Range	
4TDM	SF	D4CE5	Tandem	
				AUA42 - FXO
2FXS	BD	D4CX1	2-Wire Foreign Exchange, Station End	
2FXS/LS	BK	D4CX7	2-Wire Foreign Exchange, Loop Start	
2FXS/GT	SG	D4CX3	2-Wire Foreign Exchange with Gain Transfer	
4FXS	SB	D4CX5	4-Wire Foreign Exchange, Station End	
4TDM	SF	D4CE5	4-Wire Tandem	

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End-to-End Channel Unit Compatibility (Continued)

D4 and Series 5 compatibility table (continued)

D4 Channel Unit	D4 Code J98726()	D4 CLEI Code	D4 Function	Series 5 Function Code
DPO	BA	D4CD1	Dial Pulse Originate	AUA42 - DPT DPT
DPMO	BM	D4CD4	Dial Pulse Multifrequency Originate	
SDPO	BH	D4CD3	Sleeve Dial Pulse Originate	
2E&M	BJ	D4CE2	2-Wire E&M (900 Ohm)	
2E&M6	BT	D4CE6	2-Wire E&M 600 Ohm	
4DX	SE	D4CE4	Duplex	
4E&M	BC	D4CE10	4-Wire E&M	
4E&MER	BP	D4CE12	4-Wire E&M Extended Range	
4TDM	SF	D4CE5	Tandem	
2TO	SJ	D4C02	2-Wire Transmission Only	
4TO	SH	D4C01	4-Wire Transmission Only	
4ETO	SQ	D4C03	4-Wire Equalized Transmission Only	
2FXO	BE	D4CX2	2-Wire Foreign Exchange, Office End	AUA43 - FXS
2FXO/LS	BL	D4CX8	2-Wire Foreign Exchange, Loop Start	
2FXO/GT	SK	D4CX4	2-Wire Foreign Exchange with Gain Transfer	
4FXO	SC	D4CX6	4-Wire Foreign Exchange, Office End	
4TDM	SF	D4CE5	4-Wire Tandem	

(Continued on next page)

End-to-End Channel Unit Compatibility (Continued)

D4 and Series 5 compatibility table (continued)

D4 Channel Unit	D4 Code J98726(L)	D4 CLEI Code	D4 Function	Series 5 Function Code
				AUA43 - DPO
DPT	BB	D4CD2	Dial Pulse Terminate	
PLR	BN	D4CE7	Pulse Link Repeater	
2DX/GT	SD	D4CE3	2-Wire Duplex with Gain Transfer	
2E&M	BJ	D4CE2	2-Wire E&M (900 Ohm)	
2E&M6	BT	D4CE6	2-Wire E&M 600 Ohm	
4DX	SE	D4CE4	Duplex	
4E&M	BC	D4CE10	4-Wire E&M	
4E&MER	BP	D4CE12	4-Wire E&M Extended Range	
4TDM	SF	D4CE5	Tandem	
				AUA43 - TO
2TO	SJ	D4C02	2-Wire Transmission Only	
4TO	SH	D4C01	4-Wire Transmission Only	
4ETO	SQ	D4C03	4-Wire Equalized Transmission Only	
				AUA44 - FXO or TDS[A,B]
2FXS	BD	D4CX1	2-Wire Foreign Exchange, Station End	
2FXS/LS	BK	D4CX7	2-Wire Foreign Exchange, Loop Start	
2FXS/GT	SG	D4CX3	2-Wire Foreign Exchange with Gain Transfer	
4FXS	SB	D4CX5	4-Wire Foreign Exchange, Station End	
4TDM	SF	D4CE5	4-Wire Tandem	

(Continued on next page)

End-to-End Channel Unit Compatibility (Continued)

D4 and Series 5 compatibility table (continued)

D4 Channel Unit	D4 Code J98726()	D4 CLEI Code	D4 Function	Series 5 Function Code
				AUA44 - TDO[A,B]
2FXO	BE	D4CX2	2-Wire Foreign Exchange, Office End	
2FXO/LS	BL	D4CX8	2-Wire Foreign Exchange, Loop Start	
2FXO/GT	SK	D4CX4	2-Wire Foreign Exchange with Gain Transfer	
4FXO	SC	D4CX6	4-Wire Foreign Exchange, Office End	
4TDM	SF	D4CE5	4-Wire Tandem	
				AUA44 - TDO[C,D] or TDS[C,D]
DPO	BA	D4CD1	Dial Pulse Originate	
DPMO	BM	D4CD4	Dial Pulse Multifrequency Originate	
DPT	BB	D4CD2	Dial Pulse Terminate	
PLR	BN	D4CE7	Pulse Link Repeater	
SDPO	BH	D4CD3	Sleeve Dial Pulse Originate	
2DX/GT	SD	D4CE3	2-Wire Duplex with Gain Transfer	
2E&M	BJ	D4CE2	2-Wire E&M (900 Ohm)	
2E&M6	BT	D4CE6	2-Wire E&M 600 Ohm	
4DX	SE	D4CE4	Duplex	
4E&M	BC	D4CE10	4-Wire E&M	
4E&MER	BP	D4CE12	4-Wire E&M Extended Range	
4TDM	SF	D4CE5	Tandem	
				AUA45B
2RD/PLAR	SN	D4C23	Ringdown/Private Line Auto Ring	

(Continued on next page)

End-to-End Channel Unit Compatibility (Continued)

D4 and Series 5 compatibility table (continued)

D4 Channel Unit	D4 Code J98726()	D4 CLEI Code	D4 Function	Series 5 Function Code
				AUA52 - OCU
DS0DP	DA	D4DP1	Subrate DS0 Dataport	
DS056	DD	D4DP6	56 kb/s DS0 Dataport	
DS0DP	DH	D4DP8	All Rate DS0 Dataport	
				AUA54 - EM4 _ or PLR_
DPO	BA	D4CD1	Dial Pulse Originate	
DPMO	BM	D4CD4	Dial Pulse Multifrequency Originate	
DPT	BB	D4CD2	Dial Pulse Terminate	
PLR	BN	D4CE7	Pulse Link Repeater	
SDPO	BH	D4CD3	Sleeve Dial Pulse Originate	
2DX/GT	SD	D4CE3	2-Wire Duplex with Gain Transfer	
2E&M	BJ	D4CE2	2-Wire E&M (900 Ohm)	
				AUA54 - EM4 _ or PLR_
2E&M6	BT	D4CE6	2-Wire E&M 600 Ohm	
4DX	SE	D4CE4	Duplex	
4E&M	BC	D4CE10	4-Wire E&M	
4E&MER	BP	D4CE12	4-Wire E&M Extended Range	
4TDM	SF	D4CE5	Tandem	
				AUA56
DPO	BA	D4CD1	Dial Pulse Originate	
DPMO	BM	D4CD4	Dial Pulse Multifrequency Originate	
SDPO	BH	D4CD3	Sleeve Dial Pulse Originate	
				AUA75
2RD/PLAR	SN	D4C23	Ringdown/Private Line Auto Ring	

(Continued on next page)

End-to-End Channel Unit Compatibility (Continued)

ISDN and Series 5 compatibility table The table below lists the D4 channel units that are compatible with Series 5 channel units in ISDN applications.

<u>D4 Channel Unit Code</u>	<u>Description</u>	<u>Series 5 Unit Code</u>	<u>Description</u>	<u>Series 5 RT</u>
AHG13	BRITE	AUA90 [*]	T-BRITE	FPB, INA-RT
AHG18	BRITE II	AUA93 [†]	BRITE II	FPB

^{*} Provides CCITT standard T interface.

[†] Provides *ANSI* standard U interface.

Channel Unit Services and Applications

The central office end At the central office end of the system, a variety of equipment may be used to provide service.

For an..	The corresponding central office equipment is a..
INA-RT channel unit	D4 channel unit
Enhanced FPB RT channel unit	<i>SLC 96</i> COT channel unit or a <i>5ESS</i> [®] switch digital carrier line unit (DCLU)
Feature Package C (FPC) channel unit	Series 5 COT channel unit
FPC/AutoCut (FPC/AC) RT channel unit	Series 5 COT channel unit

How to choose the correct equipment In the following sections, the Series 5 COT channel units are listed when the COT and RT units are used as a pair (one code in the COT, a different code in the RT) to provide service. The COT channel unit operation is described when it differs significantly from the RT description.

 **NOTE:**
Because of the diversity of central office equipment, most of the descriptions in in the following sections are based on the RT channel units.

The table that lists the Series 5 channel units and gives the terminal each is used in, and the tables that list the channel units that are compatible with the Series 5 RT channel units were provided in the previous sections in this chapter. These tables and the system application can be used to determine what equipment may be used in the central office.

Basic Telephone Services — Automatic Level Compensation

Description

Automatic level compensation (ALC) is a relatively new feature that maintains a somewhat constant end-to-end loss over the expected population of cables and customer equipment. The end-to-end loss of a circuit containing an AUA158() POTS or AUA159() POTS/*SPOTS* channel unit is maintained within 4 to 8 dB for POTS applications and within 2 to 5 dB for locally switched special service applications. The AUA159() channel unit is placed in either the POTS or special services mode by selection of the corresponding mode for the *5ESS* line circuit: selecting the POTS mode of the switch causes the RT CU to operate in the POTS (4 to 8|dB) loss mode. Selecting the *SPOTS* mode causes the RT CU to operate in the special services (2 to 5 dB) loss mode. The AUA179 CU is an enhanced version of the AUA159() CU that provides ALC along with other capabilities. The AUA179 is described later in this chapter.

The AUA179 CU is an enhanced version of the AUA159C CU. It provides ALC along with other capabilities. The AUA179 is described later in this chapter.

The data sheet for the AUA158() CU is 363-005-303 and for the AUA159() CU is 363-005-304.

Single-party service

Single-party service is provided using the appropriate equipment at the central office with the following RT channel units:

- AUA58B/AUA158() POTS channel unit
- AUA150/AUA159() POTS and *SPOTS* unit
- AUA25B M *SPOTS* unit
- AUA179 ALIC5 unit.

(Continued on next page)

Basic Telephone Services — Automatic Level Compensation (Continued)

Single-party service (continued)

The RT POTS channel units are used in 2-wire single-party applications with loop-start supervision and with a loop range of 900 ohms plus the telset; fast forward disconnect is provided. The AUA58 has a fixed loss of 1 dB and the AUA158() has automatic level compensation (ALC) that provides variable loss ranging from 1.4 dB to 6.0 dB. In a universal Series 5 system, these channel units are used with the following COT channel units:

- AUA38 POTS channel unit
- AUA39 POTS and *SPOTS* unit.

The *SPOTS* and AUA179 ALIC5 CUs also provide POTS service, that is, locally switched loop start connections to residential and business telephones with "regular" connectivity to the public switch network. The AUA150 has a loop range of 1500 ohms plus the telset with a fixed loss of 0 dB and OSI protection. The AUA159() and AUA179 provide POTS service with ALC over loops ranging up to 900 ohms.

ALIC5 channel unit

The AUA179 channel unit is an *enhanced* version of the AUA159() automatic level compensation (ALC) CU. The AUA179 is *enhanced* by virtue of its capability to respond to a unique signal from a *5ESS* switch to disconnect itself from the tip and ring leads, and upon later removal of the signal, to restore normal operation. The data sheet for the AUA179 is 363-005-311. Refer to "System Application and Services" for additional information on ALIC5.

Calling party identification and on-hook transmission

Calling party identification (CPI) provides information about the caller to the called party before the called party answers. During the silent interval after the first ring, data is sent from the central office to the customer premises equipment (CPE).

On-hook transmission (OHT) allows data to be transmitted between the central office and the CPE using the voice path when it is idle. On-hook transmission supports CPI, meter reading, and energy management services.

The AUA158B, AUA159B, and AUA179 provide enhanced CPI performance by means of increased on-hook loss (that depends on loop range). Other CUs with OHT provide a fixed on-hook loss of either 4 dB or 5 dB.

(Continued on next page)

Basic Telephone Services — Automatic Level Compensation (Continued)

OHT Support This table lists the Series 5 channel units and their ability to support OHT.

COT Channel Units	RT Channel Units				
	AUA25() AUA59	AUA27	AUA58() AUA158() AUA178	AUA150 AUA159() AUA179	AUA43
AUA26	BD*	BD	BD	BD	—
AUA31	No	No	No	No	—
AUA32	No	No	No	No	—
AUA38					—
AUA39†	No	BD‡	BD‡	BD	—
AUA42()	—	—	—	—	BD
WP10	C → R§	C → R	C → R	C → R	—
WP10B	C → R	C → R	C → R	C → R	—
WP10C	C → R	C → R	C → R	C → R	—
WP10D	BD	BD	BD	BD	—
WP36	No	C → R	C → R	C → R	—
DCLU or IDCU in TR-08 Mode	POTS Service				
	BD	BD	BD	BD	—
	SPOTS Service				
	No	BD	BD	BD	—
IDCU, TR-303	No	BD	BD	BD	—

* BD in this table means OHT in both directions.

† If facing 5ESS® switch with loop start signaling, verify that the RANGE X option has been set to Y per 235-080-100, Div. 3, Section 1i, to assure proper ring trip. If facing any witch with ground start signaling, OHT will not be enabled unless the switch grounds the tip during OHT.

‡ Not recommended.

§ C → R in this table means OHT only in COT-to- RT direction.

(Continued on next page)

Basic Telephone Services — Automatic Level Compensation (Continued)

Multiparty or frequency- selective ringing

Two-wire multiparty service is provided using the appropriate central office equipment with the AUA55 RT channel unit. On-hook transmission is provided using the AUA35 multiparty channel unit in a Series 5 COT. Four- to eight-party service requires a positive ringing supply, which may be provided at the RT by the AUG1 positive ringing unit (PRU). The frequency selective ringing (FSR) applications use the AUA57 RT channel unit. Up to five-party service can be provided using the AUA37 FSR channel unit in a Series 5 COT. The multiparty and FSR channel units provide 2-party automatic number identification (ANI) (except when the AUA57 is used with a WP33 channel unit).



NOTE:

The AUA57 FSR channel unit has an option switch to select the ringing group; see Option Setting under Channel Unit Description in this chapter.

Coin service

Coin service is provided with the AUA53 channel unit in the RT and compatible equipment/apparatus at the central office (see End-to-End Channel Unit Compatibility and Channel Unit Services and Applications in this chapter). The coin channel unit provides coin-first service using ground-start signaling or dial-tone-first service using loop-start signaling. The coin channel unit is compatible with the 1C/2C-type and the 1D-type coin telephone sets.

2-wire locally- switched special services

The RT *SPOTS* CUs provide locally switched special service within a CSA environment, without requiring circuit design. These services include:

- *CENTREX* Service Lines
- PBX Trunks
- WATS Lines
- WATS Trunks
- DID Trunks
- Secretarial Lines.

PBX trunks generally use ground start; the other services use loop start signaling.

(Continued on next page)

Basic Telephone Services — Automatic Level Compensation (Continued)

2-wire locally- switched special services (continued)

Two-wire locally-switched special services use the following RT channel units:

- AUA150 POTS and *SPOTS* unit
- AUA25B M *SPOTS* unit
- AUA159() *SPOTS* unit
- AUA179 ALIC5 unit.

Two-wire locally-switched special service circuits may use either loop- or ground-start supervision. Open switching interval protection and slow forward disconnect are provided by the AUA150 and AUA25B; fast forward disconnect is provided by the AUA159() and AUA179. On-hook transmission and CPI support are given in the OHT support table supplied earlier in this chapter. The signaling on the digital line is compatible with TR-08. The AUA150 CU provides service in the carrier serving area (CSA). The AUA159() and AUA179 CUs with ALC also provide service in the CSA range. The ALC feature of these units maintains CO to CPE loss between 2 dB and 5 dB. The AUA25B M *SPOTS* channel unit was developed for economical short loop metropolitan applications for the same services. Range of this channel unit is specified in 363-005-124 data sheet. In a universal Series 5 system, these channel units are used with the AUA39 POTS and *SPOTS* channel unit in the COT.

Direct inward dial channel units

The direct inward dial (DID) trunk service uses the AUA56 channel unit in an RT in the carrier serving area. The DID channel unit is compatible with loop pulsing or battery and ground pulsing used for loop-reverse-battery signaling. In a tandem carrier arrangement, the DID channel unit is compatible with the AUA43 2-wire DPO special service channel unit (Series 5) or J98726BA 2-wire DPO channel unit (D4). In a universal Series 5 system, it is used with the AUA36 DID channel unit in the COT.

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Basic Telephone Services — Automatic Level Compensation (Continued)

POTS with derived channel alarm

Two channel units, the AUA26 (COT) and AUA27 (RT) provide single party loop start service in a *VerSuS* derived channel network. The *VerSuS* network provides vertical subscriber services including alarm service transport on POTS channels. Alarm signals are carried by a tone below the voiceband frequency and by in-band signaling. For alarm transport applications, the AUA26 and AUA27 channel units are used in Series 5 FPC systems. For POTS only applications, the channel units may be used in universal Series 5 enhanced FPB, FPC, or FP303 systems.

Basic Telephone Service — Designed Special Services

Channel units for special services

These channel units provide designed special services:

- AUA42 and AUA43 2-wire E *SPOTS* channel units
- AUA41, AUA44, and AUA54 4-wire channel units
- AUA34() and AUA52() dataport channel units
- AUA45B dual ringing repeater channel unit
- AUA75 PLAR channel unit.

Applications of these channel units are detailed in 915-710-116, Series 5 channel unit application and prescription setting. Applications for the 2-wire PLAR channel unit are also described in 363-099-107IR CIR.

Channel provisioning

The special service channel units (AUA16/AUA17, AUA34(), AUA41, AUA42, AUA43, AUA44, AUA45B, AUA52(), AUA54, and AUA75) have transmission and signaling options that must be set before service is provided.



NOTE:

The AUA45B (dual ringing repeater) and AUA75 (private line auto ring) have option switches that must be set manually before the channel unit is installed (see *Option Setting* under the *Channel Unit Description* in this chapter.)



NOTE:

Under ground start service conditions, the AUA45 and AUA75 may send continuous ringing toward the customer.

The other 2- and 4-wire special service channel units do not have physical option switches; instead, option information is stored in memory registers located on the channel unit. The channel units are programmed by the bank controller (the alarm display unit and the bank control unit), which stores a record of the options for each channel. Thus, the options can be programmed before (or after) the channel unit is installed.

(Continued on next page)

Basic Telephone Service — Designed Special Services (Continued)

Channel provisining (continued)

The craft interface unit (CIU) provides the interface for provisioning the channel units. The CIU plugs into the channel test unit (CTU) at the COT (or RT) to access the bank controller memory that stores the channel unit options. In a universal Series 5 system, the COT bank controller and the RT bank controller communicate via the data link. Thus, FPC RT and COT channel units can be provisioned from either end using the CIU. With enhanced FPB, CIU provisioning is available at the Series 5 enhanced FPB RT. Also, CIU access may be provided at a Digital Access Cross-Connect System II (DACS II).

2-wire nonlocally- switched special services

The E *SPOTS* channel units, AUA42 and AUA43, when used in the carrier serving area provide transmission and signaling for 2-wire nonlocally-switched special service circuits. The AUA42 and AUA43 may be provisioned for foreign exchange (FX), DID (dial pulse originate - DPO, or dial pulse terminate - DPT), or transmission only (TO) operation. In the foreign exchange mode, toll diversion (TD) and on-hook transmission (OHT) features are available. In the TO application, the AUA43 channel unit provides sealing current. Each 2-wire special service channel can be provisioned independently of the other.

Private line manual ringdown

The AUA45B dual ringing repeater channel unit provides 2-wire private line point-to-point manual ringdown service. In this application, pushing a button at the calling station generates ringing (AC) current to the channel unit. This signals the channel unit at the other end of the system, which responds by sending ringing toward the called station. Transmission is always enabled unless the channel unit is sending or detecting ringing.

The AUA45B channel unit detects and originates AC ringing on the T/R (tip/ring) interface. It will detect AC only or AC with DC superimposed ringing between 16 Hz and 33 Hz. Any AC signals greater than 40 Vrms across tip and ring are treated as ringing. The AUA45B will repeat the input timing of the ringing signal unless ringing is tripped by a DC closure on the T/R interface. Ringing can be tripped only during the ringing interval. The AUA45B incorporates a controllable loss feature, with the choice of 0 dB or 3 dB set by a board mounted switch for each channel. Loop range depends on how the 10 dB end-to-end loss objective is apportioned among all the circuit elements. See 915-710-116 for prescription setting guidelines.

(Continued on next page)

Basic Telephone Service — Designed Special Services (Continued)

Private line manual ringdown (continued)



NOTE:

The AUA45B channel unit has physical option switches that must be set before service is provided. Refer to *Option Setting* under *Channel Unit Description* in this chapter.

Private line auto ring (PLAR)

The AUA75 channel unit provides 2-wire private line point-to-point automatic ringing service. In this application, the channel unit detects off-hook at the calling station and sends the ringing code toward the called station. When the called station goes off-hook, the far-end (called) channel unit trips ringing and enables VF transmission.

The far-end (called) station rings at 2 seconds on and 4 seconds off until the channel unit detects off-hook (call answered). During the ringing, an audible ringback tone (generated by the far-end channel unit) is transmitted toward the calling station to alert the caller that the called station is being rung. When the called party answers (goes off-hook), ringing is tripped and a talk path is established between the two stations. At the conclusion of the call and after both stations are on-hook, the calling sequence can be repeated.

The AUA75 channel unit provides a loop-start interface to a customer station and detects negative superimposed ringing on the T/R (tip/ring) interface. On-hook transmission is provided in this unit, with an on-hook transmission loss of 3 dB in both receive and transmit directions. The AUA75 incorporates a controllable loss feature, with the choice of 0 dB or 3 dB set by a board mounted switch for each channel. Loop range depends on how the 10 dB end-to-end loss objective is apportioned among all the circuit elements. See 915-710-116 for prescription setting guidelines.



NOTE:

The AUA75 channel unit has physical option switches that must be set before service is provided. Refer to *Option Setting* under *Channel Unit Description* in this chapter.

Basic Telephone Service — Designed Special Services (Continued)

4-wire VF special services

Three Series 5 channel units, the AUA41 (current feed), AUA44 (current sink), and AUA54 (E&M signaling) provide 4-wire VF special services. Channel unit application is defined by the function code selected during provisioning. The Series 5 system 4-wire channel units serve a wide range of applications including most of the 4-wire functions provided by D4 channel units (as described in 915-710-116). The 4-wire VF channel units must be provisioned with the CIU before providing service.

The AUA41 4-wire channel unit is intended for use in circuits with loop-start, ground-start, or duplex signaling, and in private line data circuits with no signaling. In loop-start/ground-start (LS/GS) applications, the unit has the same functions as the D4 4FXS channel unit plus toll diversion; in duplex signaling applications, it performs like the D4 4DX channel unit. In private line data applications, the AUA41 is optioned for the transmission only (TO) function, with or without equalization, and functions like the D4 4TO or 4ETO channel unit. Equalization is provided only in the transmit direction. The AUA41 channel unit has a DC current feed interface for connecting to other transmission equipment or to cable terminated by other transmission equipment or a PBX.

The AUA44 channel unit can be used in circuits with loop-start, ground-start, or tandem signaling. In loop-start/ground-start applications, the unit functions like the D4 4FXO channel unit; in tandem applications the unit functions like the D4 TDM channel unit. The FXO function is selected for loop-start/ground-start applications where a 4-wire channel unit is required at the office end of a Series 5 loop-start/ground-start circuit or at the PBX end of a Series 5 off-premises station (loop-start) line. The AUA44 has a DC current sink interface for connecting to other transmission equipment or to cable terminated by other transmission equipment. Equalization is provided only in the transmit direction.

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.

(Continued on next page)

Basic Telephone Service — Designed Special Services (Continued)

4-wire VF special services (continued)

The AUA54 channel unit normally is used in the RT at a customer location. It may be used in the COT, but the AUA54 requires special connections to the COT backplane for the E&M leads. The AUA54 may interface with a PBX, automatic call distribution (ACD), or other transmission or signaling equipment located in the same building.

To allow more conventional design for tie trunk circuits, foreign exchange trunks, and off-premises station applications, a special wiring harness is available to provide access to the E&M leads in the COT. The ED-7C700-20 E&M cable assembly is fitted onto the four E&M-type COT backplane pins of all 12 channel unit slots of a digroup. This allows the E&M connections for the AUA44 and AUA54 channel units to be terminated at the distributing frame. 363-099-076IR CIR and SD 7C116-02 (issue 4B or later) contain detailed information on the ED-7C700-20 cable assembly.

Dataport services

The AUA52() office channel unit (OCU) may be used in the COT or RT to provide digital data service. In a universal Series 5 system, it is used in the RT with the AUA34() digital signal level zero (DS0) dataport channel unit in the COT. These channel units provide one channel of service in an end link of a Digital Data System (DDS) private line data circuit. The customer data rate may be 2.4, 4.8, 9.6, or 56 kb/s. The dataports must be provisioned before providing service. The OCU may be used in the COT or RT; the DS0 dataport is always used in the COT. With a Series 5 COT, the AUA3 office timing unit (OTU) is required for synchronizing the dataport channel units. The RT is loop-timed to the COT.

Basic Telephone Service — Integrated Services Digital Network (ISDN) Services

ISDN BRI defined The ISDN BRI (basic rate interface) is defined as 2B+D (two 64 kb/s B-channels and one 16 kb/s D-channel). The B-channels communicate digitized voice or data. The D-channel communicates control signaling and low-speed packet-switched data.

ISDN channel units The AUA90 channel unit provides three fixed time slots (2B+D). The AUA92 and AUA93 BRITE II channel units provide up to three time slots (B1, B2, and D) and four types of service (D-only, B1+D, B2+D, or 2B+D). An option switch is provided on the BRITE II channel units to select the type of service. In the Series 5 system, T-BRITE and BRITE II ISDN 2B+D service requires allocation of three time slots; this restricts the placement of these ISDN channel units. The AUA94 U-DSL ISDN channel unit has no placement restrictions. See Channel Unit Placement Rules in this chapter for placement restrictions on the AUA90 and AUA93 channel units.

AUA90 channel unit The AUA90 channel unit is a 4-wire channel unit. It is not provisionable and does not have option switches. The AUA90 channel unit provides an ISDN basic access T interface directly to a customer's ISDN terminal (TE1 - terminal equipment 1). The basic access T-interface does away with the need for an NT1 (network termination - layer 1) at the customer location. Point-to-point arrangements are allowed for customer terminals.

AUA92 channel unit The AUA92 channel unit is an Integrated Services Digital Network (ISDN) basic rate interface transmission extension (BRITE II) channel unit. The AUA92 is intended for use in *SLC*[®] Series 5 feature package C (FPC) central office terminal (COTs) equipped with an MC97755A1B bank control unit (BCU) — the COT must connect to an FPC or an FPC with autocut (FPC/AC) remote terminal (RT) equipped with an MC97776A1B BCU and an AUA93 BRITE II channel unit (see 365-005-131). The AUA92 provides an *ANSI* standard NT-mode U-interface for full duplex transmission to a local digital switch or to another carrier system (for example, a D4 bank, within the same central office). The U-interface 2B1Q signal provides a 4-level line code at a data rate of 160 kb/s (80k baud).

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Basic Telephone Service — Integrated Services Digital Network (ISDN) Services (Continued)

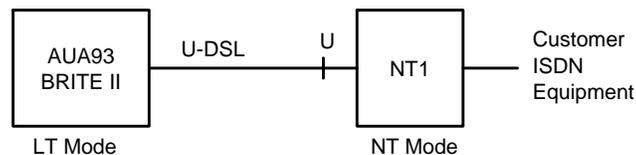
AUA93 and AUA94 channel units

The AUA93 BRITE II and AUA94 U-DSL are 2-wire channel units that comply with the T1.601-1988 American National Standards Institute for the U interface digital subscriber line (U-DSL). The AUA93 and AUA94 channel units provide ISDN basic access in the line terminating Mode (LT-Mode) to the NT1 (network termination - layer 1) at the customer location.

U-DSL with AUA93 channel unit

The digital subscriber line (DSL) is a technology that provides full-duplex service on a single twisted metallic pair at a high enough rate to support ISDN basic access and additional framing, timing recovery and operations functions.

The U interface is a reference point on the transmission line between the network termination (NT) (on the customer side) and the line termination (LT) (on the network side, for example, a channel unit). Thus, U-DSL refers to the physical and electrical connection between the LT and the NT. The NT1 is a device that terminates layer 1 [the BRITE II and U-DSL channel units use three layers for ISDN service: layer 1 (physical layer), layer 2 (data link layer), and layer 3 (network layer)]. The figure below illustrates the U-DSL with the AUA93 channel unit.



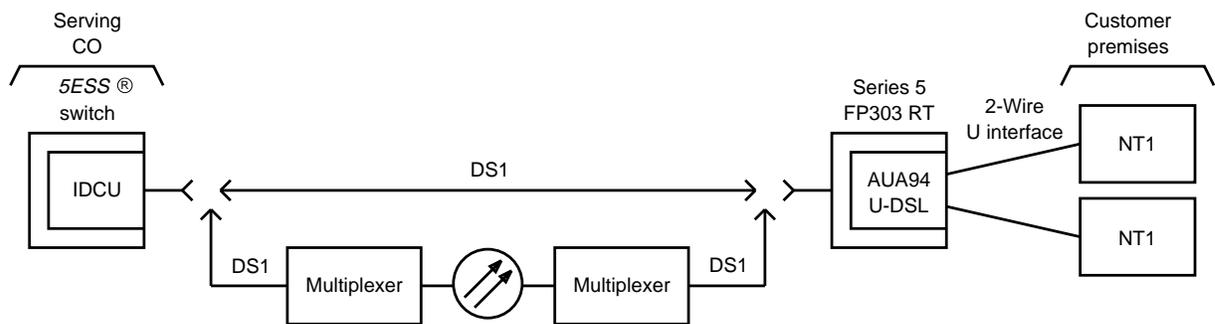
NT1 - Network termination - layer 1
U-DSL - U Interface Digital Subscriber Line
LT Mode - Line Termination Mode
NT Mode - Network Termination Mode
—+— - Reference Point (U Interface shown)

(Continued on next page)

Basic Telephone Service — Integrated Services Digital Network (ISDN) Services (Continued)

ISDN applications with AUA94 U- DSL channel unit

This diagram illustrates an ISDN application using the AUA94 U-DSL channel unit.



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Channel unit information resources

For more information on channel units see the appropriate data sheet listed below:

Channel Unit	Data Sheet
AUA90 T-BRITE channel unit	(363-005-129) and 363-205-106, AUA90 T-BRITE channel unit for ISDN, installation and maintenance
BRITE II channel units in FPC	(363-005-130 and 363-005-131) and 363-205-116, Feature Package C BRITE II channel unit installation and maintenance
AUA93 BRITE II channel unit	(363-005-131) and 363-205-107, AUA93 BRITE II (U Interface) channel unit for ISDN, installation and maintenance
AUA94 channel unit	(363-005-135) and 363-205-113, AUA94 U-DSL channel unit for ISDN, installation and maintenance

Channel Unit Description

Where to find information

This table provides channel unit and applications information sources.

Refer to ...	For information on ...
channel unit data sheets list at the beginning of this chapter	a detailed description of each channel unit
915-710-115	channel unit applications for POTS, <i>SPOTS</i> and M <i>SPOTS</i> units, coin, multiparty, FSR, and DID channel units
915-710-116	applications and prescription setting (provisioning) for the dual ringing repeater channel unit, 2-wire special service (E <i>SPOTS</i> units), 4-wire special service, and dataport channel units
363 division index for Loop Transmission Systems (363-000-000)	a list of CIRs available on Series 5 channel units

Channel Unit Description — Service Channel Capacity

Dual channel units The following channel units occupy one channel slot and provide service to two customers:

- AUA25B M *SPOTS* channel unit (RT)
- AUA26 (COT) and AUA27 (RT) POTS with derived channel alarm channel units
- AUA35 and AUA55 multiparty channel units
- AUA36 and AUA56 DID channel units
- AUA38 POTS channel unit (COT)
- AUA39 *SPOTS* channel unit (COT)
- AUA42 and AUA43 E *SPOTS* channel units
- AUA45B dual ringing repeater channel unit
- AUA58() POTS channel unit (RT)
- AUA75 dual PLAR channel unit
- AUA94 U-DSL ISDN (RT)
- AUA150 POTS and *SPOTS* channel unit (RT)
- AUA158() POTS channel unit (RT)
- AUA159() *SPOTS* channel unit (RT)
- AUA179 ALIC5 channel unit (RT).

Under certain conditions, the dual channel units may provide service only on one channel (usually the odd channel). This guideline applies in a Series 5 system with FPC when a 2- and 4-wire unit are used on the same channel; it applies also to 2-wire units in INA-RT Mode III and in an enhanced FPB RT when the far-end unit is a *SLC* 96 channel unit or D4 channel unit (See circuit design considerations in Chapter 7). The AUA36, AUA42, AUA43, and AUA56 channel units have a faceplate indicator that lights when either channel is busy. The other channel units have a busy indicator for each channel (ODD and EVEN).

(Continued on next page)

Channel Unit Description — Service Channel Capacity (Continued)

Dual channel units (continued)

The AUA25B, AUA26, AUA27, AUA35, AUA37, AUA38, AUA39, AUA45B, AUA55, AUA57, and AUA58(), AUA150, and AUA179 channel units have a faceplate jack that provides test access to the tip and ring on each channel. A test cord (Comcode 405525809) is required to plug into the jack. The AUA94 has FAIL indicator and a faceplate switch (**O/E**) that selects maintenance access to either the odd (O) or even (E) U-DSL of the channel unit. The AUA94 also has an RJ-45 faceplate jack that allows for manual testing of the channel unit with a 2B1Q line tester set for network termination (NT) mode operation.

Single-circuit channel units

The following channel units each provide one channel of service:

- AUA33 and AUA53 coin channel units
- AUA37 and AUA57 FSR channel units
- AUA41, AUA44, and AUA54 4-wire VF special service channel units
- AUA34() and AUA52() dataport channel units
- AUA90 and AUA93 ISDN channel units.

All these channel units except dataport use only the odd-numbered channel of the channel slot. The AUA33, AUA37, AUA53 and AUA57 have a faceplate indicator that lights when the channel is busy. The ISDN channel units provide one channel of service but use up to three time slots. The AUA90 and AUA93 have a **FAIL** indicator and a 15-pin test connector on the faceplate.

Channel Unit Description — Option Setting

Option setting

The AUA45B channel unit has three manual option switches; one switch is set to correspond to the channel unit location (COT or RT), the TRMT switch sets the channel loss for the transmit direction to 0 or 3 dB, and the RCV switch sets the channel loss for the receive direction to 0 or 3 dB. The AUA75 channel unit has four manual option switches; one switch is set to correspond to the channel unit location (COT or RT), the ODD and EVEN switches set the channel loss for the transmit and receive direction to 0 or 3 dB on each channel, and the D4/D3 switch selects the digital signaling compatibility (for both channels). The AUA57 (RT) FSR channel unit has an option switch to select the ringing group used by the central office; the BUSY light will flash if the switch is set improperly.

The E *SPOTS* units, 4-wire special service, and dataport channel units also have options that are set by provisioning. See *Channel Provisioning* under *Channel Unit Services and Applications* in this chapter.

There are no options or settings to be selected on POTS (including derived channel alarm units), *SPOTS* and M *SPOTS* channel units, coin, multiparty, COT FSR (AUA37), or DID channel units. The RT POTS and *SPOTS* channel units and M *SPOTS* unit automatically select the type of operation based on the channel unit installed at the COT. For the *SPOTS* and M *SPOTS* units, multiparty, DID, and coin channel units, transmission loss is fixed and signaling parameters are selected automatically by the channel unit. The AUA92 and AUA93 BRITE II ISDN units have board-mounted option switches to select the ISDN channel service.

Channel Unit Description — Office and Subscriber Interfaces

Cable

The RT POTS and *SPOTS* channel unit (AUA150) serves loaded and nonloaded cable as specified in 915-710-115, Series 5 system application engineering. The RT POTS unit (AUA58B), *SPOTS* units, DID, and E *SPOTS* channel units are designed to interface cable that conforms to carrier serving area (CSA) guidelines. The CSA design rules are detailed in RL82-02-207, IL83-09-095, and Bellcore AL-851-84/04-002. The M *SPOTS* units interface nonloaded cable within the distribution range specified in the chapter on VF plant beyond the RT in 915-710-115. The dual ringing repeater channel unit, multiparty, FSR, and 4-wire channel units, with two exceptions, are designed to serve loops beyond the CSA range. The two exceptions are the AUA52() dataport optioned for 56 kb/s data and the AUA54 E&M channel unit.

Equipment

The message channel units (POTS, coin, multiparty, and FSR), *SPOTS* units, and DID channel units at the COT normally interface with a switching machine. The E *SPOTS* channel unit at the COT normally interfaces transmission equipment or CSA cable on nonlocally-switched circuits. The AUA41 and AUA44 channel units typically interface cable to a foreign central office or to other transmission equipment. At the RT, E *SPOTS* channel units usually interface the customer's equipment either directly or through CSA cable. The 4-wire channel units normally interface customer equipment through cable or directly with customer equipment at the RT location; sometimes they may interface other transmission equipment. The AUA54 may interface with a PBX, ACD, or other transmission or signaling equipment located in the same building. The AUA54 is used in the J1C182AF RT (which has E&M signaling leads) at a customer location. If the COT has the E&M cable assembly (ED-7C700) installed, the AUA54 may be used in the COT (refer to 915-710-116).

Channel Units for SLC[®]-2000 Multi-Services Distant Terminal (MSDT) Applications

In the SLC-2000 MSDT

The SLC-2000 MSDT accepts a maximum of six Series 5 system dual channel units or SLC-2000 quad channel units that will provide a maximum of 12 or 24 channels, respectively.

Series 5 channel unit application in the SLC-2000 MSDT table

The Series 5 channel units supported in the SLC-2000 MSDT are listed in the following table.

<u>Channel Unit Code</u>	<u>Channel Unit Type</u>	<u>Services and Functions Provided</u>
AUA25B	M SPOTS [®] Unit	POTS, CENTREX service line, FX trunk, FX line, WATS trunk, WATS line, PBX-CO trunk, off-premises extension, secretarial line, Off-Premises Station (station end)
AUA27	POTS + VerSuS	POTS, VerSuS Alarm Transport
AUA38	POTS CS* + OHT	Off-Premises Station (PBX end)
AUA39	POTS and SPOTS Unit CS + OHT	Off-Premises Station (PBX end)
AUA41	4W VF CF [†]	DX4: PBX tie trunk, DX signaling, normal or reverse polarity FXS: Foreign exchange line or trunk, no toll diversion, loop- or ground-start, normal or reverse polarity FXT: Foreign exchange trunk, toll diversion, loop- or ground-start, normal or reverse polarity TO: Transmission only
AUA42	E SPOTS Unit CS	FXO: Off-Premises Station (PBX end) TO: Transmission only
AUA43	E SPOTS Unit CF	FXS: Foreign exchange line or trunk with toll diversion, Off-Premises Station (station end) TO: Transmission only

* CS = current sink

† CF = current feed

(Continued on next page)

Channel Units for SLC® -2000 Multi-Services Distant Terminal (MSDT) Applications (Continued)

Series 5 channel unit application in the SLC-2000 MSDT table (continued)

Channel Unit Code	Channel Unit Type	Services and Functions Provided
AUA44	4W VF CS	FXO: Off-Premises Station (PBX end), loop- or ground-start, normal or reverse polarity
AUA45B	Ringling Repeater	Private line manual ringdown
AUA52	Dataport	DDS, basic digital service (2.4, 4.8, 9.6, 56 kb/s)
AUA52B	All-Rate Dataport	DDS, basic digital service (2.4, 4.8, 9.6, 19.2, 56, 64 kb/s)
AUA53	Coin	Coin
AUA54	4W VF E&M	EM4: PBX tie trunk, E&M signaling, Type I or Type II PLR: PBX tie trunk, inverted-polarity E&M signaling
AUA55	Multiparty	Multiparty
AUA56	DID	PBX-CO DID trunk
AUA57	FSR	Frequency selective ringing
AUA58B	POTS + OHT	POTS, telemetry, FX line, off-premises extension, WATS line, secretarial line, Off-Premises Station (station end), <i>CENTREX</i> service line
AUA75	Private Line Auto Ring	Private line automatic ringing
AUA90	ISDN* T-BRITE	ISDN T Interface BRI
AUA93	ISDN* BRITE II	ISDN <i>ANSI/U</i> Interface BRI

* ISDN transport is available in a universal TR-08 configuration and in an integrated configuration through IDCU hair-pin.

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Channel Units for SLC[®]-2000 Multi-Services Distant Terminal (MSDT) Applications (Continued)

Series 5 channel unit application in the SLC-2000 MSDT table (continued)

Channel Unit Code	Channel Unit Type	Services and Functions Provided
AUA150	POTS and <i>SPOTS</i> Unit + OHT	Same AUA25B + Telemetry
AUA158	ALC POTS + OHT	Same as AUA58B
AUA159	ALC POTS and <i>SPOTS</i> Unit + OHT	Same as AUA150
AUA178	C-POTS	POTS with automatic level compensation

In the Series 5 RT serving the SLC[®]- 2000 MSDT

In the Series 5 RT, the AUA406 channel unit provides the interface between the RT backplane and the RT/MSDT facility. The AUA406 channel unit occupies three physical slots in an RT digroup shelf and can access from 6 to 24 (in increments of two) of the DS0 time slots in the associated DS1 digroup signal. The number of time slots used by the channel unit is selected during installation by a switch setting on the channel unit faceplate. The DS0 time slots accessible by the channel unit include the time slots associated with the three physical slots it spans plus any even number of DS0 time slots associated with the physical slots to the right of the channel unit.

Channel Unit Placement Rules — ISDN Circuits

AUA90 T-BRITE channel unit in the Series 5 RT

The AUA90 T-BRITE channel unit has applications in the Series 5 RT as follows:

- Enhanced FPB RT in a universal Mode 1 system (interfacing a SLC 96 COT)
- INA-RT (Mode I or Mode III).

In the Series 5 system, ISDN 2B+D service requires allocation of three time slots; this restricts the placement of the AUA90 T-BRITE channel unit in the Series 5 RT or INA-RT (see ISDN Service under Channel Unit Applications and Services in this chapter).

Placement rules for AUA90 T- BRITE channel units

Placement rules for T-BRITE channel units are based on a 3-slot (**tri-slot**) group. Each digroup of 12 **physical** slots is divided into 4 tri-slot groups. The tri-slot groups are physical slots 1, 2 and 3; 4, 5 and 6; 7, 8 and 9; and 10, 11 and 12.

The following figure shows the following placement rules for T-BRITE channel units:

- In a Mode I/1 RT (Series 5 INA-RT or FPB RT), a T-BRITE channel unit must not occupy the last slot in a tri-slot group. Therefore, a T-BRITE channel unit must not be installed in physical slots 3, 6, 9, or 12 in any digroup.
- In a Mode I/1 RT (Series 5 INA-RT or FPB RT), only another T-BRITE channel unit may occupy the slot to the immediate right of a T-BRITE channel unit.
- In a Mode III INA-RT, a T-BRITE channel unit displaces three physical slots and must be placed only in the first slot of a tri-slot group. With a T-BRITE channel unit in the first slot, the last two slots of the tri-slot group must remain empty.

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Channel Unit Placement Rules — ISDN Circuits

Placement rules for AUA90 T- BRITE channel units (continued)

Tri-Slot Groups for Mixed Service

T-BRITE	T-BRITE	Empty
---------	---------	-------

INA-RT Mode I or
FPB RT Universal Mode 1 only

Y	Y	Y
or	or	or
Empty	Empty	Empty

INA-RT Mode I or Mode III or
FPB RT Mode 1 or Mode 2

T-BRITE	Empty	Empty
---------	-------	-------

INA-RT Mode I or Mode III or
FPB RT Universal Mode 1 only

Y	T-BRITE	Empty
---	---------	-------

INA-RT Mode I only or
FPB RT Universal Mode 1 only

Empty	T-BRITE	Empty
-------	---------	-------

INA-RT Mode I only or
FPB RT Universal Mode 1 only

T-BRITE	Empty	Y
---------	-------	---

INA-RT Mode I only or
FPB RT Universal Mode 1 only

Y = Any valid dual- or single-channel unit.

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Channel Unit Placement Rules — ISDN Circuits (Continued)

AUA92 BRITE II channel unit in FPC COT

Each unit occupies one physical slot in a COT bank. An AUA92 providing B1+D, B2+D, or D-only service, can be placed without restriction next to any channel unit providing non-2B+D service.

Placement rules for AUA92 BRITE II channel units

Placement rules for 2B+D services are based on a 3-slot (tri-slot) group. The tri-slot groups are *physical* slots 1 - 3, 4 - 6, 7 - 9, and 10 - 12 within a digroup. The following figure illustrates the following placement rules for BRITE II channel units:

- A 2B+D AUA92 BRITE II channel unit must not occupy the last slot in a tri-slot group. Therefore, an AUA92 BRITE II channel unit optioned for 2B+D must *not* be installed in physical slots 3, 6, 9, or 12 in any digroup.
 - Only another 2B+D channel unit can occupy the slot to the immediate right of a 2B+D AUA92 BRITE II channel unit. An AUA92 optioned for B1+D, B2+D, or D-only service, or any other single- or dual-channel unit must *not* be placed in the slot to the immediate right of an AUA92 channel unit optioned for 2B+D service.
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Channel Unit Placement Rules — ISDN Circuits (Continued)

Placement rules for AUA92 BRITE II channel units (continued)

2B+D BRITE II	2B+D BRITE II or Empty	Empty
------------------	---------------------------------	-------

Y or Empty	Y or Empty	Y or Empty
------------------	------------------	------------------

Y or Empty	2B+D BRITE II	Empty
------------------	------------------	-------

2B+D BRITE II	Empty	Y
------------------	-------	---

Y = Any valid dual- or single-channel channel unit or a B1+D, B2+D,
or D-only AUA92 BRITE II channel unit.

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Channel Unit Placement Rules — ISDN Circuits (Continued)

AUA93 BRITE II (U Interface) channel unit in the Series 5 enhanced FPB, FPC, and FPC/AC RT



NOTE:

When optioned for B1+D, B2+D, or D-only service, the AUA93 may be mixed with any other channel unit (except 2B+D) without restriction. When mixed with 2B+D service, the B1+D, B2+D, or D-only AUA93 BRITE II channel unit should **not** be placed in the slot to the immediate right of an AUA90 T-BRITE channel unit or a 2B+D AUA93 BRITE II channel unit. T-BRITE channel units are only supported in FPB applications.

When optioned for 2B+D service, the placement of AUA93 BRITE II channel units is restricted because ISDN 2B+D service requires three time slots per channel unit (see ISDN Service under Channel Unit Applications and Services in this chapter).

Placement rules for AUA93 BRITE II channel units

Placement rules for BRITE II channel units (2B+D option) are based on a 3-slot (**tri-slot**) group. Each digroup of 12 **physical** slots is divided into 4 tri-slot groups. The tri-slot groups are physical slots 1-3, 4-6, 7-9, and 10-12.

The following figure illustrates the following placement rules for BRITE II channel units optioned for 2B+D service in a Series 5 FPB RT:

- A 2B+D AUA93 BRITE II channel unit must not occupy the last slot in a tri-slot group. Therefore, a 2B+D AUA93 BRITE II channel unit must not be installed in physical slots 3, 6, 9, or 12 in any digroup.
- Only another 2B+D channel unit (AUA93 or AUA90) may occupy the slot to the immediate right of a 2B+D AUA93 BRITE II channel unit. A B1+D, B2+D, or D-only AUA93 BRITE II channel unit (or any other single or dual channel unit) should **not** be placed in the slot to the immediate right of a 2B+D AUA93 BRITE II channel unit.

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Channel Unit Placement Rules — ISDN Circuits (Continued)

Placement rules for AUA93 BRITE II channel units (continued)

2B+D BRITE II or T-BRITE	2B+D BRITE II or T-BRITE or Empty	Empty
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Y or Empty	Y or Empty	Y or Empty
------------------	------------------	------------------

Y or Empty	2B+D BRITE II	Empty
------------------	------------------	-------

2B+D BRITE II	Empty	Y
------------------	-------	---

Y = Any valid dual- or single-channel channel unit or a B1+D, B2+D,
or D-only AUA93 BRITE II channel unit.

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Channel Unit Placement Rules — Feature Package B Mode 2 (RT Nail-Up)

Description

Enhanced FPB Mode 2 uses a fixed time slot assignment at the RT (RT circuit nail-up) that restricts placement of some channel units (the RT circuit nail-up is not related to the 5ESS switch nail-up). The RT circuit nail-up in Mode 2 limits placement of some channel units to the four rightmost channel slots on each digroup and reduces the available concentration time slots for the remaining Mode 2 channel units. This should be considered in coin and special service applications. The AUA105 TRU circuit pack has an SPL indicator that lights if one of these channel units is not installed correctly in a Mode 2 system. The table below lists those channel units that must be placed in the four rightmost slots of a digroup in Mode 2. These channel units are all special service except the coin channel unit.

Channel Unit Code	Channel Unit	Number of Channels
AUA53	Coin	single
AUA56*	DID (DPT)	dual
AUA41	4W1 (current feed)	single
AUA42	2W E SPOTS® unit (current sink)	dual
AUA43	2W E SPOTS unit (current feed)	dual
AUA44	4W2 (current sink)	single
AUA52†	OCU Dataport	single
AUA54	4W0 E&M	single

* In universal systems, the WP42 SPOTS channel unit| installed in the SLC® 96 COT causes RT nail-up of the AUA56 DID channel unit. The AUA56 may be used in an integrated system (Mode 1 only) with the 5E6 or later generic.

† Dataports with second channel error correction (SCEC) are not supported in enhanced FPB Mode 2. Dataport units currently are not supported in an integrated enhanced FPB system.

Channel Unit Placement Rules — Integrated Network Access - RT (INA-RT)

The CMP indicator The CMP indicator on the AUB27 ADU will light if a channel unit is installed incorrectly (in a slot that must be empty or in a slot that would affect service on that channel unit). The CMP indication is based on the assumption that the existing installation and services are correct (before CMP is lighted) and that the newly-installed channel unit is incompatible.



CAUTION:

The INA-RT bank controller attempts to retain the working services (when the CMP indicator lights), but this is not always possible. Therefore, any channel unit that causes the CMP indicator to light when installed should be removed immediately to minimize potential service interruption.

Mode I There are no placement restrictions on INA-RT special service channel units in Mode I (other than for ISDN - see Channel Unit Placement Rules in this chapter). However, INA-RT Mode I is most economical and efficient for 2-wire services (dual channel units).

Mode III single (SGL) Mode III is most efficient for 4-wire single-channel units and provides up to 48 lines in each bank (blue and/or white bank). With the AUB27 ADU optioned for SGL, only the odd channel of each slot can be used. This means that the even channel of a dual channel unit is inoperative; single-channel units are not affected.

(Continued on next page)

Channel Unit Placement Rules — Integrated Network Access - RT (INA-RT) (Continued)

Mode III single (SGL) (continued)

The placement rules for Mode III single include the following:

- Any single-channel unit may be assigned to any slot (except as specified for ISDN and dataports with second channel error correction).
- Any dual-channel channel unit may be assigned to any slot; however, the even channel is not operational (except as specified for ISDN).
- Dataport (AUA52) *without* second channel error correction (SCEC) may be assigned to any slot (except as specified for ISDN).
- Dataport (AUA52) *with* SCEC may be assigned to any slot (except as specified for ISDN); however, the slot to the immediate right of the dataport channel unit must be left empty. The last slot in a digroup cannot be used for dataport.
- The ISDN channel units may be placed only in the first slot of a tri-slot group. The remaining slots of the tri-slot group must be left empty (see Channel Unit Placement Rules in this chapter).

Mode III double (DBL)

For mixed applications of single- and dual-channel units in Mode III, the double option (AUB27 ADU optioned for DBL) may be used. In Mode III DBL, both channels of a dual channel unit can be used, but the adjacent right-hand slot must be empty. (In other words, single-channel units may be installed in adjacent slots, but dual-channel units require an empty slot on the immediate right.)



CAUTION:

Because of its complexity, this mode requires identification of the T&R location (slot assignment) in addition to the channel assignment. These two are easily confused and require careful administration. See Chapter 7 for assignment and engineering considerations.

(Continued on next page)

Channel Unit Placement Rules — Integrated Network Access - RT (INA-RT) (Continued)

Mode III double (continued)

The placement rules for Mode III double include the following:

- Any single-channel unit may be assigned to any slot except one that must be left empty (Items 2, 4, and 5).
- Any dual-channel unit may be assigned to any slot except slot 12 of a digroup or any slot that must be left empty (Items 4 and 5). The slot to the immediate right of the dual-channel unit must be left empty.
- Dataport *without* SCEC may be assigned to any slot except one that must be left empty (Items 2, 4, and 5).
- Dataport *with* SCEC may be assigned to any slot except slot 12 of a digroup or any slot that must be left empty (Items 2 and 5). The slot to the immediate right of the dataport must be left empty.
- The ISDN channel units may be placed only in the first slot of a tri-slot group. The remaining slots of a tri-slot group must be left empty (see Channel Unit Placement Rules - ISDN Circuits).

Mode III channel/ slot identification

The two ways to identify the channels for each slot in a Mode III INA-RT are:

- a new bank designation strip (on top of the existing designation strip)
- the existing bank designation strip.

Mode III INA-RT supports only 48 channels over two DS1 lines. To make counting easier, a new designation strip renumbers the slots so that each slot counts as one channel and the slots are numbered in sequence from 1 to 48. This method of identification is referred to as Mode III (48). The alternate method of identification is referred to as Mode III (96). With this method, each slot counts as one channel and the slots are numbered in sequence using only the odd numbers from 1 to 95 (that is, 1,3,5...93,95). The even channels are not numbered because they are not available for service. The Mode III (96) method uses the existing bank designation strip.



CAUTION:

Either of these methods may be used to identify channels/slots in Mode III single or Mode III double!

Channel Unit Specifications

Specification tables

Terminal-to-terminal voice-frequency transmission specifications are provided in the tables in the following sections.



NOTE:

The AUA150 channel unit can be administered for use in loops from 0 ohms to 1500 ohms. However, the automatic loss compensation (ALC) feature of the AUA158B and AUA159B channel units provides a more consistent grade of service over the 0 to 900 ohm range. Therefore, Lucent Technologies recommends using the AUA158B or AUA159B where loops can be administered using a 900 ohm resistance guideline, reserving the AUA150 for use in loops greater than 900 ohms.

Specifications for the POTS/SPOTS Channel Unit Pairs

Table with notes This table contains the transmission specifications for fixed loss POTS/SPOTS® channel pairs. These notes apply to the following table:

1. Excludes AUA31, AUA32, and AUA1.
2. Measured at 25° C.
3. Off-hook unless specified.

Parameter	Condition	Value
Loop resistance (beyond the RT, excluding the set)	AUA25B [†] / AUA27 / AUA58 AUA59 / AUA150	0-900 ohms 0-1500 ohms [†]
Loop current	AUA25B / AUA27 / AUA58 (0-900 ohms) AUA59 / AUA150 (CSA) (0-1500 ohms)	20 mA to 35 mA 25 mA to 35 mA 23 mA to 35 mA
1000 Hz loss [‡] off-hook (±0.5 dB typical, ±1.0 dB max)	AUA59 / AUA150 AUA27 / AUA58 AUA25B	0 dB 1 dB 2 dB
On-hook loss, 1004 Hz	Loss > 1004 Hz off-hook loss	< 5 dB
Frequency response (loss relative to 1004 Hz)	60 Hz 400 Hz to 3000 Hz 3200 Hz 300 Hz and 3400 Hz	> 21 dB -0.5 dB to +1 dB -0.5 dB to +1.5 dB 0 dB to +3 dB
Gain tracking [§]	-37 dBm0 to +3 dBm0 -50 dBm0 to -37 dBm0	±0.5 dB max. (± 0.25 dB avg.) ±1.0 dB max. (± 0.5 dB avg.)

[†] Although the AUA25B has a 900-ohm signalling range, locally-switched special service loss guidelines will decrease the application range. See data sheet 363-005-124 for specifics.

[‡] For locally switched special service applications, rated only within a CSA.

[‡] Measured as the ICL with the RT terminated in 600 ohms for AUA25b, 900 ohms otherwise, and with the COT terminated in 900 ohms.

[§] At 1004 Hz, relative to 0 dBm0.

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Specifications for the POTS/SPOTS Channel Unit Pairs (Continued)

**Table with notes
(continued)**

Parameter	Condition	Value
Return loss at the COT [*]	AUA27 / AUA58 / AUA59 / AUA150 (terminated by 900 ohms +2 μ F)	ERL \geq 18 dB SRL \geq 12 dB
	AUA25() terminated by 600 ohms + 2 μ F	ERL \geq 18 dB SRL \geq 12 dB
Return loss at the RT [†]	Testing into AUA27 / AUA58 / AUA59 / AUA150 900 ohms + 2 μ F reference Z	ERL \geq 18 dB SRL \geq 12 dB
	Testing into AUA25B 600 ohms + 2 μ F reference Z	ERL \geq 18 dB SRL \geq 12 dB
Idle channel noise (at the COT and RT)	20 dBrnC maximum	
Impulse noise	Measure at 47 dBrnC0 for 15 min.	\leq 15 Counts
Overload at COT and RT	+3 dBm0	\leq 0.5 dB extra loss
Signal-to-distortion	0 to -30 dBm0	> 33 dB
	-30 to -40 dBm0	> 27 dB
	-40 to -45 dBm0	>22 dB
System generated tones	0 < f < 16 kHz	< -50 dBm0
Single frequency distortion	0 - 12 kHz, 0 dBm0	< -28 dBm0 [‡]
	1004 - 1020 kHz, 0 dBm0	< -40 dBm0 [§]
Intermodulation distortion (4-tone method, -13 dBm0 input)	A-B (R2) product	> 43 dB
	2A-B (R3) product	> 44 dB

^{*} Measured with respect to 900 ohms and 2.16 μ F with the RT end terminated as listed.

[†] Measured with respect to the listed impedance with the 4-wire path broken or with the COT end terminated in 900 ohms and 2.16 μ F. For on-hook condition, COT CU must be AUA38B.

[‡] At any other frequency, 0 to 12 kHz.

[§] At any other frequency, 0 to 4kHz.

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Specifications for the POTS/SPOTS Channel Unit Pairs (Continued)

Table with notes (continued)

Parameter	Condition	Value
Data pulse distortion (PAR)		> 90
Minimum longitudinal balance at the COT and RT [*]	200 Hz, 500 Hz, 1000 Hz 3000 Hz	≥ 58 dB ≥ 53 dB
Cross talk (0 dBm0 input, 200 Hz to 3400 Hz)	C-message weighting	≤ -65 dBm0
Transhybrid return loss 900 ohms + 2 μF termination	AUA59 & AUA150	ERL ≥ 19 dB

^{*} Measured by IEEE Method 455-1976.

Specifications for the E *SPOTS* Channel Units

Table with note This table contains the transmission specifications for 2-wire E-*SPOTS*[®] (AUA4/AUA142 and AUA43) channel units. This note applies to the following table:

1. Off-hook unless specified.

Parameter	Condition	Value	
Loop resistance		CSA loops	
Gain range and granularity	Metallic interface to digital line	-1.0 dB to +6.75 dB granularity = 0.25 dB	
	Digital line to metallic interface	-8.0 dB to +1.5 dB granularity = 0.25 dB	
Gain tracking	Input -37 to +3dBm	± 0.25 dB	
	Input -50 to -37 dBm	± 0.50 dB	
Equalization		Equalized CSA cable rolloff at 0.4 k Hz varies from 0.0 dB to 1.1 dB; at 2.8 kHz, rolloff varies from 0.3 dB to 1.75 dB	
Structural impedance		600 ohms + 2.16 μF or 875 ohms + 2.16 μF	
ERL/SRL (2-wire return loss with 4-wire path broken)	With reference to structural impedance	28/20 dB	
Balance capability, CSA loops	Digital line interface of channel unit facing loop, with zero transmit and receive gain.	ERL ≥ 14 SRL ≥ 9	
Longitudinal balance	Measured in accordance with IEEE Standard 455-1976	Minimum	Average
		200 Hz	58 dB 63 dB
		500 Hz	58 dB 63 dB
		1000 Hz	58 dB 63 dB
		3000 Hz	53 dB 58 dB

(Continued on next page)

Specifications for the E SPOTS Channel Units (Continued)

Table with note
(continued)

Parameter	Condition	Value	
Cross talk	Equal-level C-message weighted between 0.2 and 3.4 kHz	-65 dB	
Idle channel noise	AUA42 (AUA142)/AUA43 pair	23 dBmC0	
Impulse noise	Measured at 59 dBmC0 with holding tone at -13 dBm0	≤15 counts in 15 minutes	
On-hook loss, 1004 Hz, (Nominal)	"OHT=YES;" Terminated with Structural Impedance; Slope=0	Rcv (to T/R)	Xmt (from T/R)
		IMP=600	9dB 2.5dB
		IMP=900	9dB 4.5dB
Signal-to-distortion ratio	Measured at -10 dBm	>33 dB	
Single-frequency distortion	0 -12 kHz at 0 dBm0 1004 Hz to 1020 Hz at 0 dBm0 per AUA42 (AUA142)/AUA43 pair	< -28 dBm0, 0 to 12 kHz -40 dBm0, 0 to 4 kHz	
Intermodulation distortion	-13 dBm0 input	A-B (R2) < -43 dB 2A-B (R3) < -44 dB	
Pulse distortion (P/AR)		≥90	
Bandwidth	Measured at 400 Hz and 2800 Hz, loss relative to loss at 1 kHz	-0.25 to +1.0 dB	

Specifications for Coin Channel Unit Pairs

Table This table contains the transmission specifications for coin (AUA33/53) channel unit pairs.

Parameter (Note)	Value
Loop resistance (beyond the RT, excluding the set)	0-1500 ohms
Loop current	> 23 mA
1000-Hz loss (± 0.5 dB typical, ± 1.0 dB max)	0 dB*
Bandwidth (Loss relative to the 1000-Hz loss)	0 to +0.5 dB at 400 Hz and 2800 Hz 0 to +3.0 dB at 300 Hz and 3000 Hz
Return loss at the COT [†]	ERL \geq 18 dB SRL \geq 12 dB
Return loss at the RT [‡]	ERL \geq 17.5 dB SRL \geq 10 dB
Idle channel noise (at the RT)	20 dBmC max.
Signal-to-distortion ratio (at -10 dBm)	>33 dB
Data pulse distortion (PAR)	> 90
Gain tracking (1004 Hz) -37 dBm0 to +3 dBm0 -50 dBm0 to -37 dBm0	± 0.5 dB max. (± 0.25 dB avg.) ± 1.0 dB max. (± 0.5 dB avg.)
Intermodulation distortion (-13 dBm0 input)	A-B (R2) Product: > 43 dB 2A-B (R3) Product: > 44 dB
Overload at COT and RT	≤ 0.5 dB increased loss at +3 dBm0
Minimum longitudinal balance at the RT [§]	200 Hz, 500 Hz, 1000 Hz (≥ 58 dB), 3000 Hz (≥ 53 dB)

* Measured as the ICL with the RT terminated in 600 ohms and with COT terminated in 900 ohms.

† Measured with respect to 900 ohms and 2.16 μ F with the 4-wire path broken or with the other end terminated in 1100 ohms in parallel with 0.03 μ F.

‡ Measured with respect to 600 ohms and 2.16 μ F with the 4-wire path broken or with the other end terminated in 900 ohms and 2.16 μ F.

§ Measured by IEEE Method 455-1976.

Specifications for Frequency Selective Ringing Channel Units

Table with note This table contains the transmission specifications for FSR (AUA3757) channel units. The following note applies to this table:

1. Measured at 25° C.

Parameter (Note)	Condition	Value
Loop resistance (beyond the RT, excluding the set)		0 - 900 ohms
1004 Hz on-hook loss		On-hook transmission not supported
Loop current		≥22 mA*
1000 Hz loss +0.5 dB typical, ±1.0 dB max.		1 dB
Bandwidth loss at 400 Hz and 2800 Hz	Relative to 1004 Hz loss [†]	-0.5 to +1.0 dB
60 Hz rejection	—	>21 dB
Return loss at the COT [†]	—	ERL ≥18 SRL ≥10
Return loss at the RT [‡]	—	ERL ≥18 SRL ≥10
Idle channel noise	—	20 dBmC maximum
Signal to distortion ratio (input signal level)	0 to -30 dBm0 -30 to -40 dBm0 -40 to -45 dBm0	≥33 dB ≥27 dB ≥22 dB
Data pulse distortion (PAR)	—	90

* Delivered over 900 ohm loop to off-hook telset, with up to eight on-hook telsets bridged across the channel unit.

† Measured with respect to 900 ohms in series with 2.16 μF and with 900 ohms in series with 2.16 μF in parallel with a hold coil at the RT.

‡ Measured with respect to 900 ohms in series with 2.16 μF with a hold coil at the RT and with -48 volt battery feed terminated with 900 ohms in series with 2.16 μF at the COT.

(Continued on next page)

Specifications for Frequency Selective Ringing Channel Units (Continued)

Table with note
(continued)

Parameter (Note)	Condition	Value
Gain tracking (at 1004 Hz relative to 0 dBm0)	-37 dBm0 to +3 dBm0 -50 dBm0 to -37 dBm0	±0.5 dB max. (±0.25 dB avg.) ±1.0 dB max. (±0.50 dB avg.)
Intermodulation distortion (4-tone method, -13 dBm0 input)	A-B (R2) Product 2A-B (R3) Product	>43 dB >44 dB
Impulse noise	Measured at 47 dBmC0	<15 counts in 15 min.
Overload at COT and RT	+3 dBm0	<0.5 dB additional loss
Minimum longitudinal balance at the COT and RT [*]	200 Hz, 500 Hz, 1000Hz 3000 Hz	≥58 dB ≥53 dB

^{*} Measure by IEEE Method 455-1976.

Specifications for Multiparty Channel Units

Table with note The transmission specifications for multiparty (AUA35/55B) channel units are contained in the following table. This note applies to the following table:

1. Off-hook unless specified.

Parameter (Note)	Condition	Value
Loop resistance (beyond the RT, excluding the set)		0 - 1500 ohms
1004 Hz on-hook loss		≤5 dB over 1004 Hz off-hook loss
Loop current		≥25 mA
1000 Hz loss +0.5 dB typical, ±1.0 dB max.		1 dB
Bandwidth	Loss at 400 Hz and 2800 Hz relative to 1004 Hz loss	-0.5 to +1.0 dB
60 Hz rejection	—	>21 dB
Return loss at the COT*	—	ERL ≥18 SRL ≥10
Return loss at the RT†	—	ERL ≥18 SRL ≥10
Idle channel noise	—	20 dBmC max.
Signal to distortion ratio (input signal level)	0 to -30 dBm0 -30 to -40 dBm0 -40 to -45 dBm0	≥33 dB ≥27 dB ≥22 dB

* Measured with respect to 900 ohms in series with 2.16 μF and with 900 ohms in series with 2.16 μF in parallel with a hold coil at the RT.

† Measured with respect to 900 ohms in series with 2.16 μF with a hold coil at the RT and with -48 volt battery feed terminated with 900 ohms in series with 2.16 μF at the COT.

(Continued on next page)

Specifications for Multiparty Channel Units (Continued)

Table with note
(continued)

Parameter (Note)	Condition	Value
Data pulse distortion (PAR)	—	>90
Gain tracking (At 1004 Hz relative to 0 dBm0)	-37 dBm0 to +3 dBm0 -50 dBm0 to -37 dBm0	±0.5 dB max. (±0.25 dB avg.) ±1.0 dB max. (±0.50 dB avg.)
Impulse noise	measure at 47 dBmC0	<15 counts in 15 minutes
Overload at COT and RT	+3 dBm0	<0.5 dB additional loss
Minimum longitudinal balance at the COT and RT [*]	200 Hz, 500 Hz, 1000Hz 3000 Hz	≥58 dB ≥53 dB

^{*} Measure by IEEE Method 455-1976.

Specifications for 4-Wire Voice Frequency Channel Units

Table with notes The table below contains the transmission specifications for 4-wire voice frequency channel units (AUA41/141, AUA44, and AUA54). The following notes apply to this table:

1. For AUA54, and for AUA44 in tandem applications, the ED7C700-20 E&M harness must be added to each digroup affected.
2. AUA54 cannot connect to cable that extends to outside plant.

Parameter	Condition	Value
Loop resistance	Excludes telset	0-2800 ohms (loop-start, ground-start) 0-5000 ohms (duplex)
Gain range (granularity)	Range depends on function code	See chart at end of table. Granularity = 0.1 dB
Gain tracking		
Input -37 to +3 dBm		±0.25 dB
Input -50 to - 37 dBm		±0.5 dB
Equalization		Post-equalization of cable less than 15 dB (H88) or 18 kft (NL) is comparable to D4 4FXS CU J98726SB). Pre-equalization and post-equalization available by emulating 150-ohm mismatch.
Structural impedance	AUA41/141 and AUA44 AUA54	600 or 1200 ohms 600 ohms
RL (any frequency)	With reference to structural impedance	23 dB
RL (1 kHz)		28 dB
Longitudinal balance	IEEE Method 455-1976	AUA41/141 AUA44 and AUA54
200 Hz		≥ 67 dB 58 dB 63 dB
500 Hz		≥ 67 dB 58 dB 63 dB
1000 Hz		≥ 67 dB 58 dB 63 dB
3000 Hz		≥ 62 dB 53 dB 58 dB

(Continued on next page)

Specifications for 4-Wire Voice Frequency Channel Units (Continued)

Table with notes
(continued)

Parameter	Condition	Value
Equal-level cross talk	C-message weighted between 0.2 and 3.4 kHz	-65 dB
Idle-channel noise	AUA41/141 - per CU pair AUA44/54 - per CU, each direction	20 dBrnC0
Impulse noise at 59 dBrnC0	With holding tone at -13 dBrnC0	≤15 counts in 15 minutes
Signal-to-distortion ratio	at -10 dBm	>33 dB
Single-frequency distortion	0-12 kHz 0 dBm0	<-28 dBm0 per CU
Bandwidth	Loss at 400 Hz & 2800 Hz relative to loss at 1 kHz	± 0.5 dB
Intermodulation distortion -13 dBm0 input	A-B (R2 product) 2A-B (R3 product)	< -43 dB < -44 dB
Pulse distortion (P/AR)	Per CU pair	AUA41/141 ≥ 94 AUA44/54 > 90

(Continued on next page)

Specifications for 4-Wire Voice Frequency Channel Units (Continued)

Table with notes
(continued)

Gain Range Chart			
Apparatus Code	Function Code	Transmit Gain (dB)	Receive Gain (dB)
AUA41/141	DX	-1.5 to 15.0*	-10.5 to 6.0
	FXS () & FXT ()	-1.5 to 15.0*	-10.5 to 6.0
	ETO4	-8.5 to 15.0*	-9.5 to 7.0
	TO4	-7.5 to 16.0	-16.5 to 7.0
AUA44	FXO () & FXP ()	-1.5 to 15.0 [†]	-10.5 to 6.0
	TD () ()	2.1 to 3.6	-2.1
AUA54	EM4 ()	-8.0 to 17.5	-17.0 to 8.5
	PLR ()	-8.0 to 17.5	-17.0 to 8.5

* These gain limits are for zero equalization. Where the circuit design calls for equalization, the limits are increased by the amount of 1 kHz equalizer gain specified in 915-710-116 for that circuit design. Note that the crosstalk limit for outside plant cable, where the signal comes off the cable, allows a TLP of no lower than -9 dB. This restricts the useful gain of these function codes to 9.0 dB in the transmit direction (to maintain the digital line TLP at 0.0 dB).

[†] For tandem function codes, the AUA44 can be provisioned for transmit gains ranging from -8.0 to 3.6 dB. The range shown in the chart represents the intended application.

Specifications for Common Electrical and Transmission Channel Units

Table with notes This table contains the AUA158(), AUA159(), and AUA179 common electrical and transmission specifications. The following notes apply to this table:

1. End-to-end performance specified with AUA38 or AUA39 at COT, terminated with $900\ \Omega + 2.16\ \mu\text{F}$.
2. When the AUA159B is first installed with the telset on-hook, COT to RT loss is 8 dB.

Parameter	Value
Frequency response (loss relative to 1004 Hz, end-to-end)	60 Hz : > 21 dB 400 Hz to 3000 Hz: -0.5 dB to +1 dB 3200 Hz: -0.5 dB to +1.5 dB 300 Hz and 3400 Hz: 0 dB to +3 dB
Overload at COT and RT	≤ 0.5 dB extra loss at +3 dBm0 level
Single frequency distortion with input of: 0 Hz to 12 kHz, 0 dBm0 1004 Hz to 1020 kHz, 0 dBm0	< -28 dBm0 at 0 Hz to 12 kHz < -40 dBm0 at 0 Hz to 4000 Hz
Signal-to-distortion with input of: 0 to -30 dBm0 -30 to -40 dBm0 -40 to -45 dBm0	> 33 dB > 27 dB > 22 dB
System generated tones $0\ \text{Hz} < f < 16\ \text{kHz}$	< -50 dBm0
Structural impedance	$600\ \Omega + 2.15\ \mu\text{F}$
Minimum longitudinal balance (measured by IEEE Method 455-1976)	200, 500, and 1000 Hz: ≥ 58 dB 3000 Hz: ≥ 53 dB
Idle channel noise, end-to-end	≤ 20 dBmC
Cross talk (0 dBm0 input, 200 Hz to 3400 Hz)	≤ -65 dBm0 (with C-message weighting)
Impulse noise at a threshold of 47 dBmC0 for 15 minutes	≤ 15 counts
Data pulse distortion (PAR), end-to-end	> 90
Gain tracking at 1004 Hz, relative to 0 dBm0: 0 -37 dBm0 to +3 dBm0 -50 dBm0 to -37 dBm0	± 0.5 dB maximum (± 0.25 dB average) ± 1.0 dB maximum (± 0.5 dB average)
Intermodulation distortion (4-tone method -13 dBm0 input)	A-B (R2) >43 dB 2A-B (R3) > 44 dB

Specifications for Loop Range, Loss and Return Loss Channel Units

Table The following table contains the AUA158 and AUA159 RT channel units loop range, loss, and return loss information.

Parameter	POTS	Special Services
Loop resistance (excluding telset)	0 to 900 Ω	CSA
1 kHz VF loss between CO and network interface (NIF) at customer location, customer premises equipment (CPE) off-hook	4 to 8 dB	2 to 5 dB
1 kHz VF loss, RT only, CPE off-hook:		
0 Ω tip-to-ring	6.0 dB	3.4 dB
Maximum loop resistance	1.4 dB	0 dB
1 kHz VF loss, AUA158 only, CPE on-hook:	3.5 dB	
1 kHz VF loss, AUA159 only, CPE on-hook	2.5 dB	2.5 dB
Return loss at COT (reference Z of 900 Ω + 2.16 μ F, RT CU terminated at voice frequencies with 900 Ω + 2.16 μ F for POTS or TR-57 CSA test loops for special services, DC resistance of loop terminations < 430 Ω , CPE on-hook or off-hook)	ERL > 18 dB SRL > 10 dB	ERL > 10 dB SRL > 5 dB
Return loss at RT (reference Z of 600 Ω + 2.16 μ F, DC resistance of 0 Ω , CPE on-hook (AUA38B only) or off-hook; CO terminated with 900 Ω + 2.16 μ F)	ERL > 18 dB SRL > 10 dB	ERL > 19 dB SRL > 11 dB

Specifications for Loop Range, Loss and Return Loss Channel Units

Table The following table contains the AUA158B and AUA159B, and AUA179 RT channel units loop range, loss and return loss information.

Parameter	POTS	Special Services
Loop resistance (excluding telset)	0 to 900 Ω	CSA
1 kHz VF loss between CO and network interface (NIF) at customer location, customer premises equipment (CPE) off-hook	4 to 8 dB	2 to 5 dB
1 kHz VF loss, RT only, CPE off-hook:		
0 Ω tip-to-ring	6.0 dB	3.4 dB
Maximum loop resistance	1.4 dB	0 dB
1 kHz VF loss, AUA179 only, CPE on-hook:		
0 Ω tip-to-ring	9.5 dB	9.5 dB
Maximum loop resistance	5 dB	6 dB
1 kHz VF loss, AUA158 only, CPE on-hook:	3.5 dB	
1 kHz VF loss, AUA159 only, CPE on-hook	2.5 dB	2.5 dB
Return loss at COT (reference Z of 900 Ω + 2.16 μ F, RT CU terminated at voice frequencies with 900 Ω + 2.16 μ F for POTS or TR-57 CSA test loops for special services, DC resistance of loop terminations < 430 Ω , CPE on-hook or off-hook)	ERL > 18 dB SRL > 10 dB	ERL > 10 dB SRL > 5 dB
Return loss at RT (reference Z of 600 Ω + 2.16 μ F, DC resistance of 0 Ω , CPE on-hook or off-hook; CO terminated with 900 Ω + 2.16 μ F)	ERL > 18 dB SRL > 10 dB	ERL > 19 dB SRL > 11 dB

Specifications for Dual Ringing Repeater Channel Units

Table with notes This table contains the transmission specifications for the AUA45() dual ringing repeater channel unit. The following notes apply to this table:

1. AUA45() at COT and RT, provisioned for 0 dB loss.
2. Measured at 25 °C.
3. Transmission enabled except during ringing.

Parameter	Value
Loop design	The unit is not limited to CSA design rules. Maximum cable loss should not exceed 9 dB, split in any proportion between the two end cable links. Total combined loop resistance (not including the terminating equipment) should not exceed 1500 ohms. Neither loop should exceed 1300 ohms.
Balance impedance	900 ohms + 2.16 μ F
Structural impedance	900 ohms + 2.16 μ F
Return loss* end-to-end	ERL \geq 23 dB SRL \geq 17 dB
Longitudinal balance [†]	\geq 58 dB (200 Hz, 500 Hz, 1000 Hz) \geq 53 dB (3000 Hz)
60 Hz loss	\geq 21dB
1000 Hz loss [‡] (\pm 0.5 dB typical, \pm 1.0 dB max)	0 dB or 3 dB (switch selectable)
Bandwidth (relative to the 1000 Hz loss; no equalization)	+1 to -0.5 dB at 400 Hz and 2800 Hz
Gain tracking (1004 Hz)	\pm 0.5 dB maximum (-37 dBm0 to +3 dBm0) \pm 1.0 dB maximum (-50 dBm0 to -37 dBm0)
Idle channel noise [§]	\leq 20 dBmC maximum

* Measured with respect to 900 ohms + 2.16 μ F with the opposite end terminated in 900 ohms + 2.16 μ F.

[†] Measured by IEEE Method 455-1976.

[‡] Measured as insertion loss between 900 ohms terminations.

[§] Measured with 900 ohms terminations on both ends.

(Continued on next page)

Specifications for Dual Ringing Repeater Channel Units (Continued)

Table with notes
(continued)

Parameter	Value
Signal-to-distortion ratio (at -10 dBm0)	> 33 dB
Intermodulation distortion (-13 dBm0 input)	> 43 dB [A-B (R2) product] > 44 dB [2A-B (R3) product]
Single frequency distortion (0-12 kHz, 0 dbm0)	< -28 dBm0
Data pulse distortion (PAR) at -13 dBm	> 90
Overload at COT and RT	≤ 0.5 dB compression at +3 dBm0
Equal-level cross talk	better than -65 dB (200 Hz to 3400 Hz)
Ringing delay	≤ 200 ms
Ringing distortion	≤ ±50 ms
Ring trip delay	≤ 200 ms for Rdc ≤ 1800 ohms
Ring trip immunity	8 μF in parallel with 10k ohms at T/R
Ringing range at COT [*]	40 Vrms across 3 REN
Ringing range at RT [*]	40 Vrms across 4 REN
Ringing cycle	2 seconds on (100 msec) 4 seconds off (100 msec)
Audible ringing	440 Hz plus 480 Hz (1.6%)
Audible ringing level	-47 to -16 dBm0 (with no more than 5 dB between components)

^{*} COT Ringing 86 Vrms and 1300 ohms of cable.
RT Ringing 100 Vrms and 1300 ohms of cable.

Specifications for Dual Private Line Auto Ring Channel Units

Table with notes The transmission specifications for the AUA75 dual private line auto ring channel unit are contained below. The following notes apply to this table:

1. AUA75 at COT and RT, provisioned for 0 dB loss.
2. Measured at 25°C.
3. Off-hook unless specified.

Parameter	Value
Loop design	The unit is not limited to CSA design rules. Maximum cable loss should not exceed 9 dB, split in any proportion between the two end cable links. Total combined loop resistance (not including the terminating equipment) should not exceed 1500 ohms. Neither loop should exceed 1300 ohms.
Structural impedance	900 ohms + 2.16 μ F
Balance impedance	900 ohms + 2.16 μ F
1000 Hz loss* (± 0.5 dB typical, ± 1.0 dB max)	0 dB or 3 dB, off-hook (switch selectable); 3dB on-hook
Bandwidth (relative to the 1000 Hz loss)	+1 to -0.5 dB at 400 Hz and 2800 Hz
Return loss† end-to-end	ERL \geq 23 dB SRL \geq 17 dB
Idle channel noise‡	≤ 20 dBmC maximum
Signal-to-distortion ratio (at -10 dBm0)	> 33 dB
Data pulse distortion (PAR) at -13 dBm	> 90
Gain tracking (1004 Hz)	± 0.5 dB maximum (-37 dBm0 to +3 dBm0) ± 1.0 dB maximum (-50 dBm0 to -37 dBm0)
Intermodulation distortion (-13 dBm0 input)	> 43 dB [A-B (R2) product] > 44 dB [2A-B (R3) product]
Single frequency distortion (0-12 kHz, 0 dbm0)	< -28 dBm0

* Measured as insertion loss between 900 ohms terminations.

† Measured with respect to 900 ohms + 2.16 μ F with the opposite end terminated in 900 ohms + 2.16 μ F.

‡ Measured with 900 ohms terminations on both ends.

(Continued on next page)

Specifications for Dual Private Line Auto Ring Channel Units (Continued)

Table with notes
(continued)

Parameter (Note)	Value
Impulse noise at 47 dBmC0	≤ 15 counts in 15 minutes
Overload at COT and RT	≤ 0.5 dB compression at +3 dBm0
Longitudinal balance*	≥58 dB (200 Hz, 500 Hz, 1000 Hz) ≥53 dB (3000 Hz)
Equal-level cross talk	better than -65 dB (200 Hz to 3400 Hz)
Ringing delay	≤ 200 ms
Ring trip delay	≤ 200 ms for Rdc ≤ 1800 ohms
Ring trip immunity	8 μF in parallel with 10k ohms at T/R
Ringing range at COT†	40 Vrms across 3 REN
Ringing range at RT‡	40 Vrms across 4 REN
Ringing cycle	2 seconds on (100 msec) 4 seconds off (100 msec)
Audible ringing	440 Hz plus 480 Hz (1.6%)
Audible ringing level	-47 to -16 dBm0 (with no more than 5 dB between components)

* Measured with 900 ohms terminations on both ends.

† Measured by IEEE Method 455-1976.

‡ COT Ringing 86 Vrms and 1300 ohms of cable.
RT Ringing 100 Vrms and 1300 ohms of cable

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Introduction

Engineering requirements

This chapter summarizes the major engineering requirements for the Series 5 system as given in 915-710-115. The engineering effort involved in the planning and design of the Series 5 system is similar to the *SLC*[®] 96 Carrier System; however, there are some differences that should be considered in the planning phase as follows:

- The Series 5 system has four framing formats.
 - The superframe (SF) format allows the Series 5 INA-RT to interface with a D4 channel bank.
 - The TR-08 format allows the Series 5 system (enhanced Feature Package B) to be used with the *5ESS*[®] switch digital carrier line unit (DCLU) or a *SLC* 96 central office terminal (COT).
 - The extended superframe (ESF) format used in the Series 5 Feature Package C (FPC) system provides a message oriented data link for special services provisioning and testing.
 - The extended superframe/new data link (ESF/ndl) is message oriented and allows the FP303 RT to be used with the *5ESS*[®] switch IDCU in the TR303 mode.



NOTE:

These formats are not compatible with each other. Some common units use option switches to select the framing format. To ensure proper system operation, these switches must be set for the same format on the units in the Series 5 system and any multiplexer connected to it.

- Some common unit changes may be required to incorporate new features in the Series 5 system (see Chapter 4, *Equipment Description*).
- The E *SPOTS*[®] channel units designed for the Series 5 system provide two 2-wire circuits per channel unit where the *SLC* 96 Carrier System with D4 channel units provides only one circuit. The 4-wire voice-frequency (VF) and dataport services are provided by channel units designed specifically for the Series 5 system. These special service channel units require provisioning with the craft interface unit (CIU) before service can be provided.

(Continued on next page)

Introduction (Continued)

Engineering requirements (continued)

- The Series 5 system does not use D4 channel units; Series 5 channel units (with manual option switches) provide 2-wire ringdown (dual ringing repeater), private line auto ring (2W PLAR), and BRITE II integrated services digital network (ISDN) services. See Chapter 3 for information on service applications for each mode and system configuration.
 - Since the full 96-pair count of the system is used, the Series 5 system has no equivalent of the *SLC 96* carrier Mode 3 for most applications. The exception is INA-RT Mode III (designed to interface a D4 channel bank).
 - The Series 5 channel unit placement restrictions are different from the *SLC 96* Carrier System. Most of the restrictions apply to Series 5 enhanced Feature Package B (FPB) Mode 2 and INA-RT. There are some restrictions on dataports using second channel error correction (SCEC) and ISDN channel units. Guidelines not specified in this chapter are given in Chapter 6, *Channel Units*.
 - Customer location applications may use specific codes of equipment and apparatus for compliance with national, state, and local requirements. Refer to the section *About This Applications and Planning Guide* (following the overall table of contents) and to the Series 5 ordering guide for more information on *UL* Listing and EMC compatibility.
-

System Planning

Minimum configuration for a universal FPC system

This minimum configuration serves up to 48 subscriber channels using shelf group A/B channels in the blue system. The alarm display unit/alarm suppressor unit (ADU/ASU) is always installed in the COT when the white system is not equipped. The alarm display unit (ADU) has switch options that must be set to suppress alarms associated with the unequipped shelves in the blue system. The minimum configuration requires only two T1 lines. The protection line is optional. The white system also may be established in a minimum configuration. The preferred sequence is to equip the blue system first, followed by the white system, as needed.

(Continued on next page)

System Planning (Continued)

Minimum configuraton for an enhanced FPB system

The minimum configuration for an enhanced FPB system serves 48 channels in one system. In an enhanced FPB Mode 1 RT, the minimum configuration is A and B digroups equipped; in Mode 2, the minimum is A digroup equipped. In an enhanced FPB system, loss of the TR-08 data link interrupts service on the A digroup (which carries the data link on the DS1 signal). Thus, removal of the circuit packs that control the data link can cause service interruption on the A digroup. Converting from the 48-channel minimum configuration to a 96-channel configuration requires removal of the ADU to reset option switches.

In enhanced FPB Mode 1, the data link is generated by the bank controller (BCU and ADU). Removing the ADU will interrupt service on the A digroup; service is not restored until after the ADU is reinstalled. If the the bank control unit (BCU) is removed, it does not interrupt service; however, service will be interrupted momentarily when the BCU is reinstalled. In enhanced FPB Mode 2, the data link is controlled by the transmit/receive unit (TRU), and removing the BCU or ADU has no effect on service.

Minimum configuration for an FP303 system

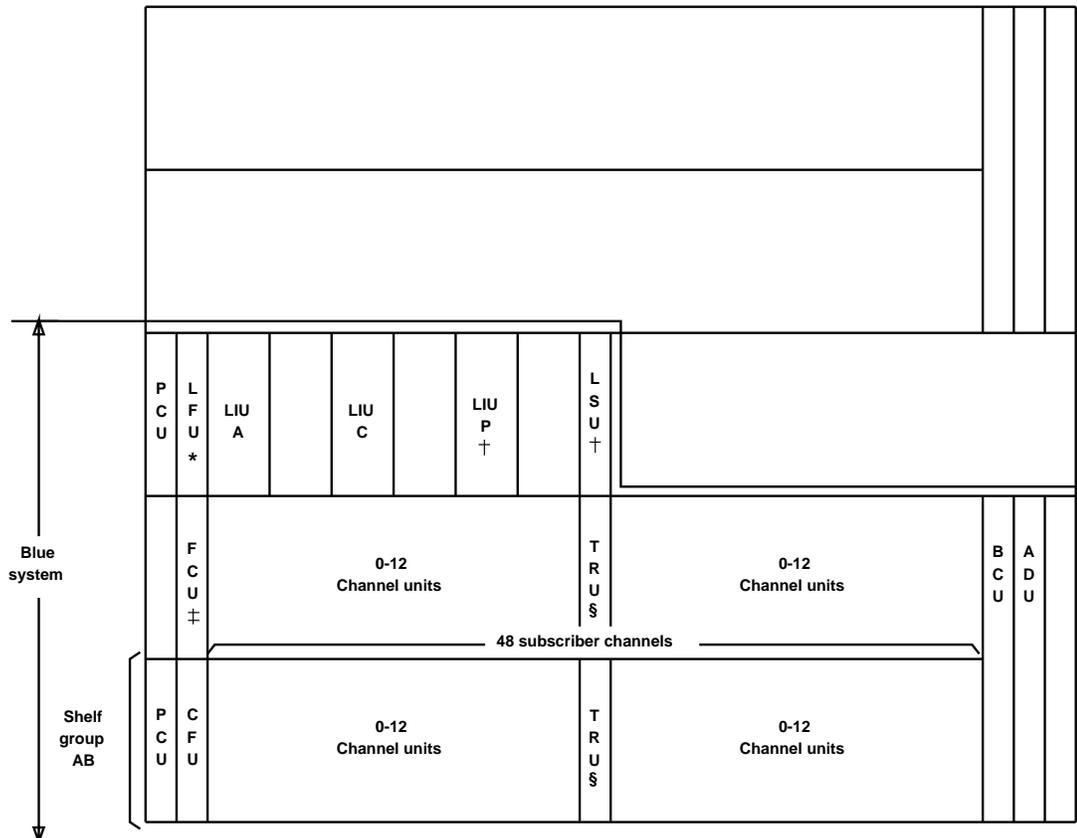
The minimum configuration serves up to 96 voice frequency (VF) or ISDN customers concentrated on 2 DS1 facilities. Since the A and C line interface unit (LIU) DS1 facilities carry the active and standby embedded operations channel (EOC) and the timeslot management channel (TMC), the minimum system must include the A and C LIUs and the AB and CD shelf transmit/receive units (TRUs).

(Continued on next page)

System Planning (Continued)

Minimum configuration for an FP303 system illustrated

This figure shows the common units installed in the minimum configuration for an FP303 system.



- * Required only with line-powering AUA 62() LIUs
- † Optional
- ‡ Required only with 2-type fan units
- § The TRU faceplate connector is required.

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Mixed Bank Considerations

Description

In a mixed (or split) bank application, the Series 5 dual channel bank assembly contains two different systems. A mixed bank may use the following:

- Enhanced Feature Package B (FPB) with MC97776A1 BCU
- Feature Package C (FPC)
- Integrated Network Access Remote Terminal (INA-RT)
- FP303 and Enhanced FPB.

The FPC and FPC/AutoCut applications and restrictions are identical for testing and alarming and are combined as FPC in the guidelines for mixed bank applications. System alarm coordination is covered in Chapter 8, *System Alarms and Maintenance*.

Mixed bank test unit requirements and capabilities

Test unit requirements and capabilities are summarized in the following table and described in the paragraph following. The local telephone company may have additional administrative concerns related to provisioning and system identification with a mixed bank.

<u>Unit and Mode</u>	<u>FPC and Enhanced FPB</u>	<u>INA-RT and Enhanced FPB</u>	<u>FP303 and Enhanced FPB</u>	<u>FPC and INA-RT</u>
CTU Req'd	AUB22	AUB22	AUB22	AUB25
Test Mode	PGTC	PGTC	PGTC	XTC

To test channels using the pair gain test controller (PGTC) or extended test controller (XTC), the proper channel test unit (CTU) must be installed. The AUB22 CTU is required in a dual channel bank equipped with enhanced FPB in either half (blue or white bank). The AUB25 CTU is required in a dual channel bank equipped with FPC in either half (blue or white bank). The INA-RT does not support test access with the PGTC or XTC, so the CTU installed does not affect INA-RT. The table above summarizes these applications.

An FP303 system can be mixed in a dual channel bank assembly with an enhanced FPB system.

INA-RT

Mode selection

The INA-RT contains two 96-line systems (Mode I) or two 48-line systems (Mode III).

- Mode I is recommended for applications with a large percentage of dual channel units, DDS channel units provisioned for SCEC, or ISDN channel units. This operating mode provides most efficient use of 48 dual-channel 2-wire channel units, although the single-channel 4-wire channel units may also be used.
- Mode III is recommended for applications with a large percentage of single channel units: 4-wire VF channel units or DDS channel units (provisioned without SCEC). This operating mode is most efficient using 48 single-channel 4-wire channel units since facilities are reduced. Dual-channel 2-wire channel units (CUs) may also be used.

Summary of INA-RT modes

This table summarizes the modes and applications for the INA-RT.



NOTE:

This table provides a starting point for choosing the appropriate mode for expected applications. **Channel assignment also must be considered.** Refer to the text for channel and slot assignment for INA-RT in this chapter. Detailed option setting information is given in 363-205-104, *INA-RT User's Manual*.

Mode (ADU option)	System Capacity	System IDs (ADU option)	Channel Slot Count	SGL/DBL (ADU option)	Typical Application
Mode I (48)	96 channels (four DS1s)	Different (two IDs) [†]	1 - 48 per shelf [†]	—	Dual CUs
Mode I (96)	96 channels (four DS1s)	Same (one ID)	1 - 96 per system	—	Dual CUs
Mode III (48)	48 channels (two DS1s)	Different (one ID) [‡]	1 - 48 per system [†]	SGL DBL	Single CUs Mixed CUs
Mode III (96)	48 channels (two DS1s)	Same (one ID)	1 - 96 (odd only) [¶]	SGL DBL	Single CUs Mixed CUs

[†] In Mode I (48), each shelf has its own system ID.

[†] Uses new bank designation strips shipped with the BCU.

[‡] One set of ID switches on the ADU is ignored.

[¶] Each physical slot is identified as one channel using odd numbering from 1 to 95 (in other words, 1,3,5 ... 91, 93, 95) during assignment and provisioning.

(Continued on next page)

INA-RT (Continued)

Summary of INA-RT modes (continued)

Mode I (48) and Mode III (48) allow consistent numbering of channels end-to-end between the D4 bank and INA-RT. These modes help simplify administration and maintenance. If channel numbers do not need to correspond at both ends, Mode I (96) or Mode III (96) may be used with the existing designations for more convenient CIU testing at the INA-RT.

INA-RT channel assignment

The most difficult part of engineering an INA-RT system is the channel assignment because of the difference in numbering between INA-RT and the D4 bank. The 48-channel D4 bank identifies one channel for each slot in a digroup, numbered 1A, 2A, 3A, ... up to 24A (the other digroup is numbered 1B, 2B, ... 24B). On the other hand, the 96-line INA-RT identifies *two* channels per slot, numbered 1/2, 3/4, 5/6, ... up to 96 for each system.

To help prevent confusion in identifying channels at each end, options are provided on the ADU for system identification and channel assignment. These options change the INA-RT channel slot numbering to make system administration easier and to provide alarms and local indications based on 48 or 96 channels. The 48-channel options are consistent with the 48 channels in a D4 channel bank and are supported with new self-adhesive designation strips (Comcode 846309011) shipped with the MC97769A1 BCU. Refer to *Circuit Design Considerations* for details on channel and slot assignment for INA-RT.

Framing format selection

The framing format must be selected by an ADU option switch. The BCU provisions all LIUs according to the framing format set by this option switch. For the SF D4 format, the BCU provisions the LIU for D4 framing. No data link is provided with INA-RT, so in the SF format, the signaling frame pattern is supplied in every superframe. With the ESF format, the 4 kb/s data link bits are all ones (except when a yellow alarm is transmitted for the digroup).

The INA-RT framing format should be set to match that of the central office equipment connected to the INA-RT. Allowable equipment includes:

- D4 Bank: Usually SF, although the D4 bank may use ESF framing with the LIU3ESF-AHG8 D4 LIU.
 - D5 Bank: Usually ESF.
 - Digital Cross-Connect System (including Lucent Technologies' DACS products): Either SF or ESF.
 - SLC 96 Carrier D4 Emulator: SF format. Requires a specific SLC 96 carrier data link unit, F-62115 CP (refer to CIR 363-099-0661R).
-

(Continued on next page)

INA-RT (Continued)

Other considerations

Other engineering considerations include the following:

- INA-RT may be used in mixed bank applications
- external protection switching can be provided if desired for the INA-RT.

Guidelines for system identification are given in Chapter 8, *System Alarms and Maintenance*.

System Optioning

Choosing system options

The Series 5 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 in order for the system to operate. Some special service channel units require prescription setting of option switches or provisioning of options.

The engineer must provide information to installation forces on the options required on the common units selected for the particular application. The following decisions on the Series 5 system application must be reflected in the common unit selection and further option selection on those plug-ins.

Universal (Feature Package C)

Universal means the use of a COT with an RT. Universal FPC is a system that uses a Series 5 COT with a Series 5 RT.

Universal or integrated (Enhanced Feature Package B)

Universal enhanced FPB is a system that uses a *SLC 96* carrier COT with a Series 5 RT. Integrated enhanced FPB is a system that uses a TR-08 digital switch interface [such as the *5ESS* switch digital carrier line unit (DCLU)] or a subscriber loop interface module (SLIM) with a Series 5 RT.

Feature Package 303

Feature Package 303 is a system that uses a TR-303 digital switch interface [such as the *5ESS* switch with an integrated digital carrier unit (IDCU)].

Protected or unprotected

This choice is based on the facility choice and the risk associated with the potential of in-service failure of the facility.

(Continued on next page)

System Optioning (Continued)

Full or partially equipped banks

The telephone company may equip only part of the system if slow growth is expected. Partial equipping for a universal system must be in either the A/B digroups or the C/D digroups. With FP303 configurations, the telephone company can elect to equip only one system of a dual channel bank and equip the other system at a later time. In addition, the telephone company can elect to equip only the A and C LIU DS1 facilities and add the B and/or D LIU DS1 facilities at a later time. Equipping the B and/or D LIU DS1 facilities involves adding a B and/or D LIU and setting the S2-7 and/or S2-8 option switches on the ADU to the equipped position.

Alarm planning

Several alarm options are possible. The Series 5 RT generates a power minor alarm (PMN) when AC power is lost. This alarm, when sent to the COT, will alert the operating company to a condition that, if not cleared in a reasonable time (that is, battery capacity), could result in customer loss of service. If the central office alarm display is equipped to show the PMN status, the COT should be optioned to transmit PMN by itself to the office alarm system; otherwise, PMN can be grouped with the central office MN alarm. See Chapter 8, *System Alarms and Maintenance*.

Each universal FPC system is capable of sending two miscellaneous alarms from the RT location to the office and remote alarm system. The engineer can choose to present each alarm as either an MJ or MN alarm. The enhanced FPB system miscellaneous alarms are limited by the SLC 96 carrier system TR-08 format. See Central Office Planning and Chapter 8 (*System Alarms and Maintenance*) for details on connection of the alarms. No plug-in optioning is needed for enhanced FPB miscellaneous alarms.

Design options

The engineer, when designing the facility and its support, will make common unit option decisions that must be specified on the work order. These include office cable equalization, LIU pad settings, and order wire build-out. The design rules for these options are contained in 915-710-115, Series 5 system application engineering.

(Continued on next page)

System Optioning (Continued)

Specific plug-in option settings

All engineer selected options are listed. Additional options are set during turnup from instructions in 363-205-400 (COT TOP) and 363-205-401 (RT TOP).



CAUTION:

All options of all LIUs in a bank, either COT or RT, should be identical. These options must be set as specified on the engineering work order or facility record.

AUA61D LIU

S1

- B - For B8ZS line code - use when clear channel capability is needed and for FP303.
- Z - For per channel zero code suppression (ZCS).



NOTE:

Caution should be used when optioning Series 5 for B8ZS. The engineer should ensure that the entire DS1 facility is B8ZS compatible. Also, some bipolar violation monitoring sets are not B8ZS compatible. FP303 requires that this switch be set to B.

S4

- RATE 32 - Received signal sent to TCU. Codes two digroups into one DS1 signal for INA-RT Mode III.
- RATE 64 - Received signal sent to TRU. Allows 64 kb/s PCM operation (FPC, enhanced FPB, and FP303).

S2

Cable equalization to the DSX (cross-connect panel); 5 choices. For design information in RT applications, see DS1 equalization requirements in 915-710-115. The option switches and their cable range are specified in data sheet 363-005-150 (AUA61D).

(Continued on next page)

System Optioning (Continued)

AUA61D LIU (continued)

S3

RLB ENB - Enables line loopback.

RLB DIS - Disables line loopback.



NOTE:

The AUA61D LIU can request a far-end loopback by grounding the receive DS1 input. This is done by applying a DC voltage to the center tap of the receive transformer (in other words, a simplex voltage). The loopback request capability is provided by equipping the line fuse unit (LFU) and setting the S3 switch on the LIU to ENB. The loopback request works with the DDM-1000/DDM-2000 multiplexer; however, in at least one case, the simplex voltage on the receive pair of the LIUs caused false alarms with another vendor's multiplexer. The customer may determine whether the loopback request works with a particular multiplexer. In systems that are not compatible with the loopback request, the LFU may be removed to prevent further problems.

AUA62D and AUA64D LIUs

S100

B/Z - Same as AUA61D (B8ZS/ZCS line code)

Sections 1 and 2 are receive pad options - See 915-710-115 (the chapter on digital line design) for design rules and data sheets 363-005-151 (AUA62D) and 363-005-152 (AUA64D) for option switch information.

S4

RATE 32 - Same as AUA61D (for INA-RT Mode III)

RATE 64 - Same as AUA61D (for FPC, enhanced FPB, and FP303)

S1/S2

Transmit pad options - See 915-710-115 (the chapter on digital line design) for design rules and data sheets 363-005-151 (AUA62D) and 363-005-152 (AUA64D) for option switch information.

(Continued on next page)

System Optioning (Continued)

**AUA1, AUA21B
TRUs (FPC)** No options

**AUA105(),
AUA109 RT TRU
(Enhanced FPB
and FPC/AC)** No options

**AUA22B RT TRU
(Enhanced FPB)** No options

**AUA112() RT
TRU (FP303)** No options

AUA73B LSU **S1 (D/F)**

D - Denies access to protection line
F - Forces digroup onto protection line

S2

RATE 32 - Same as AUA61D (for INA-RT Mode III)
RATE 64 - Same as AUA61D (for FPC and enhanced FPB)

AUA74 LSU **S1 (D/F)**

D - Denies access to protection line
F - Forces digroup onto protection line

(Continued on next page)

System Optioning (Continued)

MC97755A1,
MC97756A1,
MC97769A1,
MC97776A1(),
MC97777A1, and
MC97796A1 BCUs

No options

AUB6 COT ADU
(FPC) **S1**

- 1 - PL: Protection line
- 1 - NPL: No protection line
- 2 - 32/64: INA-RT Mode III / 64kb/s PCM operation
- 3 - ABP: A/B digroups in preservice state
- 3 - ABI: A/B digroups in the in-service state
- 4 - CDP: C/D digroups in preservice state
- 4 - CDI: C/D digroups in the in-service state
- 5 - ABU: A/B digroups unequipped
- 5 - ABE: A/B digroups equipped
- 6 - CDU: C/D digroups unequipped
- 6 - CDE: C/D digroups equipped
- 7, 8, 9, 10 - Unused

S3, S4, S5, S6

System identification switches (0001) to (9999)

(Continued on next page)

System Optioning (Continued)

AUB24 RT ADU (FPB) S2

- 1, 3, 4, 5 - Positions same as AUB6
- 6 - Always set to closed position (CD digroups equipped).
- 2, 7 - Always set to open position



Note 1: The closed position of switch segment 7 is reserved for future use.

- 8 - Unused



Note 2: The miscellaneous alarm capabilities of FPC and enhanced FPB systems are different (see Chapter 8).

AUB26 RT ADU (FPC) S1

- 1, 2, 3, 4, 5, 6 Positions - same as AUB6
- 7 - 1MN: MN alarm for RT MISC1
- 7 - 1MJ: MJ alarm for RT MISC1
- 8 - 2MN: MN alarm for RT MISC2
- 8 - 2MJ: MJ alarm for RT MISC2
- 9 - D1D/D4: Set to D4
- 10 - Unused

(Continued on next page)

System Optioning (Continued)

**AUB27() RT ADU S1
(INA-RT, FPB,
FPC/AC, and
FP303)**

- 1 - NPL: No protection line
- 1 - PL: Protection line
- 2 - 2: Two DS1 lines (FPB Mode 2 or INA-RT Mode III) (Not used for FP303)
- 2 - 4: Four DS1 lines (Not used for FP303)
- 3 - ABI: A/B digroups in-service
- 3 - ABP: A/B digroups preservice
- 4 - CDI: C/D digroups in-service
- 4 - CDP: C/D digroups preservice
- 5 - ABE: A/B digroups equipped
- 5 - ABU: A/B digroups unequipped
- 6 - CDE: C/D digroups equipped
- 6 - CDU: C/D digroups unequipped
- 7 - 1MJ: Associates RTMISC1 with a MAJOR alarm (Not used with INA-RT)
- 7 - 1MN: Associates RTMISC1 with a MINOR alarm (Not used with INA-RT)
- 8 - 2MJ: Associates RTMISC2 with a MAJOR alarm (Not used with INA-RT)
- 8 - 2MN: Associates RTMISC2 with a MINOR alarm (Not used with INA-RT)

(Continued on next page)

System Optioning (Continued)

AUB27() RT ADU S2 (INA-RT, FPB, FPC/AC, and FP303) (continued)

- 1 - 16: Selects a 16-bit field length (Not used unless the distant terminal is a SLIM) (Not used for FP303)
- 1 - 13: Selects a 13-bit field length (Not used for FP303)
- 2 - FS: Selects the TR-08 framing pattern
- 2 - FE: Selects the extended superframe framing pattern (FP303 and FPC/AC position)
- 3 - NC: No cutover enables S2-2 (Used in FPC/AC only) (FP303 position)
- 3 - CUT: Cutover hunting enabled *disables* S2-2 (Used in FPC/AC only)
- 4 - SGL: Odd channels only are operational (INA-RT Mode III only) (FP303 position)
- 4 - DBL: Both channels are operational (INA-RT Mode III only)
- 5 - PA: Power minor alarm is integrated according to S2-6 (INA-RT only)
- 5 - NPA: Power minor alarm is not integrated (INA-RT only) (FP303 position)
- 6 - MJP: Integrated power minor alarm appears as a MAJOR alarm (INA-RT only)
- 6 - MNP: Integrated power minor alarm appears as a MINOR alarm (INA-RT only) (FP303 position)
- 7 - —: Set to left (toward bottom of board) to equip B DS1 facility. Set to right (toward top of board) to unequip B DS1 facility. (FP303 only)
- 8 —: Set to left (toward bottom of board) to equip D DS1 facility. Set to right (toward top of board) to unequip D DS1 facility. (FP303 only)

S3

- DL: Data link to the office is enabled (Not used for FP303)
- NDL: Data link to the office is not enabled (Not used for FP303)

S4 - S7

System identification switches (0000 to 9999) [A/B (lower) shelf in INA-RT]

(Continued on next page)

System Optioning (Continued)

**AUB27() RT ADU
(INA-RT, FPB,
FPC/AC, and
FP303) (continued)**

S8 - S11

System identification switches (0000 to 9999) [C/D (upper) shelf in INA-RT / Not used in FPB, FPC/AC, or FP303]

NORM/CLR



CAUTION:

For a FP303 system, a temporary service interruption will occur if the NORM/CLR option plug is left in the CLR position.

CLR: Enables the bank provisioning memory (EEPROM) to clear following BCU insertion if a provisioning data 3-way mismatch exists and no provisionable channel units are in the bank.

NORM: Provisioning memory can only be cleared by the CIU.

AUB3B AIU

S2

1, 7 - Not used

2, 3 - Always closed (set by 363-205-400 TOP)

4, 5 - Always open (set by 363-205-400 TOP)

6 - Closed: RT PMN actuates CO PMN alarm (Office alarm system must be equipped with a PMN alarm).

6 - Open: RT PMN actuates CO MN alarm (no office PMN alarm).

8 - Closed: RT PMN actuates CO MN alarm (no office PMN alarm).

8 - Open: RT PMN actuates CO MN alarm (Office alarm system must be equipped with a PMN alarm).



CAUTION:

S2 switch positions 6 and 8 must be optioned as pairs; for example, 6 closed and 8 open or 6 open and 8 closed, depending on how the RT PMN is to be reported. Other combinations should not be specified.

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System Optioning (Continued)

ED-7C613-30, G3 LDU

The LDU is equipped with a daughter board coded ED-7C613-30, G2. This board provides build-out resistance for the order wire. The design information for selecting the build-out options is in 915-710-115 in the chapter on order wire engineering. The option switch information is in the data sheet 363-005-222. In RT building applications, the ED-7C613-30, G2 board is located in the miscellaneous pair panel. It must be optioned after the engineer calculates the settings and specifies them on the work order.

Central Office Planning

Forecasting guidelines

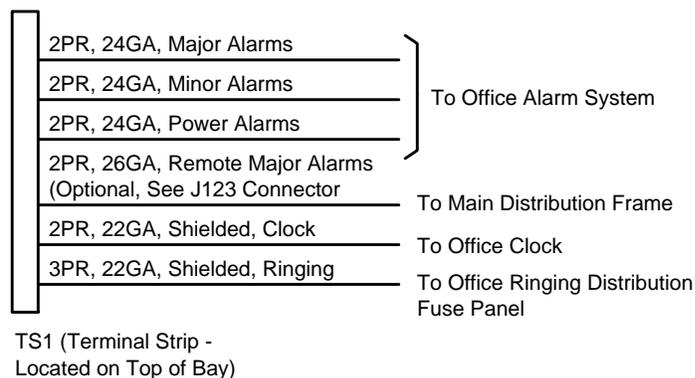
Central office equipment should be provided for an economical period, with equipment provided to last through this engineering period. A forecast must be provided for the quantity of universal systems and integrated systems required for this period. This forecast must be for all feeder cable routes radiating from the wire center and should specify the quantity of metallic T1 lines terminating and the quantity being provided via fiber. The forecast should cover the following:

- frame terminations on the main distributing frames for universal systems
- digital line terminations on the subscriber digital distribution frame (SDDF)
- COT bays for universal systems
- DCLU requirements for integrated systems
- digital facilities interface (DFI) for conventional T1 terminations in the DCLU
- DSX-1 (DS1 cross-connect panel) terminations
- office repeater bay (ORB) requirements
- fiber optic multiplex and fiber system needs.

All external connections are made to connectorized cables except for several wire-wrap terminals for alarms and the cables for -48 volt battery and ground connections. Typical lead requirements figures follow. Fuses and alarm indicators for the systems are located on the heat baffles between each dual channel bank.

Typical lead requirements figures

This figure shows the alarm, clock, and ringing lead requirements for each COT bay configuration.

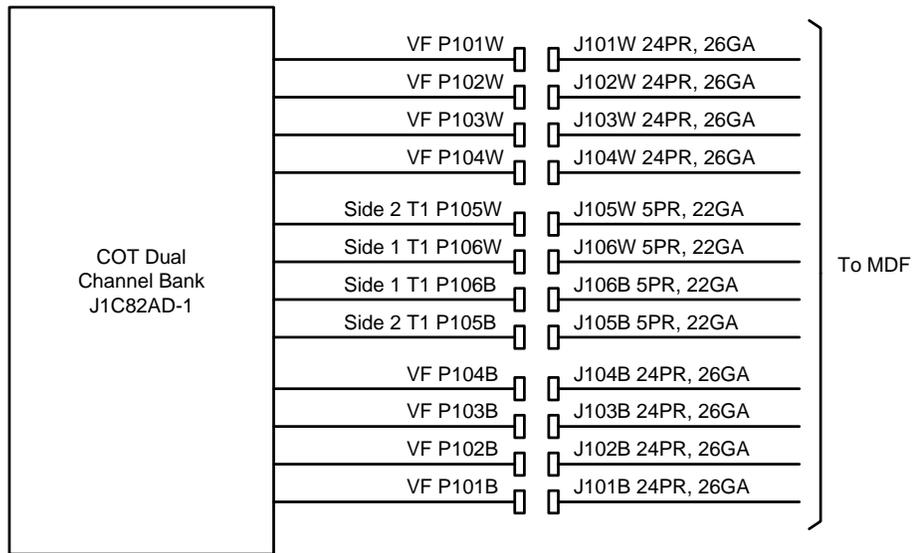


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Central Office Planning (Continued)

Typical lead requirements figures (continued)

Voice-frequency and T1 lead requirements for each COT dual channel bank assembly are shown below.

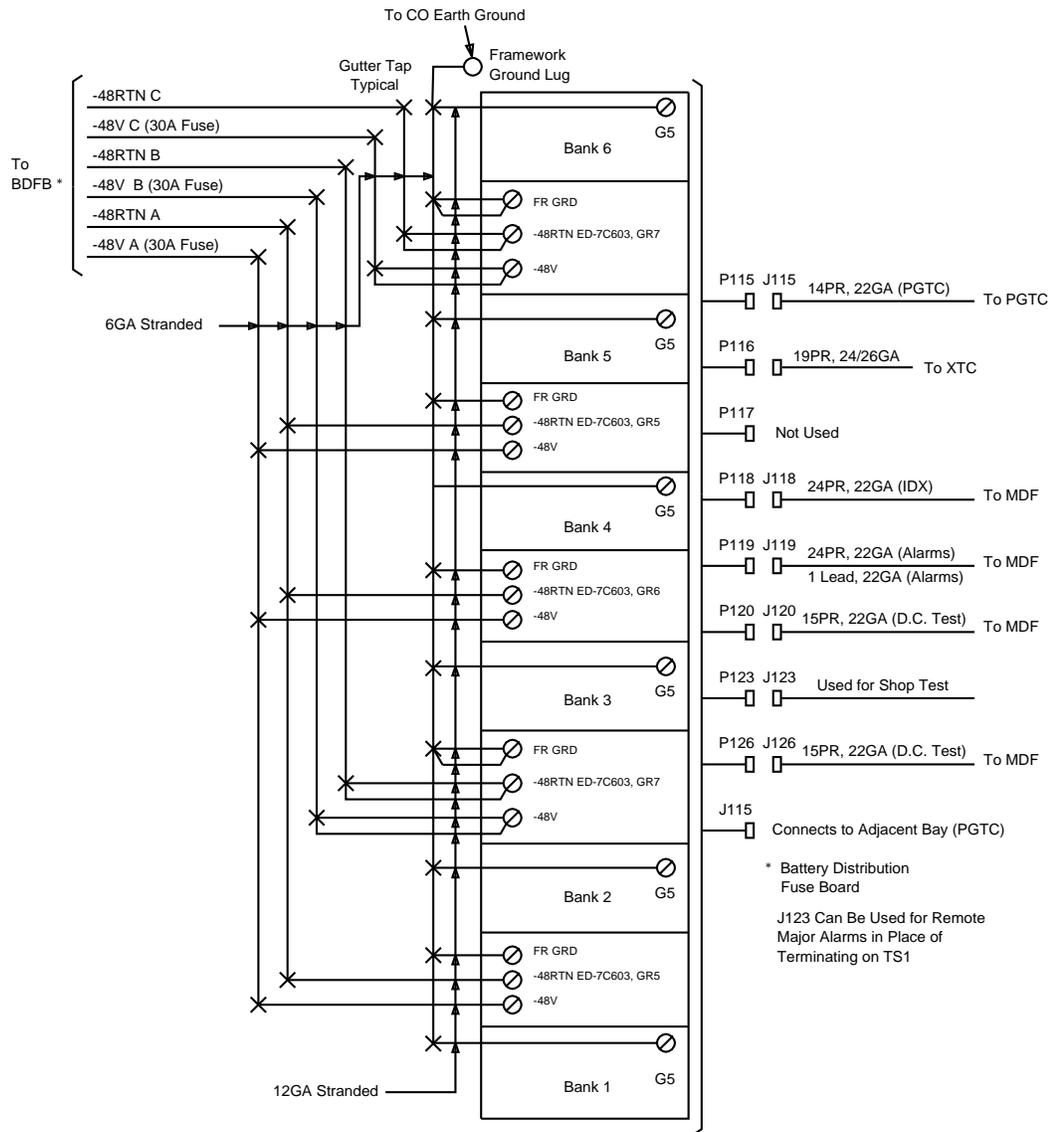


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Central Office Planning (Continued)

Typical lead requirements figures (continued)

The J1C182D, L1 11-foot 6-inch bay, PGTC, alarm, DC test, system ID and -48 V distribution lead requirements are shown below.



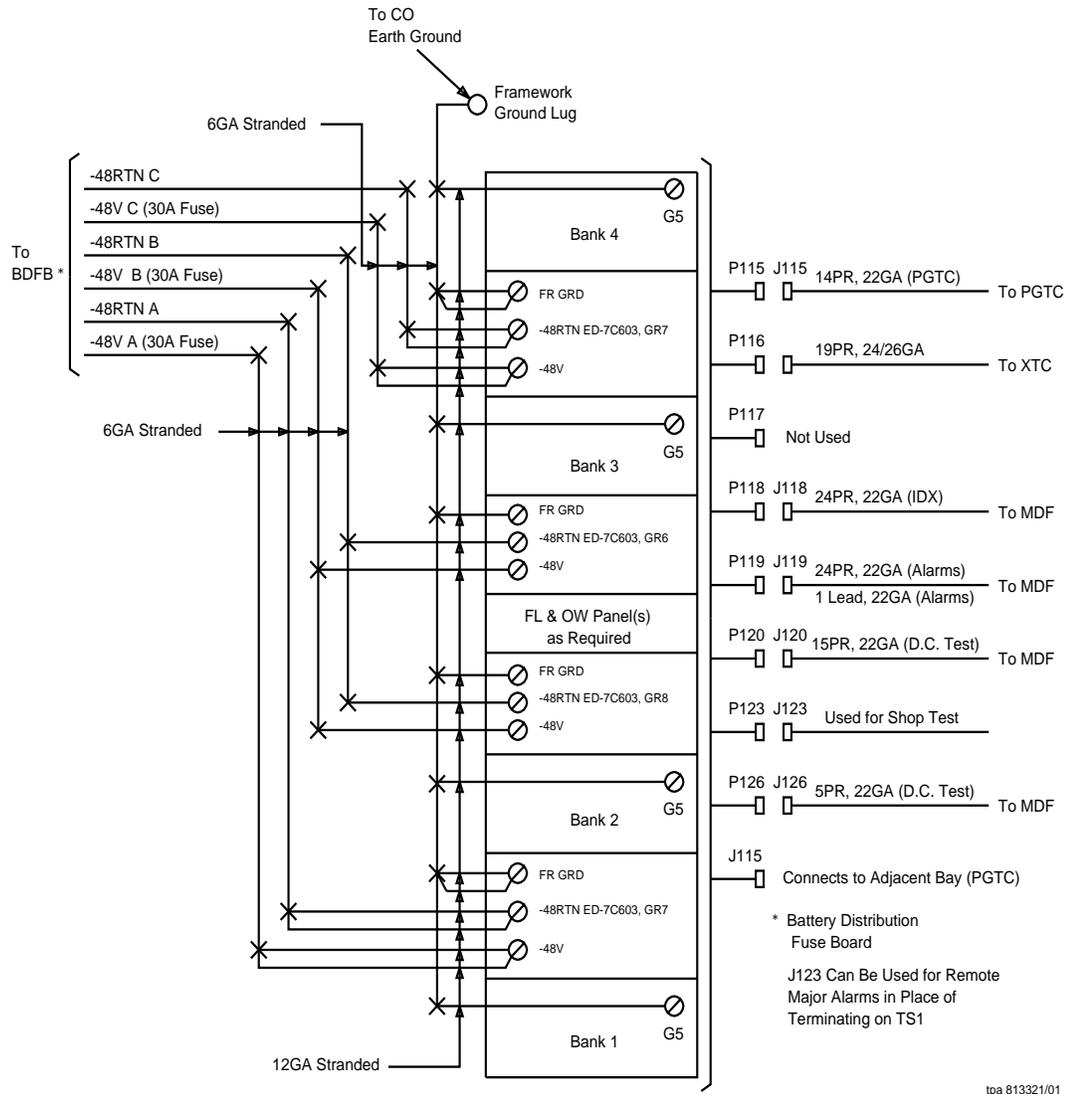
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Central Office Planning (Continued)

Typical lead requirements figures (continued)

The J1C182E, L1 9-foot bay, PGTC, alarm, DC test, system ID and -48 V distribution lead requirements are shown below.

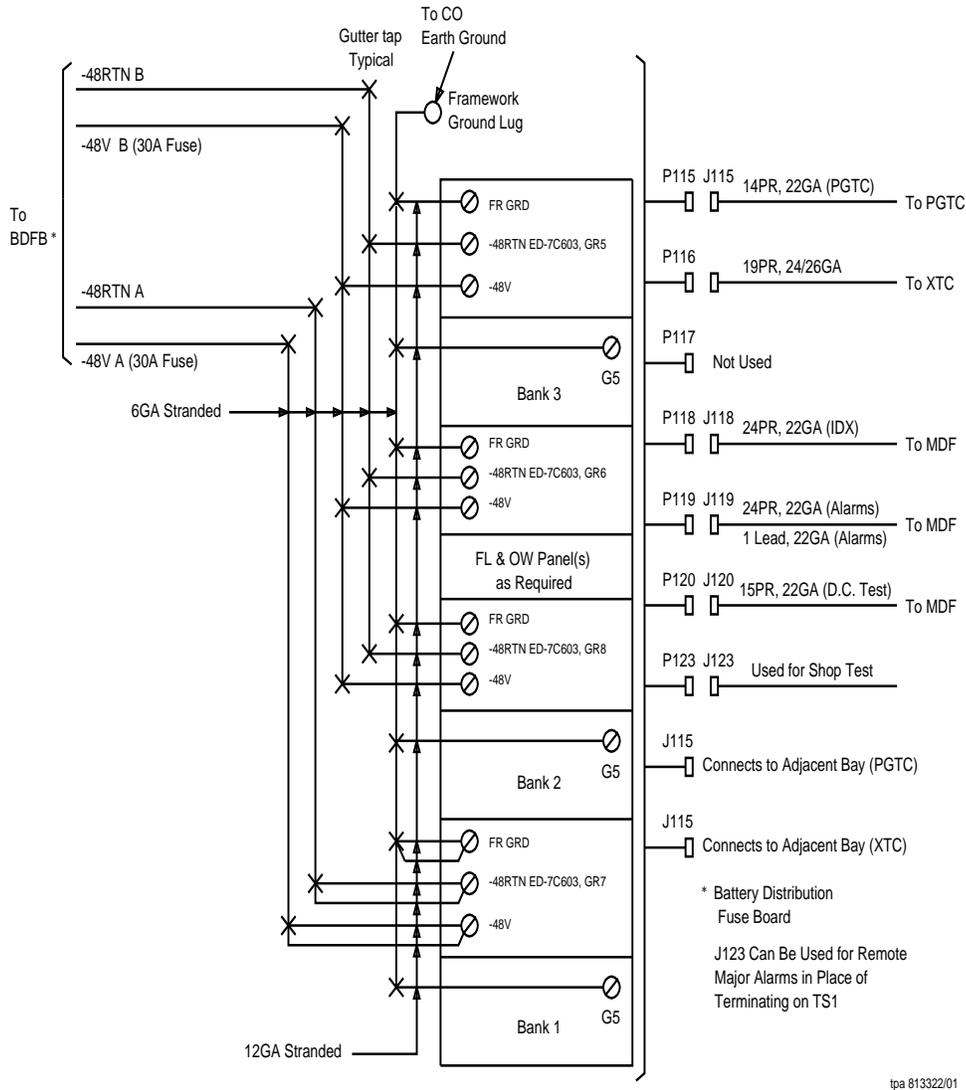


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Central Office Planning (Continued)

Typical lead requirements figures (continued)

The J1C182F, L1 7-foot bay, PGTC, alarm, DC test, system ID and -48 V distribution lead requirements are shown below.



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Central Office Planning (Continued)

Floor plan data sheets

The Series 5 system contains twice as many lines in a COT bay as the *SLC 96* Carrier System. This can result in considerable floor space savings in large central offices. The following eight pages show floor plan data sheets (FPDS) for the COT bays showing physical and cabling data as well as heat release and current drain information. Standard engineering procedures apply in the provisioning of other central office equipment such as ORBs, DSX-1 terminations, DCLUs, DFIs, etc.

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued) This FPDS (sheet 1 of 2) is for the 11-foot 6-inch COT frame with six DCBs.

ISSUE: 1		UNOFFICIAL FLOOR PLAN DATA						5SBC	1
DATE:									
EQUIPMENT IDENTIFICATION		PHYSICAL DATA		CABLING DATE		HEAT RELEASE, WATTS			
MFR'S NAME: LUCENT TECHNOLOGIES MFR'S CODE: J1C182A, L1 RATING: LUCENT STANDARD FLOOR PLAN DESIGNATION: 5SBC TOPES SUFFIX: 1 CLE BASIC CODE: 5SBC		NEBS COMPATIBLE: NO HEIGHT: 11-6 DEPTH: 1-0 EFFECT WIDTH: 2-2 WEIGHT LBS. 760 FRWK TYPE: UNEQUAL FLG MIN FRONT AISLE: 2-6 MIN REAR AISLE: 2-0 FRAMES/FUNCTION: 1 (1) UNITS/FRAME: 1152 (1)		SHIELD OR CLASS	EFFECTIVE CABLE AREA (SQ. IN.)		BUSY	IDLE	PLANNING VALUE
						MAX	1770	870	1013
				1	12.0	MIN	846	564	
				2	9.0				
3	2.0								
DC CURRENT DRAINS									
VOLTAGE	LIST NO.	BUS	MAX AMPS	MIN AMPS					
-48 (4)	1		45.60	12.00					
-48 (4)	2		69.00	15.00					
AC CURRENT DRAINS									
VOLTAGE	CATEGORY	RUNNING CURR. AMPS	INRUSH						
			CURR. AMPS	DURATION SECS					
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 11'6" FRAME WITH SIX DUAL CHANNEL BANKS					FPD 801-450-106-1 SHEET 1 OF 2		

NOTES: 1. INDICATES THE NUMBER OF CIRCUITS FOR UNITS/FRAME.

2. THE HEAT RELEASE AND DC CURRENT DRAINS OF SLC SERIES 5 SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), THE ASSOCIATED ACTIVITY RATE AND WHETHER T1 LINE POWER IS PROVIDED AT THE SERIES 5 FRAME. 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.

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued) This FPDS (sheet 2 of 2) is for the 11-foot 6-inch COT frame with six DCBs.

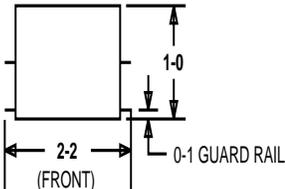
ISSUE:	1	UNOFFICIAL FLOOR PLAN DATA	5SBC	1																																
DATE:																																				
<p>NOTES CONTINUED:</p> <p>3. HEAT RELEASE VALUES ARE BASED ON THE FOLLOWING EQUIPMENT CONFIGURATIONS.</p> <p>MAX - ALL SPECIAL SERVICE CHANNEL UNITS WITH -130 VOLTS, T1 LINE POWER FROM THE FRAME.</p> <p style="padding-left: 40px;">BUSY - 18 CCS IDLE - 0 CCS</p> <p>MIN - ALL POTS CHANNEL UNITS WITHOUT T1 LINE POWER FROM THE FRAME.</p> <p style="padding-left: 40px;">BUSY - 6 CCS IDLE - 0 CCS</p> <p>BECAUSE THE FRAME DISSIPATES MORE THAN 60 WATTS PER SQUARE FOOT OF ALLOTTED AREA (BASED ON 2' 6" FRONT AND 2' 0" REAR AISLE SPACE), CONSULT BSP SECTIONS OF THE 760-230-1XX SERIES FOR ADDITIONAL COOLING INFORMATION. THIS FRAME IS COOLED BY NATURAL CONVECTION ONLY.</p> <p>4. EACH FRAME IS SERVED BY THREE BDFB FUSED FEEDER CABLES. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>BUS</th> <th>VOLTS</th> <th>LIST</th> <th>MAX (NOTE 5)</th> <th>MIN (NOTE 6)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">A</td> <td>52</td> <td>1</td> <td>15.2 AMPS</td> <td>4 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>23.0 AMPS</td> <td>5 AMPS</td> </tr> <tr> <td rowspan="2">B</td> <td>52</td> <td>1</td> <td>15.2 AMPS</td> <td>4 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>23.0 AMPS</td> <td>5 AMPS</td> </tr> <tr> <td rowspan="2">C</td> <td>52</td> <td>1</td> <td>15.2 AMPS</td> <td>4 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>23.0 AMPS</td> <td>5 AMPS</td> </tr> </tbody> </table> <p>5. MAX AMPS ARE BASED ON SPECIAL SERVICES (CF) CHANNEL UNITS AND PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p>(A) LIST 1 DC DRAIN AT 18 CCS.</p> <p style="padding-left: 40px;">SUBTRACT 16.2 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 5.4 AMPS FROM EACH OF A, B & C BUSSES.</p> <p>(B) LIST 2 DC DRAIN AT 36 CCS.</p> <p style="padding-left: 40px;">SUBTRACT 19.2 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 6.4 AMPS FROM EACH OF A, B & C BUSSES.</p> <p>6. MIN AMPS ARE BASED ON POTS CHANNEL UNITS AND NOT PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p>(A) LIST 1 DC DRAIN AT 6 CCS.</p> <p style="padding-left: 40px;">ADD 16.2 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 5.4 AMPS FOR EACH OF A, B & C BUSSES.</p> <p>(B) LIST 2 DC DRAIN AT 12 CCS.</p> <p style="padding-left: 40px;">ADD 19.2 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 6.4 AMPS FOR EACH OF A, B & C BUSSES.</p>					BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)	A	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS	B	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS	C	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS
BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)																																
A	52	1	15.2 AMPS	4 AMPS																																
	42.5	2	23.0 AMPS	5 AMPS																																
B	52	1	15.2 AMPS	4 AMPS																																
	42.5	2	23.0 AMPS	5 AMPS																																
C	52	1	15.2 AMPS	4 AMPS																																
	42.5	2	23.0 AMPS	5 AMPS																																
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 11'6" FRAME WITH SIX DUAL CHANNEL BANKS		FPD 801-450-106-1 SHEET 2 OF 2																																

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 1 of 2) is for the 11-foot 6-inch COT frame with five DCBs.

ISSUE: 1		UNOFFICIAL FLOOR PLAN DATA						5SBC	2
DATE:									
EQUIPMENT IDENTIFICATION		PHYSICAL DATA		CABLING DATE		HEAT RELEASE, WATTS			
MFR'S NAME: LUCENT TECHNOLOGIES MFR'S CODE: J1C182A, L2 RATING: LUCENT STANDARD FLOOR PLAN DESIGNATION: 5SBC TOPES SUFFIX: 2 CLE BASIC CODE: 5SBC		NEBS COMPATIBLE: NO HEIGHT: 11-6 DEPTH: 1-0 EFFECT WIDTH: 2-2 WEIGHT LBS: 720 FRWK TYPE: UNEQUAL FLG MIN FRONT AISLE: 2-6 MIN REAR AISLE: 2-0 FRAMES/FUNCTION: 1 (1) UNITS/FRAME: 960 (1)		SHIELD OR CLASS	EFFECTIVE CABLE AREA (SQ. IN.)		BUSY	IDLE	PLANNING VALUE
				1	12.0	MAX	1475	725	843
				2	8.5	MIN	706	470	
				3	2.0	DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES. X 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 (4)	1		44.30	10.00					
-48 (4)	2		63.80	12.50					
AC CURRENT DRAINS					NOTES: 1. INDICATES THE NUMBER OF CIRCUITS FOR UNITS/FRAME. 2. THE HEAT RELEASE AND DC CURRENT DRAINS OF SLC SERIES 5 SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), THE ASSOCIATED ACTIVITY RATE AND WHETHER T1 LINE POWER IS PROVIDED AT THE SERIES 5 FRAME. 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.				
VOLTAGE	CATEGORY	RUNNING CURR. AMPS	INRUSH						
			CURR. AMPS	DURATION SECS					
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 11'6" FRAME WITH 5 DUAL CHANNEL BANKS			FPD 801-450-106-2 SHEET 1 OF 2				

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 2 of 2) is for the 11-foot 6-inch COT frame with five DCBs.

ISSUE:	1	UNOFFICIAL FLOOR PLAN DATA	5SBC	2																																
DATE:																																				
<p>NOTES CONTINUED:</p> <p>3. HEAT RELEASE VALUES ARE BASED ON THE FOLLOWING EQUIPMENT CONFIGURATIONS.</p> <p>MAX - ALL SPECIAL SERVICE CHANNEL UNITS WITH -130 VOLTS, T1 LINE POWER FROM THE FRAME.</p> <p style="padding-left: 40px;">BUSY - 18 CCS IDLE - 0 CCS</p> <p>MIN - ALL POTS CHANNEL UNITS WITHOUT T1 LINE POWER FROM THE FRAME.</p> <p style="padding-left: 40px;">BUSY - 6 CCS IDLE - 0 CCS</p> <p>BECAUSE THE FRAME DISSIPATES MORE THAN 60 WATTS PER SQUARE FOOT OF ALLOTTED AREA (BASED ON 2' 6" FRONT AND 2' 0" REAR AISLE SPACE), CONSULT BSP SECTIONS OF THE 760-230-1XX SERIES FOR ADDITIONAL COOLING INFORMATION. THIS FRAME IS COOLED BY NATURAL CONVECTION ONLY.</p> <p>4. EACH FRAME IS SERVED BY THREE BDFB FUSED FEEDER CABLES. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>BUS</th> <th>VOLTS</th> <th>LIST</th> <th>MAX (NOTE 5)</th> <th>MIN (NOTE 6)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">A</td> <td style="text-align: center;">52</td> <td style="text-align: center;">1</td> <td style="text-align: center;">15.2 AMPS</td> <td style="text-align: center;">4 AMPS</td> </tr> <tr> <td style="text-align: center;">42.5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">23.0 AMPS</td> <td style="text-align: center;">5 AMPS</td> </tr> <tr> <td rowspan="2" style="text-align: center;">B</td> <td style="text-align: center;">52</td> <td style="text-align: center;">1</td> <td style="text-align: center;">13.9 AMPS</td> <td style="text-align: center;">2.0 AMPS</td> </tr> <tr> <td style="text-align: center;">42.5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">17.8 AMPS</td> <td style="text-align: center;">2.5 AMPS</td> </tr> <tr> <td rowspan="2" style="text-align: center;">C</td> <td style="text-align: center;">52</td> <td style="text-align: center;">1</td> <td style="text-align: center;">15.2 AMPS</td> <td style="text-align: center;">4 AMPS</td> </tr> <tr> <td style="text-align: center;">42.5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">23.0 AMPS</td> <td style="text-align: center;">5 AMPS</td> </tr> </tbody> </table> <p>5. MAX AMPS ARE BASED ON SPECIAL SERVICES (CF) CHANNEL UNITS AND PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p>(A) LIST 1 DC DRAIN AT 18 CCS.</p> <p style="padding-left: 40px;">SUBTRACT 13.5 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 5.4 AMPS FROM EACH OF A AND C BUSSES AND 2.7 AMPS FROM B BUS.</p> <p>(B) LIST 2 DC DRAIN AT 36 CCS.</p> <p style="padding-left: 40px;">SUBTRACT 16.0 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 6.4 AMPS FROM EACH OF A AND C BUSSES AND 3.2 AMPS FROM B BUS.</p> <p>6. MIN AMPS ARE BASED ON POTS CHANNEL UNITS AND NOT PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p>(A) LIST 1 DC DRAIN AT 6 CCS.</p> <p style="padding-left: 40px;">ADD 13.5 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 5.4 AMPS FOR EACH OF A AND C BUSSES AND 2.7 FOR B BUS.</p> <p>(B) LIST 2 DC DRAIN AT 12 CCS.</p> <p style="padding-left: 40px;">ADD 16.0 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 6.4 AMPS FOR EACH OF A AND C BUSSES AND 3.2 AMPS FOR B BUS.</p>					BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)	A	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS	B	52	1	13.9 AMPS	2.0 AMPS	42.5	2	17.8 AMPS	2.5 AMPS	C	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS
BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)																																
A	52	1	15.2 AMPS	4 AMPS																																
	42.5	2	23.0 AMPS	5 AMPS																																
B	52	1	13.9 AMPS	2.0 AMPS																																
	42.5	2	17.8 AMPS	2.5 AMPS																																
C	52	1	15.2 AMPS	4 AMPS																																
	42.5	2	23.0 AMPS	5 AMPS																																
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 11'6" FRAME WITH 5 DUAL CHANNEL BANKS		FPD 801-450-106-2 SHEET 2 OF 2																																

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 1 of 2) is for the 9-foot COT frame with four DCBs.

ISSUE: 1		UNOFFICIAL FLOOR PLAN DATA						5SBC	3
DATE:									
EQUIPMENT IDENTIFICATION		PHYSICAL DATA		CABLING DATE		HEAT RELEASE, WATTS			
MFR'S NAME: LUCENT TECHNOLOGIES MFR'S CODE: J1C182B RATING: LUCENT STANDARD FLOOR PLAN DESIGNATION: 5SBC TOPES SUFFIX: 3 CLE BASIC CODE: 5SBC		NEBS COMPATIBLE: NO HEIGHT: 9-0 DEPTH: 1-0 EFFECT WIDTH: 2-2 WEIGHT LBS: 572 FRWK TYPE: UNEQUAL FLG MIN FRONT AISLE: 2-6 MIN REAR AISLE: 2-0 FRAMES/FUNCTION: 1 (1) UNITS/FRAME: 768 (1)		SHIELD OR CLASS	EFFECTIVE CABLE AREA (SQ. IN.)		BUSY	IDLE	PLANNING VALUE
						MAX	1180	580	675
				1	9.0	MIN	564	376	
				2	6.0	DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES. X DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000.			
3	2.0								
DC CURRENT DRAINS									
VOLTAGE	LIST NO.	BUS	MAX AMPS	MIN AMPS					
-48 (4)	1		34.20	8.00					
-48 (4)	2		49.8	10.00					
AC CURRENT DRAINS									
VOLTAGE	CATEGORY	RUNNING CURR. AMPS	INRUSH						
			CURR. AMPS	DURATION SECS					
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 9' 0" FRAME WITH 4 DUAL CHANNEL BANKS					FPD 801-450-106-3 SHEET 1 OF 2		

- NOTES: 1. INDICATES THE NUMBER OF VF CIRCUITS FOR UNITS/FRAME.
2. THE HEAT RELEASE AND DC CURRENT DRAINS OF SLC SERIES 5 SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), THE ASSOCIATED ACTIVITY RATE AND WHETHER T1 LINE POWER IS PROVIDED AT THE SERIES 5 FRAME. 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.

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 2 of 2) is for the 9-foot COT frame with four DCBs.

ISSUE:	1	UNOFFICIAL FLOOR PLAN DATA			5SBC	3																																
DATE:																																						
<p>NOTES CONTINUED:</p> <p>3. HEAT RELEASE VALUES ARE BASED ON THE FOLLOWING EQUIPMENT CONFIGURATIONS.</p> <p style="margin-left: 40px;">MAX - ALL SPECIAL SERVICE CHANNEL UNITS WITH - 130 VOLTS, T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">BUSY - 18 CCS IDLE - 0 CCS</p> <p style="margin-left: 40px;">MIN - ALL POTS CHANNEL UNITS WITHOUT T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">BUSY - 6 CCS IDLE - 0 CCS</p> <p>BECAUSE THE FRAME DISSIPATES MORE THAN 60 WATTS PER SQUARE FOOT OF ALLOTTED AREA (BASED ON 2' 6" FRONT AND 2' 0" REAR AISLE SPACE), CONSULT BSP SECTIONS OF THE 760-230-1XX SERIES FOR ADDITIONAL COOLING INFORMATION. THIS FRAME IS COOLED BY NATURAL CONVECTION ONLY.</p> <p>4. EACH FRAME IS SERVED BY THREE BDFB FUSED FEEDER CABLES. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>BUS</th> <th>VOLTS</th> <th>LIST</th> <th>MAX (NOTE 5)</th> <th>MIN (NOTE 6)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">A</td> <td>52</td> <td>1</td> <td>15.2 AMPS</td> <td>4 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>23.0 AMPS</td> <td>5 AMPS</td> </tr> <tr> <td rowspan="2">B</td> <td>52</td> <td>1</td> <td>3.8 AMPS</td> <td>0 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>3.8 AMPS</td> <td>0 AMPS</td> </tr> <tr> <td rowspan="2">C</td> <td>52</td> <td>1</td> <td>15.2 AMPS</td> <td>4 AMPS</td> </tr> <tr> <td>42.5</td> <td>2</td> <td>23.0 AMPS</td> <td>5 AMPS</td> </tr> </tbody> </table> <p>5. MAX AMPS ARE BASED ON SPECIAL SERVICES (CF) CHANNEL UNITS AND PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 40px;">(A) LIST 1 DC DRAIN AT 18 CCS.</p> <p style="margin-left: 80px;">SUBTRACT 10.8 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 5.4 AMPS FROM EACH OF A AND C BUSSES.</p> <p style="margin-left: 40px;">(B) LIST 2 DC DRAIN AT 36 CCS.</p> <p style="margin-left: 80px;">SUBTRACT 12.8 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 6.4 AMPS FROM EACH OF A AND C BUSSES.</p> <p>6. MIN AMPS ARE BASED ON POTS CHANNEL UNITS AND NOT PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 40px;">(A) LIST 1 DC DRAIN AT 6 CCS.</p> <p style="margin-left: 80px;">ADD 10.8 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 5.4 AMPS FOR EACH OF A AND C BUSSES.</p> <p style="margin-left: 40px;">(B) LIST 2 DC DRAIN AT 12 CCS.</p> <p style="margin-left: 80px;">ADD 12.8 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 6.4 AMPS FOR EACH OF A AND C BUSSES.</p>							BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)	A	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS	B	52	1	3.8 AMPS	0 AMPS	42.5	2	3.8 AMPS	0 AMPS	C	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS
BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)																																		
A	52	1	15.2 AMPS	4 AMPS																																		
	42.5	2	23.0 AMPS	5 AMPS																																		
B	52	1	3.8 AMPS	0 AMPS																																		
	42.5	2	3.8 AMPS	0 AMPS																																		
C	52	1	15.2 AMPS	4 AMPS																																		
	42.5	2	23.0 AMPS	5 AMPS																																		
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 9' 0" FRAME WITH 4 DUAL CHANNEL BANKS			FPD 801-450-106-3 SHEET 2 OF 2																																	

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 1 of 2) is for the 7-foot COT frame with three DCBs.

ISSUE: 1		UNOFFICIAL FLOOR PLAN DATA						5SBC	4
DATE:									
EQUIPMENT IDENTIFICATION		PHYSICAL DATA		CABLING DATE		HEAT RELEASE, WATTS			
MFR'S NAME: LUCENT TECHNOLOGIES MFR'S CODE: J1C182C RATING: LUCENT STANDARD FLOOR PLAN DESIGNATION: 5SBC TOPEX SUFFIX: 4 CLE BASIC CODE: 5SBC		NEBS COMPATIBLE: YES HEIGHT: 7-0 DEPTH: 1-0 EFFECT WIDTH: 2-2 WEIGHT LBS. 448 FRWK TYPE: UNEQUAL FLG MIN FRONT AISLE: 2-6 MIN REAR AISLE: 2-0 FRAMES/FUNCTION: 1 (1) UNITS/FRAME: 576 (1)		SHIELD OR CLASS	EFFECTIVE CABLE AREA (SQ. IN.)		BUSY	IDLE	PLANNING VALUE
						MAX	885	435	506
				A	6.0	MIN	423	282	
B	4.0	DIMENSIONS 12 INCHES AND OVER ARE IN FEET AND INCHES. ALL OTHER DIMENSIONS ARE IN INCHES. X DENOTES ESTIMATED VALUE. FOR GENERAL INFORMATION, SEE THE SECTIONS OF FPD 800-000-000.							
C	2.0								
DC CURRENT DRAINS									
VOLTAGE	LIST NO.	BUS	MAX AMPS	MIN AMPS					
-48 (4)	1		26.00	6.00					
-48 (4)	2		37.70	7.50					
AC CURRENT DRAINS									
VOLTAGE	CATEGORY	RUNNING CURR. AMPS	INRUSH						
			CURR. AMPS	DURATION SECS					
LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 7' 0" FRAME WITH 3 DUAL CHANNEL BANKS					FPD 801-450-106-4 SHEET 1 OF 2		

- NOTES: 1. INDICATES THE NUMBER OF CIRCUITS FOR UNITS/FRAME.
2. THE HEAT RELEASE AND DC CURRENT DRAINS OF SLC SERIES 5 SYSTEMS VARY SIGNIFICANTLY DEPENDING ON HOW EACH SYSTEM IS PROVISIONED. VARIABLES INCLUDE THE TYPE OF CHANNEL UNITS (POTS OR SPECIAL SERVICES), THE ASSOCIATED ACTIVITY RATE AND WHETHER T1 LINE POWER IS PROVIDED AT THE SERIES 5 FRAME. 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.

(Continued on next page)

Central Office Planning (Continued)

Floor plan data sheets (continued)

This FPDS (sheet 2 of 2) is for the 7-foot COT frame with three DCBs.

ISSUE:	1	UNOFFICIAL FLOOR PLAN DATA	5SBC	4																							
DATE:																											
<p>NOTES CONTINUED:</p> <p>3. HEAT RELEASE VALUES ARE BASED ON THE FOLLOWING EQUIPMENT CONFIGURATIONS.</p> <p style="margin-left: 40px;">MAX - ALL SPECIAL SERVICE CHANNEL UNITS WITH - 130 VOLTS, T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">BUSY - 18 CCS IDLE - 0 CCS</p> <p style="margin-left: 40px;">MIN - ALL POTS CHANNEL UNITS WITHOUT T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">BUSY - 6 CCS IDLE - 0 CCS</p> <p style="margin-left: 40px;">BECAUSE THE FRAME DISSIPATES MORE THAN 60 WATTS PER SQUARE FOOT OF ALLOTTED AREA (BASED ON 2' 6" FRONT AND 2' 0" REAR AISLE SPACE), CONSULT BSP SECTIONS OF THE 760-230-1XX SERIES FOR ADDITIONAL COOLING INFORMATION. THIS FRAME IS COOLED BY NATURAL CONVECTION ONLY.</p> <p>4. EACH FRAME IS SERVED BY TWO BDFB FUSED FEEDER CABLES. CURRENT DRAINS FOR EACH FEEDER CABLE ARE SHOWN IN THE FOLLOWING TABLE FOR POSSIBLE BAY CONFIGURATIONS.</p> <table border="1" style="margin-left: 40px; border-collapse: collapse; width: 60%;"> <thead> <tr> <th>BUS</th> <th>VOLTS</th> <th>LIST</th> <th>MAX (NOTE 5)</th> <th>MIN (NOTE 6)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">A</td> <td style="text-align: center;">52</td> <td style="text-align: center;">1</td> <td style="text-align: center;">15.2 AMPS</td> <td style="text-align: center;">4 AMPS</td> </tr> <tr> <td style="text-align: center;">42.5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">23.0 AMPS</td> <td style="text-align: center;">5 AMPS</td> </tr> <tr> <td rowspan="2" style="text-align: center;">B</td> <td style="text-align: center;">52</td> <td style="text-align: center;">1</td> <td style="text-align: center;">10.9 AMPS</td> <td style="text-align: center;">2.0 AMPS</td> </tr> <tr> <td style="text-align: center;">42.5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">14.7 AMPS</td> <td style="text-align: center;">2.5 AMPS</td> </tr> </tbody> </table> <p style="margin-left: 40px;">5. MAX AMPS ARE BASED ON SPECIAL SERVICES (CF) CHANNEL UNITS AND PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">(A) LIST 1 DC DRAIN AT 18 CCS.</p> <p style="margin-left: 120px;">SUBTRACT 8.1 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 5.4 AMPS FROM A BUS AND 2.7 AMPS FROM B BUS.</p> <p style="margin-left: 80px;">(B) LIST 2 DC DRAIN AT 36 CCS.</p> <p style="margin-left: 120px;">SUBTRACT 9.6 AMPS PER FRAME FOR NO T1 LINE POWER. THIS IS 6.4 AMPS FROM A BUS AND 3.2 AMPS FROM B BUS.</p> <p>6. MIN AMPS ARE BASED ON POTS CHANNEL UNITS AND NOT PROVIDING T1 LINE POWER FROM THE FRAME.</p> <p style="margin-left: 80px;">(A) LIST 1 DC DRAIN AT 6 CCS.</p> <p style="margin-left: 120px;">ADD 8.1 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 5.4 AMPS FOR A BUS AND 2.7 AMPS FOR B BUS.</p> <p style="margin-left: 80px;">(B) LIST 2 DC DRAIN AT 12 CCS.</p> <p style="margin-left: 120px;">ADD 9.6 AMPS PER FRAME WHEN PROVIDING T1 LINE POWER. THIS IS 6.4 AMPS FOR A BUS AND 3.2 AMPS FOR B BUS.</p>					BUS	VOLTS	LIST	MAX (NOTE 5)	MIN (NOTE 6)	A	52	1	15.2 AMPS	4 AMPS	42.5	2	23.0 AMPS	5 AMPS	B	52	1	10.9 AMPS	2.0 AMPS	42.5	2	14.7 AMPS	2.5 AMPS
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LUCENT TECHNOLOGIES		SLC SERIES 5 CENTRAL OFFICE TERMINAL FRAME 7' 0" FRAME WITH 3 DUAL CHANNEL BANKS		FPD 801-450-106-4 SHEET 2 OF 2																							

Facility Engineering

Protection switching considerations with digital loop multiplexers

Digital loop multiplexers (such as DDM-1000 and DDM-2000) have three characteristics that affect DS1 protection switching in a digital loop carrier (DLC) system. These characteristics are as follows:

- Framed or unframed DS1 signals can be transmitted by a digital loop multiplexer.
- Because of the design of digital loop multiplexer terminals, bipolar violations in the received DS1 signal of the near-end multiplexer terminal cannot be transmitted to the far-end multiplexer terminal.
- If a digital loop multiplexer terminal detects a loss of signal on one of its receive DS1 low-speed ports, it will transmit an unframed all ones (1's) signal to the far-end digital loop multiplexer terminal (this unframed all 1's signal is also called a blue signal).

In most applications using digital loop multiplexers, end-to-end DS1 protection switching (from near- to far-end DLC terminal) is not necessary. The digital loop multiplexer terminals typically provide both low-speed port (DS1) and high-speed fiber protection switching, which is usually more than enough to protect the facility. Extending protection to the DLC terminals protects only against failure in the wiring between the DLC terminal and the multiplexer or against an LIU failure. Neither of these failures is likely to occur often enough to justify end-to-end protection switching.

A protection line that is connected from the DLC through a digital loop multiplexer cannot provide complete protection. If the system uses a Series 5 enhanced FPB RT and a 5ESS switch DCLU, only excessive bipolar violations in the received DS1 signal are unprotected (because they cannot be transmitted to the near-end multiplexer terminal). If the system has a SLC 96 COT, the received DS1 signal at the far-end multiplexer terminal cannot be protected at all (the multiplexer cannot transmit any of the errors that would be detected by the SLC 96 COT).

However, protection may be provided for a T1 extension using the SLIM. The SLIM is required for full protection of the T1 digital line between the Series 5 systems and the RT containing the digital loop multiplexer.

Compatibility with digital loop multiplexers

The Series 5 system LIUs have line code option switches that affect compatibility with digital loop multiplexers. These option switches must be set for the same line coding used by the multiplexer; otherwise, the system may not operate.

(Continued on next page)

Facility Engineering (Continued)

Fiber facility engineering

The design of the fiber facility is a function of the choice of fiber cables and multiplexing equipment. The Series 5 system can interface a fiber facility using the AUA61-type LIUs and appropriate DSX cross-connect equipment. The protection line may be passed through the fiber facility if desired. Specific route design information for fiber facilities is included in manufacturer's documentation. See 915-710-111 for examples of this documentation.

A fiber hub concept with conventional T1 extensions can result in an efficient and economical method for providing digital lines. An office repeater arrangement (small cross-section repeater shelf or DS1 extension shelf) must be provided at the hub for these extensions. If protection for the T1 extensions is desired to a Series 5 enhanced FPB RT, a SLIM interface must be provided to the fiber hub. For FPC or FPC/AC system, the protection line can be extended through the multiplexer.

Fiber multiplexers such as the Lucent Technologies' DDM-2000 multiplexer or DDM-1000 multiplexer are compatible with Series 5 systems. Specific details are available on applications using either the DDM-2000 or DDM-1000 multiplexer with Series 5 systems in the same structure or cabinet. Details on the DDM-1000 multiplexer can be found in 363-206-100, *DDM-1000 User's Manual*. Details on the DDM-2000 multiplexer can be found in 363-206-202, *DDM-2000 User/Service Manual*.

The Series 5 system and the selected fiber multiplexer must be line coding compatible. If clear channel capability is needed, the Series 5 system must be optioned for B8ZS line coding, and the fiber system must have B8ZS capability.



NOTE:

There are NO existing services that require the **B** option (B8ZS) of switch S100 on an LIU. This switch should never be set to **B**! Future issues of this and other Series 5 documents will advise on the use of the **B** option when appropriate services exist. Until then, always set the option to **Z**. When operating with the DDM-1000 or DDM-2000 multiplexer, the Series 5 LIU option should be set to **Z** and the DDM-1000 or DDM-2000 multiplexer should be optioned for **AMI**.

(Continued on next page)

Facility Engineering (Continued)

Fiber facility engineering (continued)

The AUA61-type LIUs can request a far-end loopback by grounding the receive DS1 input. This is done by applying a DC voltage to the center tap of the receive transformer (in other words, a simplex voltage). The loopback request capability is provided by equipping the LFU and setting S3 switch on the LIU to ENB. This capability works with the DDM-1000 and DDM-2000 multiplexers; however, in at least one case, the simplex voltage on the receive pair of the LIUs caused false alarms with another vendor's multiplexer. The customer may determine whether the loopback capability works with a particular multiplexer. In systems that are not compatible with the loopback capability, the LFU may be removed to prevent further problems.

Digital line engineering

The digital line engineering design program (DILEP II) is the recommended method to determine repeater spacing. When provided, the protection line of the Series 5 system must be considered in the total line calculations since it is always powered and remains in an active state. When the Series 5 system is arranged in the universal configuration, five T1-type lines are required per system. The DILEP II program is more convenient than manual calculation because the route and design data is stored in a data file. 902-200-110 provides information for selecting cable pairs and binder units for digital lines that will form the best overall design.

The DILEP II program has a capacity of 1,000 T1 lines (200 universal Series 5 systems), 50 demand repeaters, 50 manhole locations, and 100 cable sections. There is no limit on the number of route junctions. In addition to these capabilities, DILEP II has the following features that are used in Series 5 system T1 line design:

- Design of repeaterless route junctions.
- Remote terminal LIU transmit/receive pad loss (line build-out). This allows the program to select automatically the correct Series 5 LIU pad options for repeaterless route junctions and short end sections to a remote terminal location.

The process of running a DILEP II design for any T1 facility supported digital loop carrier system is outlined in BR-902-200-120. Many useful examples are included. The following notes may be useful in interpreting DILEP II for the Series 5 system. Before starting the design procedure, the following items should be determined:

- The maximum number of digital lines to be installed in the main route and in the branches.
 - The approximate locations for the RTs.
-

(Continued on next page)

Facility Engineering (Continued)

Digital line engineering (continued)

Proposed and future RT sites should be documented and included on the digital line schematic (DLS), which is a summary of the digital route. When the system layout is completed, a field check of the tentative repeater and RT locations should be made to verify that the locations are suitable.

If the digital line terminates on an ORB or if the digital facility is provided via a multiplexer, the AUA61-type LIU is used in the Series 5 system. Line powering must be provided from the ORB or by the multiplexer.

T1 line powering can be provided by a Series 5 AUA62-type LIU with power looped back at an AUA64-type LIU. The AUA62-type is used to power the T1 digital line from the COT and at the RT when needed. The AUA62-type LIU provides a constant 60 mA current with a voltage of 0 to -130 volts. The AUA64-type LIU is used at the RT to loop the line powering current back to the COT. Line powering rules are detailed in 915-710-115.

Order wire, fault locate and DC test pair requirements are the same as required for SLC 96 system (see 915-710-115).

Remote Terminal

Remote terminal arrangements

The Series 5 system RT equipment arrangement consists of various combinations of dual channel banks (two 96-line systems), power shelf, ringing equipment, and a battery supply mounted in a cabinet or frame. Arrangements with bulk power use a centralized power source and battery supply instead of the power shelf and battery shelves in each frame.

The Series 5 system capacity for various RT enclosures is provided in the capacities table in Chapter 5.

Two basic RT frame arrangements are available. The first accepts two dual channel banks when locally powered (batteries in each bay) and the second accepts three dual channel banks when powered by a bulk battery power plant. The frame may be mounted on a customer's 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 363-205-000, Series 5 ordering guide.

Existing unfilled enclosures may be considered for transition from *SLC 96* carrier to the Series 5 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 will probably be easier to remove the wiring for a given bay than try to reuse it for the Series 5 system.

The derived pair wiring for the *SLC 96* and Series 5 Carrier Systems are the same — however, the alarm pair wiring, power and ringing connections, and fusing requirements are different. Therefore, *SLC 96* and Series 5 Carrier Systems should not be mixed in a bay.

If bay splicing space is a problem, a different splicing and protection arrangement will have to be provided to fit 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.

(Continued on next page)

Remote Terminal

Power drain requirements

The table below provides a summary of Series 5 power drain requirements for the 51A cabinet, 80D cabinet, and the 7-foot RT bay mounted in a concrete hut or controlled environment vault (CEV). Drains are based on 600 ohms total for conductor loop resistance and the station set. To convert the DC power drain to an approximate AC load, multiply by 1.6.

Bay Components	-48 V DC Power Drain (Watts) [*]	117 V AC Power Drain (VA) ^{*,†}
Series 5 Dual Channel Bank Without Back Powering	104 + 1.20n	170 + 1.94n
Series 5 Dual Channel Bank With Back Powering	210 + 1.20n	320 + 1.82n
Ringling Generators (Per Bay)	13 + 2.50m	21 + 3.95m
Fans (Per Bay)	67.6	103
High-Rate Charge	91N	139N
Battery Heater	—	152N

^{*} n = Number of lines off-hook simultaneously

m = Number of lines rung simultaneously

N = Number of battery strings per bay (maximum of three).

[†] There is a maximum of two Series 5 dual channel banks per bay.

Remote Terminal (Continued)

Rectifier and battery charger requirements

Rectifier and battery charger requirements for distributed power RT cabinets and 7-foot bays is supplied in this table.

<u>Standard Arrangement*</u>	<u>Dual Banks Per Frame or Cabinet</u>	<u>Number of 336A1 Rectifiers†</u>	<u>Number of Battery Chargers†</u>
AC-Powered	1	2	2
7-ft Frame	2	4	3
80D Cabinet	2	4	4
	4	8	6
80D Cabinet with DDM-2000	1	6	9
	3	8	6
51A Cabinet	1	2	2‡
90A BRT Cabinet	1	4	4
	2	3	3

* Other arrangements are available that provide additional battery backup. One additional 337A1 is required for each battery shelf added for backup.

† Required for frame or cabinet fully equipped with specified number of dual banks.

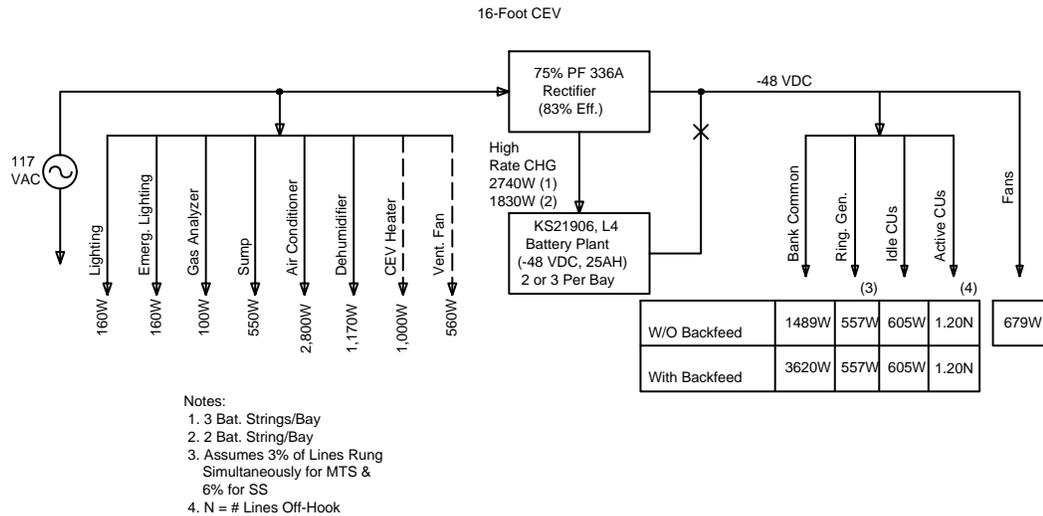
‡ Mounted in power shelf.

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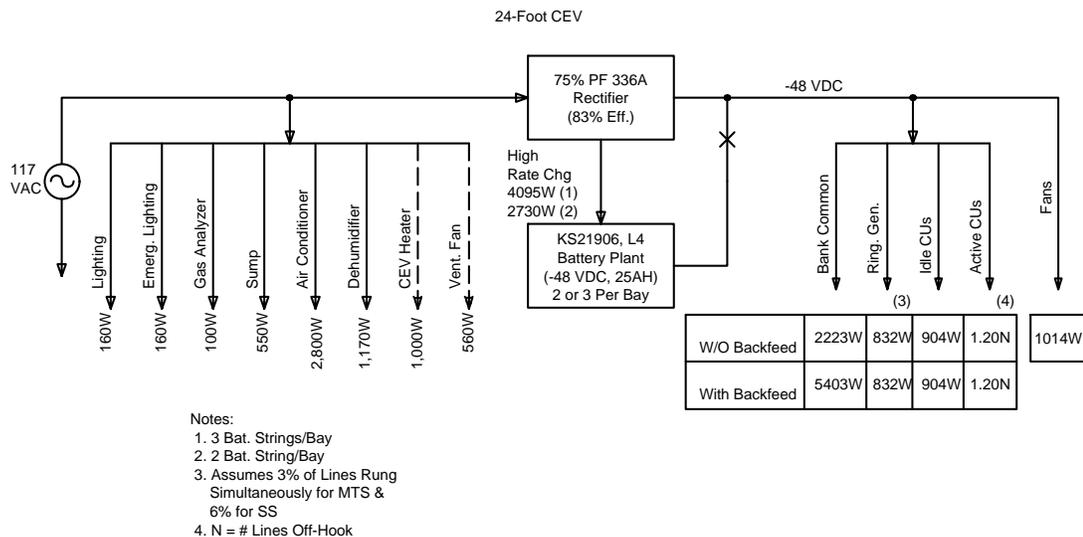
Remote Terminal (Continued)

Power drains for distributed power RT enclosures

This figure show the power drains for a fully equipped 16-foot CEV.



The figure below shows the power drains for a fully equipped 24-foot CEV.

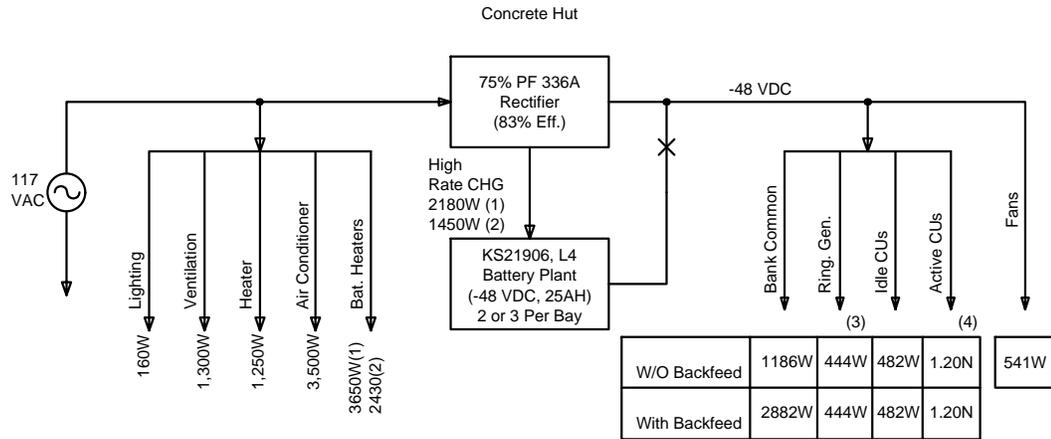


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Remote Terminal (Continued)

Power drains for distributed power RT enclosures (continued)

The power drains for a fully equipped concrete hut are shown in this figure.



- Notes:
1. 3 Bat. Strings/Bay
 2. 2 Bat. String/Bay
 3. Assumes 3% of Lines Rung Simultaneously for MTS & 6% for SS
 4. N = # Lines Off-Hook

Remote Terminal Site

RT location selection

The RT location may be chosen based on the following:

- existing or proposed plant configuration
- economics and functional requirements.

The site should provide the following:

- a safe environment for parking as well as working
- consistent, easy access
- an area that is not prone to flooding or constant dampness.

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.

Voice-Frequency (VF) Distribution Plant

Description

The derived feeder facilities pair gain (PG) cable are labeled the same way as *SLC 96* system. Both the central office and the field connecting arrangements are the same as used for *SLC 96* system and are terminated on the central office frame and feeder distribution interface (FDI) to read 1-96 and 4DD.

The distribution facility used for the derived pairs between the Series 5 RT and the customer should be standard cable plant in good condition. The use of unshielded cables, open, multiple, or rural wire should be avoided because of the cable's susceptibility 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 Vrms. 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

The VF design limits for 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. For designed special services, the guidelines are given in 915-710-116, Series 5 channel unit application and prescription setting. The VF limits for Series 5 ISDN channel units are given in 363-205-106 (for AUA90) and 363-205-107 (for AUA93). Chapter 6, *Channel Units*, gives more detail on channel unit applications.

Carrier serving area (CSA) summary

The CSA concept is to sectionalize an entire route into discrete geographical units or CSAs so that when digital subscriber carrier is deployed, every customer will have 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.

(Continued on next page)

Voice-Frequency (VF) Distribution Plant (Continued)

Carrier serving area (CSA) summary (continued)

A summary of CSA design requirements follows:

- 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 and 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.
-

ALIC5 Engineering

Methodology

A cutover from an analog to a digital switch using the ALIC5 methodology typically involves leaving in place the segment of original loop from the analog switch to the bridging location. This section describes the design considerations for the RT metallic extensions.

For most applications of the ALIC5 channel unit, the CU's tip and ring will be bridged to an existing working circuit, at some intermediate location such that the working line on to the CPE conforms to existing design rules for a DLC loop. The presence of the open-circuited leg back to the analog switch will generally affect the design of the new main leg, but a bridge lifter can frequently be used to eliminate such effect.

Bridge lifters

To isolate the post cutover main cable from the decommissioned leg back to the analog switch, a saturable inductor type of bridge lifter can be installed at the junction point, unless the circuit uses on-hook transmission for services such as calling name/number delivery. An example of this type of bridge lifter is the Model 1574D sold by Coil Sales and Manufacturing, Rolling Meadows, IL.

ALIC5 channel unit characteristics

The ALIC5 CU has the following characteristics that affect the design of the metallic extension.

- The cable resistance range is 900 ohms (not including telset resistance) for POTS service; for locally switched special services, the range is prescribed by the definition of a carrier serving area (typically 750 ohms).
- Channel unit off-hook and on-hook loss depends on the off-hook resistance seen by the CU across its tip and ring, such that increasing loss of the cable tends to be offset by decreasing loss of the CU. This automatic compensation occurs in two different modes:
 - for POTS service the loss between CPE and central office (CO) is maintained between 4 and 8 dB
 - for special service applications the loss is held within 2 to 5 dB.

Note that the presence of a bridged tap of any length does not influence the ALC loss provided by the ALIC5 CU, since a bridged tap to an open circuit does not contribute to tip/ring resistance.

(Continued on next page)

ALIC5 Engineering — DLC Loops

Existing design guidelines

For circuits deployed using DLC, design guidelines exist that are summarized below. These guidelines apply directly when a bridge lifter is employed at the junction location to eliminate the effect of the extra bridged tap back to the analog switch.

Loss, CO-to-CPE

Section 6.7 of the TR-57 requirement for loss, allows a CO-to-CPE loss at 1004 Hz between impedances of 900 ohms at the CO and 600 ohms at the CPE up to 8 dB.

Return loss at CO

Acceptable values of return loss at the CO are taken to be the mean less 1.0 sigma; for ERL this equates to $11 - 3 = 8$ dB; for SRL, $6 - 2 = 4$ dB.

Frequency distortion

If the distortion of a candidate loop with extra bridged tap is less than that of a 1500 ohm loop that conforms to loop design rules, the frequency distortion performance is considered satisfactory.

ALIC5 Engineering — Effect of Extra Bridged Tap

Description Using the guidelines in the previous section, the transmission properties of a broad population of possible ALIC5 loops with extra bridged tap (decommissioned leg back to the analog switch) have been analyzed to determine the limits of those that will provide satisfactory service after the cut. Considering a certain analog loop and allowing the RT to be located at any distance from the CPE, a family of transmission quality results has been obtained. The family corresponding to the longest analog loop that provides satisfactory quality for all possible RT locations along its route has been selected as the range limit. There are several constraints to this process.

Loaded cable If the analog loop is loaded, a bridge lifter must be used to isolate the DLC loop from the loaded bridged tap.

On-hook transmission applications Services requiring on-hook transmission (OHT) cannot tolerate a bridge lifter, since the bridge lifter relies on the off-hook condition to establish transmission through itself.

Guidelines for DLC loop design Considering the previously mentioned restrictions and the population of loops that are not providing OHT, the following guidelines can be used to select those loops not requiring a bridge lifter or an RT visit immediately following the cut. The guidelines are based on placing the RT close to the bridging location; where there is to be a significant distance from RT to bridging location, the circuit layout may have to be analyzed by the engineer.

- Special service circuits must be equipped with a bridge lifter unless:
 - a quick dispatch to the RT is planned,
 - the combination of the main DLC loop and the decommissioned bridge tap obeys the CSA rules.
 - For POTS circuits using nonloaded cable, bridge lifters are not required if the analog loop is not longer than 16 kft and the cable is 19, 22, or 24 gauge; the ALIC5 CU can be in either the POTS or special services mode. For 26 gauge, the 16 kft limit also applies when the CU is in the special services mode, but when operating in the POTS mode the limit reduces to 13 kft.
-

SLC[®]-2000 MSDT Planning and Engineering

Applications

With the *SLC-2000* MSDT, fiber distribution can be provided economically in applications ranging from new residential developments to the rehabilitation of aging copper plant. Opportunities for the telephone company to provide Fiber to the Customer include the following:

Individual homes — The *SLC-2000* MSDT can be located at curb or the rear lot line to provide service to several living units. For larger line capacities, the *SLC-2000* MSDT may be located in an equipment closet within a building.

Condominiums, townhouses, and small apartments — The *SLC-2000* MSDT may be free standing at the front, rear, or side of the property or mounted on the side of the building. Where space is available, it may be located in an equipment closet within the building.

Small and midsize businesses — The *SLC-2000* MSDT provides an attractive enclosure for fiber distribution directly to the floor of small businesses. The *SLC-2000* MSDT bandwidth and flexibility allow economical transport of voice and data services to business customers.

College and university buildings — The *SLC-2000* MSDT is ideally suited for voice and data transport in residential academic communities with a high density of office, classroom, and living quarters. The adjunct video system also provides the opportunity to add multichannel cable television [community antenna television (CATV)] transport for entertainment or educational services (such as classroom lectures).

Engineering

Fiber distribution to the *SLC-2000* MSDT may be provided from a Series 5 RT located in an 80E cabinet, CEV, or hut. Where use of a CEV or hut might be inconvenient, expensive, or even prohibited by local zoning, the local exchange carrier may locate the RT (serving the *SLC-2000* MSDT) in an 80E cabinet. The 80E cabinet is an appropriate solution when the area to be served is limited and the local exchange carrier wants to use the *SLC-2000* MSDT. The 80E arrangement is especially attractive when the cost of real estate is expensive and the cost of real estate acquisition and ownership may be replaced by an easement for the 80E cabinet. The 80E cabinet can serve only *SLC-2000* MSDTs that are powered from 120 V AC or -48 V DC.

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SLC[®]-2000 MSDT Planning and Engineering (Continued)

Engineering (continued)

The entire payload capacity of the RT/MSDT DS1 signal can provide up to 24 subscriber circuits at the *SLC-2000* MSDT. As a result, the *SLC-2000* MSDT could serve up to 16 (or more) living units in residential applications, depending on the line take (subscriber line usage per living unit). The installed first cost per living unit decreases as the number of living units increases; this is because the RT and *SLC-2000* MSDT common equipment is shared.

The *SLC-2000* MSDT provides an excellent opportunity to economically upgrade the distribution plant to fiber. For rehabilitation of aging copper plant, the *SLC-2000* MSDT should be located as close as possible to the existing drops. When customer drops are significantly deteriorated, careful selection of some of the drops for replacement and re-routing will provide optimum use of the *SLC-2000* MSDT. Maximum impedance is 132 ohms for the copper drop from the MSDT to the subscriber.

Site planning

The *SLC-2000* MSDT consists of plug-in units housed in an outside plant closure mounted either at the customer location or at the curb a short distance from the customer location. The MSDT can be mounted for buried telephone utilities if the electrical power can also be supplied from buried facilities. For aerial plant, it may be mounted next to or on a utility pole. This arrangement works best when the telephone company and power company share the pole and the telephone company can arrange for AC power connections on the same pole (next to the MSDT).

Circuit Design Considerations

Procedures

Procedures that can be used for assigning circuits in a Series 5 system are contained in BR 680-201-023 Bellcore practice. These procedures are based on the paper record [manual exchange customer cable record (ECCR)] system, and were later converted to the automated Facility Assignment and Control System (FACS). FACS is capable now of implementing this process.

Channel assignment (Enhanced FPB or FPC)

In universal enhanced FPB systems, some Series 5 dual channel units provide service only on the odd channel because the equivalent D4 bank or *SLC* 96 channel unit has only a single channel. This is true for E *SPOTS* units (AUA42 and AUA43), the dual ringing repeater (AUA45B), 2W PLAR (AUA75), and the DID unit (AUA56). In integrated enhanced FPB systems, special service nail-up applications depend on the software generic (5E4.2 generic or later for the *5ESS* switch).

Channel assignment in enhanced FPB Mode 2 systems must be based on the placement guidelines given in Chapter 6.

In a Series 5 FPC system, some circuits can have an AUA42 or AUA43 2-wire unit on one end and an AUA41, AUA44, or AUA54 4-wire VF unit at the other end. Because the 2-wire units are dual channel and the 4-wire units are single channel, the 2-wire unit must be provisioned on the odd-numbered channel, and the even-numbered channel is not available for service. In a Series 5 FPC system, this guideline applies only when a 2-wire and 4-wire unit are used on the same channel.

BRITE II ISDN channel assignments

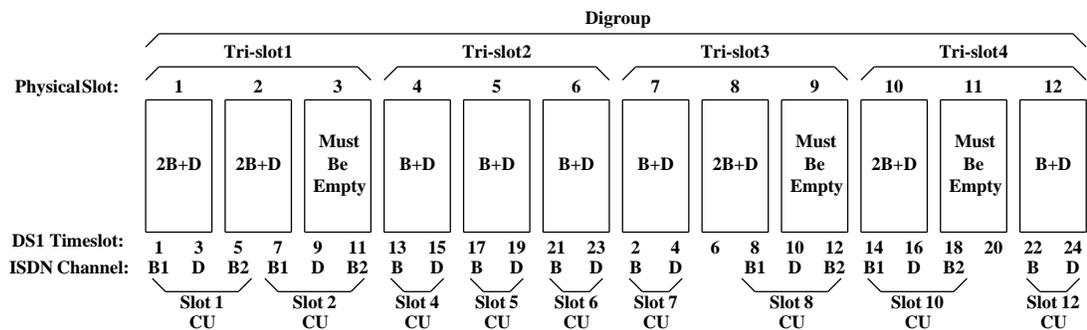
The following figure shows examples of BRITE II ISDN channel assignments for Feature Package B and Feature Package C. When a BRITE II channel unit is optioned for 2B+D service, how the ISDN channels get assigned to DS1 timeslots is dependent on whether the unit is located in first or second physical slot in a tri-slot group. When located in the first physical slot of a tri-slot group, the B1 and D channels are assigned the first and second timeslots associated with this first physical slot, and the B2 channel is assigned the first timeslot associated with the second physical slot in the tri-slot group. When located in the second physical slot in a tri-slot group, the B1 channel is assigned the second timeslot associated with this second physical slot, and the D and B2 channels are assigned the first and second timeslots associated with the third physical slot in the tri-slot group. Because of these 2B+D channel assignments, placement rules apply in tri-slots providing 2B+D service. Placement rules do not apply to tri-slots only providing B+D, D-only, or any single- or dual-channel service.

(Continued on next page)

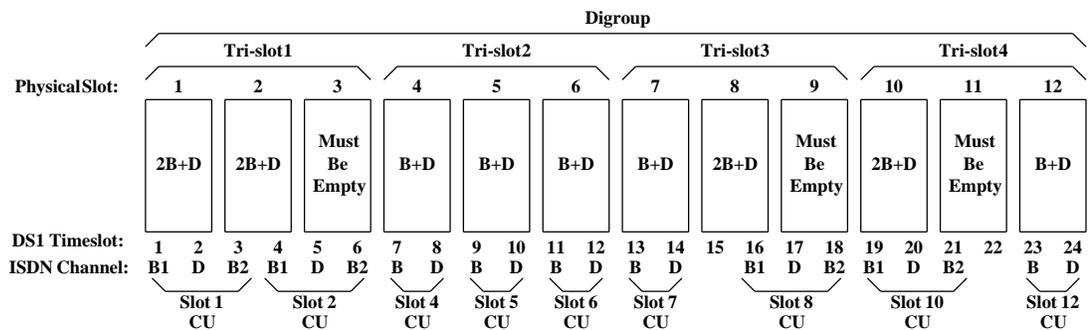
Circuit Design Considerations (Continued)

BRITE II ISDN channel assignments (continued)

When a BRITE II channel unit is optioned for B+D service, the B1 or B2 channel is assigned the first timeslot and the D channel is assigned the second timeslot associated with the physical slot. When optioned for D-only service, the D channel is assigned the first timeslot associated with the physical slot and the second timeslot is unused. Within a tri-slot group, any single- or dual-channel channel unit or a D-only BRITE II channel unit can be used where a B+D channel unit is shown.



A. Feature Package B (FPB) (D1D Counting)



B. Feature Package C (FPC) (D4 Counting)

(Continued on next page)

Circuit Design Considerations

Service codes

The following tables list the typical service codes for various services and the Series 5 channel units that provide these functions. In these tables, the channel units listed are for universal Series 5 applications (Series 5 COT and RT). For channel units compatible with Series 5 channel units in other applications, refer to channel unit compatibility in Chapter 6.

Basic telephone services service codes

This table contains the typical service codes for basic telephone services.

<u>Service Description</u>	<u>Channel Unit</u>		<u>Typical Service Code</u>
	<u>COT</u>	<u>RT*</u>	
Single Party	AUA38 AUA39	AUA25B AUA58() AUA150 AUA158() AUA159()	ES
Coin — Dial Tone First	AUA33	AUA53	EC
Coin — Prepay	AUA33	AUA53	EC
Multiparty	AUA35	AUA55	EM
Frequency Selective Ringing	AUA37	AUA57	EM

* For ranges and engineering considerations, refer to 915-710-115, Series 5 system, application engineering.

(Continued on next page)

Circuit Design Considerations (Continued)

Locally switched special services service codes

This table contains the typical service codes for locally switched special services.

Service Description	Channel Unit		Typical Service Code
	COT	RT*	
PBX-CO Trunk	AUA39	AUA150 AUA159()	TK
WATS Line (to end offices)	AUA39	AUA150 AUA159()	WO, WZ
WATS Trunk (to end offices)	AUA39	AUA150 AUA159()	WS, WY
<i>CENTREX</i> Service Line	AUA39	AUA150 AUA159()	CL
Secretarial Line	AUA39	AUA150 AUA159()	SL
Direct Inward Dial	AUA36	AUA56	DI
ISDN BRITE	†	AUA90	—
	†	AUA93	—

* Channel units (except AUA90) provide service in the carrier serving area (CSA).

† Central office terminal channel unit depends on application.

(Continued on next page)

Circuit Design Considerations (Continued)

Designed special services service codes

This table contains the typical service codes for designed special services.

Service Description	Channel Unit		Typical Service Code [†]
	COT	RT*	
2.4, 4.8, 9.6, 56, and 64 kb/s Digital Data	AUA34	AUA52	DP, DQ, DR, DW, DV
Foreign Exchange/WATS Line	AUA42	AUA43	FX, WO, WZ
Foreign Exchange/WATS Trunk	AUA42	AUA43	FT, WS, WY
Long Distance Line	AUA42	AUA43	LL, LT
ACD Line/Trunk	AUA42	AUA43	TU/TR
Type 2 (up to 2.4 kb/s) Voiceband Data	AUA42/43	AUA43	ND, SS, LA
DID Trunk	AUA43	AUA42	DI
Off-Premises Station, PBX End	AUA43	AUA42	OS
Private Line Voice	AUA42/43	AUA43	PL, LB
PBX Tie Trunk	AUA41	AUA41/54	IT, SA, TA, TL
Four Wire Private Line Data	AUA41	AUA41	FD, SS
Private Line Auto Ring	AUA75	AUA75	PL
Manual Ringdown	AUA45B	AUA45B	PL

* The AUA42 and AUA43 channel units provide service in the CSA. For other engineering considerations, refer to 915-710-116, Series 5 system, channel unit application and prescription setting.

† Lucent Technologies' service codes are listed in 795-402-100AC; Bellcore service codes are listed in SR-ISD-000307.

(Continued on next page)

Circuit Design Considerations (Continued)

NCI code documentation

There are three Bellcore documents related to the designed special services service codes, two published and one to be published, which 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 a LEC and an end user. For example, the NCI code 04DS015B specifies a 4-wire DS1 interface at an IXC's point of termination, with a superframe framing format, B8ZS zero code suppression, and 110 ohms impedance. Series 5 system channel units provide the proper interface for most NCI codes. The two published documents are as follows:

- Special Report SR-ISD-000307 *NC/NCI Code Dictionary, Industry Support Interface* March, 1988
- Technical Report TR-TSY-000054 *High Capacity Digital Service (1.544/Mb/s) Interface, Generic Requirements for End Users* April, 1989.

The document to be published is: TR-NPL-000342, *High Capacity Digital Special Access Service -- Transmission Parameter Limits and Interface Combinations*.

The service code is a key part of the loop assignment process. The service codes listed for special service circuits are used in the *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:

- a unique identifier
- a form that people can read and decipher
- a form that is acceptable for manual and mechanized procedures.

(Continued on next page)

Circuit Design Considerations (Continued)

Assignment information (line termination status)

Channel unit slots in the Series 5 system do not have to be pre-equipped with special service channel units. After the circuits are designed, special service channels may be provisioned with the craft interface unit before the channel units are installed. Special service circuits to be served by a Series 5 system are considered to be designed circuits. Service capability codes are assigned to specific services as needed. Service capabilities of equipped Series 5 system channels have been coded by Bellcore as follows:

1. D: (Reserved for design circuits)
2. EC: Equipped for coin service
3. ED: Equipped for design circuits
4. EM: Equipped for multiparty service
5. ES: Equipped for single-party service
6. ETB: Equipped for trunk-type service
7. EY: E *SPOTS* unit status code (COT=AUA42, RT=AUA43)
8. EW: E *SPOTS* unit status code (COT=AUA43, RT=AUA42)
9. EZ: E *SPOTS* unit status code (COT=AUA43, RT=AUA43)
10. NE: Not equipped
11. null [For Loop Facility Assignment and Control System (LFACS) use only]
12. RD: (Assigned to a DDS circuit)

Special service order and assignment processes are required to take advantage of E *SPOTS* channel units. The processes and services associated with each arrangement of pairs of E *SPOTS* channel units (EY, EZ, and EW) have been provided in BR 680-201-023.

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.

(Continued on next page)

Circuit Design Considerations (Continued)

Engineering support for loop assignment

Certain information must be furnished to the LAC by the outside plant engineer so LAC records can be prepared. This information is normally furnished with the engineering work order for installing the equipment. This information includes:

- the Series 5 system number, the RT site location identity (*CLLI* 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 package and system arrangement) and its compatibility for special service usage
- a list of distribution terminals to be served by the Series 5 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.

(Continued on next page)

Circuit Design Considerations (Continued)

Designed special services

The Series 5 enhanced FPB RT, the INA-RT or the FPC system can provide 2- and 4-wire special services and digital data service (DDS). The FPC system offers enhanced testing capability (using the XTC) for special services. 915-710-116 provides detailed application and prescription setting information for designed special services.

Most of the channel units that provide designed special services must be provisioned with the CIU for prescription settings (attenuation, impedance, equalization, etc.). The D4 channel unit settings are used in the circuit design phase; they are converted to Series 5 channel unit settings during CIU provisioning. A few of the special service channel units are prescription set using manual option switches. See Chapter 6 for more information on special service channel units.

If improved testing of special circuits is desired, the PGTC in an office must be replaced by an XTC. See Chapter 9, *Circuit Maintenance* for more information on the XTC. Engineering planning information for the XTC is contained in CIR 363-099-039TD.

Channel and Slot Assignment for INA-RT

Description

This section covers placement of the special service channel units; ISDN channel unit placement is described in rules for ISDN circuits (Chapter 6, *Channel Units*). The CMP indicator on the AUB27 ADU will light if a channel unit is installed incorrectly (in a slot that should be empty or in a slot that would affect service on that channel unit). The CMP indication is based on the assumption that the existing installation and services are correct (before CMP is lighted) and that the newly-installed channel unit is incompatible.



CAUTION:

The INA-RT bank controller attempts to retain the working services (when the CMP indicator lights), but this is not always possible. Therefore, any channel unit that causes the CMP indicator to light when installed should be removed immediately to minimize potential service interruption.

Mode I

There are no placement restrictions on INA-RT special service channel units in Mode I (other than for ISDN). However, INA-RT Mode I is most economical and efficient for 2-wire services (dual channel units).

Mode III single (SGL)

Mode III is most efficient for 4-wire single-channel units and provides up to 48 lines in each bank (blue and/or white bank). With the AUB27 ADU optioned for SGL, only the odd channel of each slot can be used. This means that the even channel of a dual channel unit is inoperative; single-channel units are not affected.

The placement rules for Mode III single include the following:

- a. Any single-channel unit may be assigned to any slot except one that must remain empty (as stated in Items (d) and (e) for dataports provisioned for second channel error correction and ISDN channel units).
- b. Dataports (AUA52) provisioned *without* second channel error correction (SCEC) may be assigned to any slot except one that must remain empty (as stated in Items (d) and (e) for dataports and ISDN).
- c. Any dual-channel channel unit may be assigned to any slot except one that must remain empty (as stated in Items (d) and (e) for dataports and ISDN). However, the even channel is not operational in dual-channel units in this mode.

(Continued on next page)

Channel and Slot Assignment for INA-RT (Continued)

Mode III single (SGL) (continued)

- d. Dataports (AUA52) provisioned *with* SCEC may be assigned to any slot except one that must remain empty (as stated in Item (e) for ISDN); however, the slot to the immediate right of the dataport channel unit must remain empty. The last slot in a digroup cannot be used for a dataport provisioned with SCEC.
- e. ISDN channel units may be placed only in the first slot of a tri-slot group. The remaining slots of the tri-slot group must remain empty. (The tri-slot groups in each digroup are physical slots 1, 2, and 3; 4, 5, and 6; 7, 8, and 9; and 10, 11, and 12.)

Mode III double (DBL)

For mixed applications of single- and dual-channel units in Mode III, the double option (AUB27 ADU optioned for DBL) may be used. In Mode III DBL, both channels of a dual channel unit can be used, but the adjacent right-hand slot must remain empty (in other words, single-channel units may be installed in adjacent slots, but dual-channel units require an empty slot on the immediate right).



CAUTION:

Because of its complexity, this mode requires separate identification of the tip and ring location (slot assignment) in addition to the channel assignment.

The placement rules for Mode III double include the following:

- a. Any single-channel unit may be assigned to any slot except one that must remain empty (as specified in Items (c), (d), and (e) for dual-channel units, dataports, and ISDN).
- b. Dataports provisioned *without* SCEC may be assigned to any slot except one that must remain empty (as specified in Items (c), (d), and (e) for dual-channel units, dataports, and ISDN).
- c. Any dual-channel unit may be assigned to any slot except slot 12 of a digroup or any slot that must remain empty (as specified in Items (d) and (e) for dataports and ISDN). The slot to the immediate right of the dual-channel unit must remain empty.

(Continued on next page)

Channel and Slot Assignment for INA-RT (Continued)

Mode III double (DBL) (continued)

- d. Dataports provisioned *with* SCEC may be assigned to any slot except slot 12 of a digroup or any slot that must remain empty (as specified in Items (c) and (e) for dual-channel units and ISDN). The slot to the immediate right of this dataport must remain empty.
- e. ISDN channel units may be placed only in the first slot of a tri-slot group. The remaining slots of a tri-slot group must remain empty.



CAUTION:

Dual-channel channel unit numbering must be carefully thought through by the circuit designer so that the service order or WORD (work order record detail) is accurate.

Mode III DBL examples of identification

Mode III (96) DBL — With a dual channel unit (for example, AUA43) in slot 1, the odd channel is numbered 1 and the even channel is numbered 3 for CIU access. However, T&R access is associated with slot 1 pairs.

If the channel unit is installed in slot 2, its odd channel would be channel 3 and its even channel would be channel 5 for CIU access. Here, T&R access would be associated with slot 2 pairs.

Mode III (48) DBL — With the same dual channel unit in slot 1, the odd channel is numbered 1 and the even channel is numbered 2 for CIU access. The T&R access is associated with slot 1 pairs.

If the channel unit is installed in slot 2, its odd channel would be channel 2 and its even channel would be channel 3 for CIU access. Here, T&R access would be associated with slot 2 pairs.

(Continued on next page)

Channel and Slot Assignment for INA-RT (Continued)

Channel assignment considerations

Dual channel units can be administered two ways in Mode III. The ADU has an option switch S2, position 4 that is labeled SGL/DBL (single/double). In SGL, only the odd half of the channel unit functions; it is equal to a single channel unit. In DBL, both channels of the channel unit are available, but the slot to the immediate right of the dual channel unit must be vacant. Although the DBL position uses the channel units more efficiently, there are administrative rules that must be understood by both circuit designers and testers. With the Mode III INA-RT system in DBL, dual channel units require two operating channels corresponding to the number of the slot in which the channel unit is installed and the slot to the immediate right. The service order must note that the second channel's T&R (tip and ring) pair is connected to the slot in which the channel unit is inserted.

Channel/slot identification

Each Mode I system can be identified as a 96-line system or as two 48-line systems. The Mode I (48) system provides identification corresponding to the D4 channel banks at the far end. To help identify the channels in a Mode I (48) system, an adhesive designation strip (see the following figure) should be placed over the B and/or D shelf designation strip as needed.

The Mode III INA-RT has two versions, Mode III (48) and Mode III (96). Both versions support only 48 channels over the two DS1 lines. In the Mode III (48) system, each slot counts as one channel, and the slots are numbered in sequence from 1 to 48. New designation strips (shown in the following figure) are used for slot numbering. In the Mode III (96) system, each slot counts as one channel, and the slots are numbered in sequence using only odd numbers, from 1 to 95 (that is, 1,3,5...93,95); the even numbers are ignored in assignment and provisioning.

(Continued on next page)

Channel and Slot Assignment for INA-RT (Continued)

Add-on designation strips illustrated

This figure illustrates the designation strip for a Mode I (48) system in the top view (a), and Mode III (48) system in the bottom view (b).

1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40	41/42	43/44	45/46	47/48
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NOTE: This strip is added to the B and/or D shelves. The A and C shelves remain the same.

a. Mode I (48)

25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

NOTE: This strip (numbered 25-48) is added to B and/or D shelves.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

NOTE: This strip (numbered 1-24) is added to A and/or C shelves.

b. Mode III (48)

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Common System Maintenance

Features

The features listed below help prevent interrupted service and provide status information when trouble is reported:

- in FP303,
 - DS1 performance monitoring to detect marginal facilities and transmission equipment
 - digital subscriber line (DSL) performance monitoring to detect marginal ISDN basic rate lines and transmission equipment
 - system alarm status down to the circuit pack level (including channel units) sent in detailed ASN.1 message to the switch autonomously and by request
 - local test access through the craft interface unit (CIU) for alignment and testing of special service channel units
 - remote test access for voice and special service circuits through the extended test controller (XTC) for the Switched Access Remote Testing System (SARTS) or Mechanized Loop Testing (MLT) system (MLT-2), or a local test desk (LTD)
 - diagnostic testing of COT and RT channel units via the XTC
 - compatible with the pair gain test controller (PGTC) and other provisioning and testing support systems used with the *SLC 96 Carrier System*
 - simplified electronic special services provisioning and single-ended circuit alignment
 - continuous monitoring of circuits serving a digroup (24 channels), double digroup (48 channels), or system (96 channels)
 - alarm indicators at the COT and RT that display the system status and fail indicators that show defective plug-in units for isolating common system failures
 - the COT and RT display consistent alarm information (for example, when a failure occurs and the COT shows far end failed, the RT will show near end failed)
 - floating contact closures for transmitting alarms via alarm telemetry systems (like TASC/E2A) to a remote alarm center
 - floating contact closures for remote indication of specific digroups (customers) out of service
 - floating contact closures to report miscellaneous RT conditions remotely
 - an optional protection digital line with automatic or manual control
 - automatic isolation of failures to the COT, the digital facility, or the RT: manual loopback is not required
-

Performance Monitoring — FP303 DS1

FP303 DS1 performance monitoring

DS1 performance monitoring helps detect marginal facilities and transmission equipment by continuously monitoring the DS1 signal. Each line interface unit (LIU) collects a 1-minute count for the performance parameters listed in the following table by tracking CRC-6 violations and out-of-frame conditions on its receive DS1.

Parameter	Description
Coding Violations (CV)	CRC-6 violations.
Framing Event Counts (FEC)	Out-of-frame (OOF) events.
Errored Seconds (ES)	Seconds having one or more CRC-6 violations or OOF conditions.
Severely Errored Seconds (SES)	Seconds having more than 320 CRC-6 violations or one or more OOF conditions.
Unavailable Seconds (UAS)	Seconds the receive DS1 service is unavailable. A DS1 is considered unavailable if 10 consecutive SESs occur or an outage with trunk conditioning exist. Service is considered restored if 15 ± 5 seconds of continuous in-frame operation occurs and 10 consecutive seconds without an SES.
Degraded Minutes (DM)	Minutes having greater than 93 CRC-6 violations.

At the end of the 1-minute period, the bank controller (BC) reads the counts and clears the LIU registers for the next 1-minute counts. The BC stores the current and previous 15-minute counts for CV and the last thirty-two 15-minute counts for FEC, ES, SES, UAS, and DM (a total of 8 hours of counts). In addition, the BC stores a daily count for all parameters in *current day* registers. At the end of a 24-hour period, the BC stores the daily counts in *previous day* registers (discarding their previous content) and clears the *current day* registers for the next 24-hour totals. This history performance data can be used to assess DS1 performance against performance objectives and help to predict impending failures.

(Continued on next page)

Performance Monitoring — FP303 DS1 (Continued)

FP303 DS1 performance monitoring (continued)

The local digital switch (LDS) can retrieve the DS1 performance data from the FP303 RT on demand. The LDS can reset (initialize to zero) the parameter counts. The data retrieved will be designated corrupt if something interferes with the data collection (for example, the LIU is removed).

With the exception of the CV, associated with each performance parameter is a daily and 15-minute performance alert threshold stored in non-volatile memory on the BC. The default values for these performance alert thresholds are listed below.

<u>Parameter</u>	<u>#/15-minutes</u>	<u>#/day</u>
FEC	2	17
ES	65	648
SES	10	100
UAS	3	10
DM	4	360

The BC monitors the counts and autonomously sends a threshold-crossing alert message to the LDS over the embedded operations channel (EOC) should any count exceed the threshold. The LDS can set and retrieve the thresholds by sending operations messages to the RT over the EOC. In addition, the LDS can send a message to inhibit DS1 threshold-crossing alerts. The BC reports a 15-minute threshold crossing within 1 minute and a daily threshold crossings within 15 minutes.

Performance Monitoring — FP303 DSL

Description

Digital subscriber line (DSL) performance monitoring helps detect marginal ISDN basic rate lines and transmission equipment by continuously monitoring the DSL signal. Each AUA94 ISDN channel unit collects counts in both the receive and transmit directions for the performance parameters listed in the following table by tracking CRC-6 violations on its DSLs.

Parameter	Description
Block Errors (BE)	CRC-6 violations measured in a single direction of transmission.
Errored Seconds (ES)	Seconds having one or more CRC-6 violations in a single direction of transmission.
Severely Errored Seconds (SES)	Seconds having <i>s</i> or more CRC-6 violations in a single direction of transmission.*

*TR-821 specifies that *s* has a default value of 3, but the LDS can change this value in a range between 1 and 84 by sending an EOC message to the RT.

Each hour, the bank controller (BC) reads the counts and clears the six channel unit registers for the next hour counts. To comply with the 5ESS switch automatic line evaluation (ALE) feature, the BC keeps interval counts in addition to hour counts. The interval can range from 1 to 24 hours and is set by sending an operations message to the RT over the EOC. The BC stores the following parameter count history:

- BE — current interval and hour, previous interval and hour
- ES — current interval and hour, previous eight intervals and hours, current day, previous day
- SES — current interval and hour, previous interval and hour, current day, previous day.

This history performance data can be used to assess DSL performance against performance objectives and help to predict impending failures.

The local digital switch (LDS) can retrieve the DSL performance data from the FP303 RT on demand. On a per DSL basis, the LDS can reset (initialize to zero) the parameter counts. The data retrieved will be designated corrupt if something interferes with the data collection (for example, the AUA94 channel unit is removed).

(Continued on next page)

Performance Monitoring — FP303 DSL (Continued)

Description (continued)

The ES and SES parameters have hourly and daily alert thresholds, and interval and daily ALE thresholds. The same threshold settings apply in both the receive and transmit direction.

The defaults for DSL performance alert thresholds are:

<u>Parameter</u>	<u>#/hour</u>	<u>#/day</u>
ES	40	100
SES	10	25

The default values for DSL performance ALE reporting thresholds are:

<u>Parameter</u>	<u>#/interval</u>	<u>#/day</u>
ES	20	50
SES	5	15

The LDS can change these settings on a per DSL or per RT basis by sending EOC messages to the FP303 RT. In addition, the LDS can send a message to inhibit DSL threshold-crossing alerts.

The AUA94 channel unit stores a copy of the hourly alert thresholds and alerts the BC if a threshold is reached. The BC stores the hourly and daily alert thresholds in non-volatile memory. The BC autonomously sends an alert threshold-crossing message to the LDS over the embedded operations channel (EOC) should any count exceed a threshold. The BC reports an hourly alert threshold crossing within 2 minutes and a daily alert threshold crossing within 1 hour. For ALE reporting, the BC stores both the interval and daily thresholds in non-volatile memory. If a count reaches an interval or daily threshold, the BC sends the SES and ES interval or daily counts for both the receive and transmit direction to the LDS on demand.

Performance Monitoring — FP303 DSL (Continued)

System alarms and indicators

Depending on the immediate or potential effect on customer service, system alarms may be classified as major, minor, or power minor. System alarms are provided by COT/RT/MSDT local indicators, COT bay alarm indicators, central office audible and visual alarms, and maintenance center indications (remote telemetry). System alarms are supported by local indicators on the circuit packs. In FP303, system alarm status is sent in detailed ASN.1 message to the switch autonomously and by request.

Local indicators also provide a visual status for various system functions, including carrier line failure (CLF), digroup out of service or on protection, busy channels, blown fuses, busy testing, incompatibility (placement error), etc. Some units have a fail indicator that lights momentarily as part of a self-test when the unit is installed. The indicator goes off if the test is successful; otherwise, it stays lighted to show that the unit should be replaced. The fail indicator provides immediate visual verification if a unit fails during installation testing and trouble clearing.

Channel testing

The Series 5 system is equipped with automatic monitoring features to isolate trouble quickly and to report current or potential service outage using the existing local and remote alarm system. If the problem appears to be in the channel, the channel may be tested automatically via a test system or manually using a test set connected to the CIU.

The basic telephone service and locally-switched special service channel units are tested with MLT or a local test desk using the PGTC developed for the *SLC 96* Carrier System. The XTC provides enhanced PGTC test capabilities such as isolating trouble in the COT or RT channel unit. In addition, the XTC provides remote test access for SARTS in testing special service channel units. The XTC is designed to interface gracefully with MLT and SARTS. This allows testing of the interoffice portion of a special service circuit as well as the COT and RT channel units.

If testing of the loop beyond the RT is required, it can be tested via the local test desk or MLT on request by the special services center (SSC) to the maintenance center (MC). Drop testing from SARTS is available also. This enhanced testing capability expedites service restoration and reduces costly dispatch of personnel.

(Continued on next page)

Performance Monitoring — FP303 DSL (Continued)

Channel testing (continued)

Detailed maintenance procedures are provided in 363-205-500 (TOP). A trouble report from one customer usually means a channel unit problem or distribution facility problem. This problem can be diagnosed directly from the repair service bureau using the channel test feature. A central office alarm may mean a service outage (major alarm), a potential loss of service (minor alarm), or loss of AC power or rectifier failure at the RT (power minor). These alarms, together with the status indicators, can be sent to a remote maintenance center over a telemetry system. By observing the alarms received, the remote maintenance center can sectionalize the trouble and dispatch directly to the trouble location. Most of the troubles in the system will be corrected by replacing defective circuit packs. Appropriate repair procedures should be used to repair the cable portion of the T1 digital line. If trouble occurs in the connecting digital facility (for example, a multiplexer), appropriate procedures for the facility should be used for trouble clearing and repair.

Alarm and Status Indicators

Introduction

The Series 5 system alarms are intended to alert the responsible maintenance center to any system troubles. Series 5 system alarm capabilities include office alarms, status indicators, and alarm control features. Remoting of Series 5 system alarm and status indicators is also discussed. The Series 5 system provides improved features for both local and remote alarming. Remote alarms are essential to assure rapid response to system failures and enclosures problems. This allows quick, correct dispatch to the trouble location that reduces maintenance costs and reduces the time that a line may be out of service.

There are five categories of alarm and status indicators:

- RT local indicators
- COT local indicators
- COT bay alarm indicators
- central office audible and visual alarms
- remote maintenance center indicators.

The COT and RT application and bay wiring schematics, SD-7C116-01 and SD-7C118-01 respectively, give greater detail on how these alarms are provided and connected.

The urgency of trouble depends on its immediate or potential effect on customer service. Three types of alarm messages are provided by the Series 5 carrier system:

- Major (MJ). A group of 24 or more customers is out of service.
- Minor (MN). The trouble is not service affecting, but could become service affecting if additional trouble occurs.
- Power Minor (PMN). This is used to show a power unit failure or loss of commercial AC power at the RT. This condition is not immediately service affecting because of the battery reserve.

(Continued on next page)

Alarm and Status Indicators (Continued)

RT local indicators The table below describes the alarm and status indicators that would appear (except for IDXL and IDXU) on the Series 5 RT bank as you observe the system. The IDXL and IDXU indicators are not displayed. Each system should be stenciled with its system identification (system ID).

Name	Color	Description
MJ	Red	MAJOR alarm. Indicates a failure that causes a loss of service in one or more digroups or, for FP303 systems, that call carrying capacity is reduced by 25% or more.
MN	Yellow	MINOR alarm. Indicates a protected failure affecting one or more digroups.
PMN	Yellow	POWER MINOR alarm. Indicates a failure in the commercial AC power plant or the AC rectifier at the RT.
ACO	Yellow	ALARM CUT OFF status. Indicates that the office alarms and remote closure (except system ID) have been turned off.
NE	Yellow	NEAR END status. Sectionalizes a failure to the local terminal.
FE	Yellow	FAR END status. Sectionalizes a failure to the terminal at the other end of the system.
CLF	Yellow	CARRIER LINE FAILURE status. Sectionalizes a system failure to the T1 line connected to the LIU.
DIGROUP A	Red	DIGROUP A status. Indicates the A digroup is in trunk processing or, for FP303, LIU-A DS1 facility has failed.
DIGROUP B	Red	DIGROUP B status. Indicates the B digroup is in trunk processing or, for FP303, LIU-B DS1 facility has failed.
DIGROUP C	Red	DIGROUP C status. Indicates the C digroup is in trunk processing or, for FP303, LIU-C DS1 facility has failed.
DIGROUP D	Red	DIGROUP D status. Indicates the D digroup is in trunk processing or, for FP303, LIU-D DS1 facility has failed.

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Alarm and Status Indicators (Continued)

RT local indicators (continued)

<u>Name</u>	<u>Color</u>	<u>Description</u>
MISC 1	Yellow	RT MISCELLANEOUS 1 status. Indicates that this RT input is active.
MISC 2	Yellow	RT MISCELLANEOUS 2 status. Indicates that this RT input is active.
IDXU		IDX - UPPER bank ID. Remote only (No indicator on equipment). Identifies at the remote alarm center the system that contains the alarm and status indications.
IDXL		IDX - LOWER bank ID. Remote only (No indicator on equipment). Identifies at the remote alarm center the system that contains the alarm and status indications.

COT local indicators (universal system only)

The alarm and status indicators that would appear (except for IDXL and IDXU) on the Series 5 COT bank as you observe the system, are the same as for the Series 5 RT bank, and are listed in the previous table. The IDXL and IDXU indicators are not displayed. Each system should be stenciled with its system ID.

Central office bay alarm indicators (universal system only)

The central office bay is equipped with a heat baffle with central office bay alarms displayed. All MJ, MN, and PMN alarms from all systems in the bay are multiplied together. The failed system can be identified from local indicators on the COT bank. An option to combine the PMN bay alarm display with MN is available. This could be used when the office is not equipped to display PMN alarms.

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Alarm and Status Indicators (Continued)

Central office audible and visual alarms (universal system only)

The central office bay provides connections to provide a MJ audible, MJ visible, MN audible, MN visible, and two PMN outputs to the office alarm system. These alarms are multiplied throughout each bay and each dual bank. System identification of the alarm can be determined by observing in sequence the aisle alarm, the bay alarm, and finally the local indicators. An option to combine the PMN bay alarm display with MN is available on the alarm interface unit (AIU) AUB3B. This could be used when the office is not equipped to display PMN alarms.

Maintenance center indicators

The alarm and status indicators (except ACO), listed in the table in the RT local indicators section, are available for remoting to a remote alarm center. Two connections per alarm or status indicator are available for connection to two remote centers, if needed. All indicators are multiplied within a bay except the system ID indicators (IDXL and IDXU). Operation of the local or remote ACO will extinguish all remote, office, and bay alarms except for the remoted system ID indications.

The Series 5 enhanced Feature Package B (FPB) remote alarm and status capabilities are controlled by the capabilities of the central office equipment [the *SLC 96* COT, subscriber loop interface module (SLIM), or *5ESS*[®] switch digital carrier line unit (DCLU)]. Remoted group indicators are not provided. The miscellaneous alarm capability is also limited.

RT local indicators for the SLC[®]-2000 MSDT

Almost all indicators at the RT in a Series 5 system serving a *SLC-2000* multi-services distant terminal (MSDT) are identical to an RT in a conventional Series 5 system. The exceptions are the indicators associated with the RT optics power shelf that provides power to the AYB1B optical units (OUs) in the optics shelf assemblies, the fan units, and the dual bank assemblies. A common voltage loss to the RT optics power shelf will cause a power minor alarm to be reported to the central office and maintenance center. A major alarm will also be reported if a power converter unit (PCU) fails or is missing from its slot in the RT optics power shelf.

The loss of a valid fiber optical signal from the *SLC-2000* MSDT will result in an out-of-service (OOS) indicator lighted on the RT channel unit. This indication is not transmitted to the COT but is reported to the maintenance center via Mechanized Loop Testing (MLT) system test access.

(Continued on next page)

Mixed Bank Alarms

Feature package list

This section covers alarm capabilities when the following feature packages are mixed:

- Enhanced Feature Package B (FPB) with MC97776A1 bank control unit (BCU)
- Feature Package C (FPC)
- Integrated Network Access Remote Terminal (INA-RT)
- Feature Package 303 (FP303).

The Feature Package C (FPC) and FPC/AutoCut applications and restrictions are identical for testing and alarming and are combined as FPC in the following guidelines.

The alarming capability of enhanced FPB, FPC, FP303, and the INA-RT are significantly different for power minor alarms (PMN) (indicating the loss of commercial AC power at the RT).

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Mixed Bank Alarms (Continued)

Alarm considerations The following table summarizes the alarm considerations for mixed feature packages.

<u>White/ Blue</u>	<u>INA- RT/FPC</u>	<u>FPC/ FPB*</u>	<u>FPB*/ FPC</u>	<u>INA-RT/ FPB*</u>	<u>FPB*/ INA-RT</u>	<u>FPC/ INA-RT</u>	<u>FP303/ FPB*</u>	<u>FPB*/ FP303</u>
Central Office Power Minor	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Appears in	FPC	Both	Both	FPB*	FPB*	FPC	Both	Both
Refer to Note	<u>2,5</u>	<u>1,2</u>	<u>1,2</u>	<u>1,4</u>	<u>1,3,4</u>	<u>2,5</u>	<u>1</u>	<u>1</u>

Notes:

1. The enhanced FPB bank will display the PMN alarm when enhanced FPB is installed in the blue or white bank with the AUB24 or AUB27 alarm display unit (ADU).
2. The FPC bank will display and remote the PMN alarm when FPC is installed in the blue or white bank.
3. The INA-RT does not remote any alarms but does have external outputs for major, minor, and power alarms that can be remoted by the other bank.
4. The INA-RT white bank can have its major and minor alarm outputs from J305 wired together into J111 of the power shelf (as described in 363-099-075MG, SLC *Series 5 Carrier System 51- and 80-Type Cabinet Door Alarms*). Then a major or minor INA-RT alarm will be remoted as a minor - far-end (MN and FE) alarm by the enhanced FPB bank.
5. If the split is between FPC and INA-RT, the alarm is remoted by the FPC bank.

*Enhanced

Miscellaneous Alarms

Feature package capabilities

The Series 5 system is capable of transmitting miscellaneous alarm information from the RT location to the central office and to remote maintenance centers. The capabilities are different for enhanced FPB, FPC, and FP303. The Series 5 INA-RT does not provide RT miscellaneous alarms.

The FPC system has two miscellaneous alarm closures per system in addition to a PMN closure. These alarms can be either major or minor as selected by an option switch on the RT alarm display unit (ADU). Therefore, each FPC dual bank has the capacity of four miscellaneous alarm inputs from the RT building or cabinet. A 7-foot RT frame equipped with FPC has a capacity of eight miscellaneous alarm inputs. This may be useful in structures with small initial fill and where miscellaneous equipment such as fiber systems need alarm support. Alarm connections are made at the miscellaneous pair panel.

The miscellaneous alarm capacity of the enhanced FPB system is controlled by the *SLC 96* Carrier System data link format. Each enhanced FPB system at the RT can transmit only one bit of information (power/miscellaneous: P/M bit) to the COT in response to AC power failure and abnormal RT enclosure conditions.

Original enhanced FPB (MC97771A1 or MC97776A1 BCU)

In enhanced FPB, both blue and white systems can detect the PMN alarm indication. The PMN, MISC1, and MISC2 alarm inputs are combined in the system BCU so that an alarm condition on any one or more of the inputs provides an alarm output. The alarm output is transmitted on the P/M bit to the central office. This arrangement provides two miscellaneous inputs for each dual bank with the option to use either system's PMN indication for loss of AC power and the MISC1 or MISC2 input for an environmental/door alarm. For a single (Blue) bank installation, a door alarm can be effected by connecting it to the open battery alarm (per CIR 363-099-075MG).

New enhanced FPB (MC97776A1B BCU)

The miscellaneous alarm handling of the new enhanced FPB system with the MC97776A1B bank controller is slightly different than the Original Enhanced FPB. The loss of AC power alarm is carried only over the P/M alarm data link of the Blue (lower) bank. This results in the door alarm carried by the White bank becoming unique (only the door alarm sends the P/M alarm of the White bank). The new BCU also allows use of the the MISC1 input for a door alarm when the Blue bank comprises a single bank installation (instead of using the open battery alarm procedure).

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Miscellaneous Alarms (Continued)

FP303 (MC97777A1 BCU)

In FP303, alarm information from the RT to the central office local digital switch (LDS) is sent over an Embedded Operations Channel (EOC) with an active and standby EOC on LIU-A and LIU-C DS1s. This allows transfer of individual alarm messages for the available MISC1 and MISC2 environmental alarm information and loss of AC power at the RT (PMN). This differs from TR008 SLC systems that have a bit oriented data link on DS1 A with only a single bit available for transfer of the PMN/MISC alarms.

The RT MISC1 and MISC2 sensor inputs may be independently set to major or minor alarm severity by option switches on the ADU. Each message will be autonomously sent to the central office whenever a condition is detected. It will include the selected alarm severity and a printable string available at the local digital switch (LDS) that reads *MISC1 environ alarm* or *MISC2 environ alarm*. The 5ESS switch master control center (MCC) display will also show when an environmental alarm is present and include the alarm severity. In TR303 or TR008 interface, the 5ESS switch can provision the alarm severity of these two alarms to Critical, Major or Minor. This provisioning change, if done at the LDS, is not made at the RT.

Loss of AC power at the RT is reported on the EOC as a separate alarm message with a printable string indicating *RT AC power loss - PMN*. This message is sent with a Minor alarm severity since the RT will transfer to battery power without loss of service. The 5ESS switch master control center (MCC) will also provide a display of presence of a Power alarm received from the RT with a Minor alarm indication.

Alarm control feature

Maintenance personnel should log the alarm information and then momentarily operate the alarm cutoff pushbutton. Depressing the **ACO** (alarm cutoff) pushbutton will silence audible and visual alarms and cause the ACO status indicator to light. All remote alarms and status indicators will be shut off except the remoted system ID. If an additional alarm from the same or different system occurs before the original trouble is cleared, the alarm will sound again. The ACO function can be remoted through a telemetry system that provides a control function.

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Miscellaneous Alarms (Continued)

Telemetry connections for remote system alarms

Remoting Series 5 alarms may be desirable and will require connection of the alarms to the appropriate scan points (or telemetry) and a telemetry system. The Series 5 system should be supported by remote maintenance centers. Also, because many telemetry and support systems are available [such as E2A, Switching Control Center System (SCCS), Telecommunications Alarm Surveillance and Control System (TASC), PREDICTOR, and ACORN[®] network control system], the Series 5 system provides a generic interface (dry contact closures) that can be connected to an appropriate telemetry system. See SD-7C116-01 for alarm connection options. All alarm and status indicators have two contact closures so that two remote monitoring locations can be supported.

System alarms from electromechanical offices

In electromechanical office (E/M), the alarm and status indicator outputs may connect to the TASC central computer, typically through E2A status and command (SAC) telemetry remote units. The E2A SAC remote unit has scan points that supply battery and ground and expect to see a contact closure from the Series 5 system. The E2A SAC remote unit has control points that supply a contact closure toward the equipment.

Alarms from ESS[®] switch offices

The Series 5 system alarm and status information may be transmitted from ESS switch offices over the maintenance teletype channel. Alarm and status indicator outputs from the Series 5 system can be connected to the miscellaneous scan points through a remote master scanner applique circuit. These scan points should supply battery and ground and be normally unsaturated. The maximum allowable wiring resistance to the scan points is controlled by ESS switching equipment. Because the number of scan points may be limited, a separate telemetry system may be preferable.

Integrated Network Access - Remote Terminal (INA-RT) Alarms

Description

Two contact closures are operated by the BCU for major and minor alarm lines to the maintenance (alarm) center. A third contact closure, also operated by the BCU, may be used to send a PMN (power minor) alarm to the maintenance center. These leads were originally used as MISC1 and MISC2 miscellaneous input alarms. Also, see *Mixed Bank Alarms* in this chapter.



NOTE:

Details of options affecting alarms and detailed telemetry arrangements are given in 363-205-104, INA-RT User's Manual.

INA-RT local indicators

In addition to the usual Series 5 RT visual alarms, the INA-RT ADU has a CMP (compatibility) alarm, a PRV (provisioning memory) alarm, and an ACO (alarm cutoff) indicator. The CMP alarm provides rapid, visible feedback to the craft personnel when common circuit packs or option switch settings result in an incompatible configuration. The CMP indicator also lights when a channel unit is installed in an invalid slot (any slot that causes it to contend for time slots with another unit). The PRV alarm shows that the provisioning memory is being updated (when no other alarms are lighted) or that provisioning has failed (when MN and FAIL indicators are also lighted). The ACO indicator shows that the ACO button has been depressed.

The MC97769A1 BCU has two indicators labeled 48 and 96. For Mode I, the 48 indicator shows that the RT bank is operating as two 48-line systems. The 96 indicator shows that the INA-RT is operating as a single 96-line system. For Mode III, the 48 indicator shows that a channel counting sequence of 1 to 48 has been chosen. The 96 indicator shows that a channel counting sequence of 1 to 96 (odd channels only; 1, 3, 5, etc.) is used.

The 48 or 96 indicator lights when the LED TEST button is depressed on the ADU or when a provisioning session is established with the craft interface unit (CIU). The lighted indicator shows the administrative size of the system.

The digroup indicators are labeled differently from the digroup indicators on the other Series 5 system BCUs. Each digroup indicator has two names. The first set of names (A, B, C, and D) identifies the Series 5 system digroup. The second set of names (A1, B1, A2, and B2) refers to the A and B digroups of two 48-line (2 digroup) D4 banks to which the INA-RT may be connected.

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Integrated Network Access - Remote Terminal (INA-RT) Alarms (Continued)

INA-RT remote alarms

Two options on the ADU work together to select the method of transmitting major, minor, and power minor alarms to a maintenance center.

- The PA/NPA option is set to PA to provide the integrated power alarm function. The integrated power alarm also sends a major or minor alarm to the maintenance center. This switch operates with the MJP/MNP option.
- The MJP/MNP option determines whether the integrated power alarm raises a major (MJP) or a minor (MNP) alarm at the maintenance center.

The MISC1 and MISC2 terminals on connector J305 provide a method of sending INA-RT alarms to a maintenance center. The DL/NDL (data link/no data link) switch on the AUB27 must be set to the NDL position for the alarm telemetry connections to function.

System Identification Number

Recommendation It is recommended that each Series 5 system be individually numbered in sequence in each central office. Special services provisioning and testing requires that a circuit be selected by the system number and channel slot number. The CIU channel access, MLT II special services circuit access, and Switched Access Remote Testing System (SARTS) special services circuit access all require the system to be addressed by system number.

Numbering plan The engineering office should develop and execute a plan to number each Series 5 system in each service node (central office) with a system number (0001 to 9999). System ID number 0000 should not be assigned to an in-service system; it will preclude test access to that system by SARTS. The work order used initially to turn up each system should specify that the system number be set in the ADU.

The Series 5 system number is set in the system by setting four, 10-position rotary switches, on the COT or RT ADU. The number choices are 0000 to 9999. Every system in an office must have a different number.

All systems should be numbered regardless of feature package, so that future upgrades or feature package conversions will be numbered. Each system ID setting should be unique: no two ADUs should have the same system ID number. The system ID should be stenciled on each system.

The system ID for INA-RT can be set several different ways, depending on the mode. System alarms and local indications will reflect the system ID setting in the different modes (see INA-RT alarms in this chapter). Details on how to set the system ID and other options are given in 363-205-104, INA-RT User's Manual.

In Mode I (48) or Mode III (48), each set of switches on the ADU is set to a different number. In Mode I (48), this setting identifies each shelf as a separate 48-channel system (2 systems and 96 channels per bank served by the ADU). In Mode III (48), since there are only 48 channels in the system, one set of switches on the ADU (one system ID) is ignored. Both of these modes allow 1-to-1 channel correspondence between the INA-RT systems and the D4 banks.

In INA-RT Mode I (96) or Mode III (96), each set of switches on the ADU is set to the same number. In Mode I (96), this setting tells the bank controller to identify the INA-RT as one 96-channel system. In Mode III (96), this setting provisions only the odd channels of the 96 identified channels to provide a 48-channel system.

System Maintenance

Fault-locating T1 lines

Fault-locating tests are used to help locate faulty repeaters or cable sections that can cause excessive errors or total signal failure. Active or passive fault-locating procedures may be used on Series 5 systems. These are standard T1 fault-locating procedures adapted specifically to the Series 5 system (see 363-205-500). An order-wire pair and one or more fault-locating pairs may be provided as desired for the transmission facility. The pairs may be shared by many RTs over the same route. A fault-locating panel is available that may be used with active or passive fault-locating filters and for single- or double-ended fault locating. The AUA78 fault-locating test adapter provides access to the digital line in Series 5 systems for fault-locating tests.

DS1 testing (INA-RT)

With INA-RT, DS1 testing is limited to automatic loopback testing when a line interface unit (LIU) input fails and to jack access with an AUA78 fault-locating test adapter. The LT (manual terminal loopback) test switch on the D4 bank cannot be used in INA-RT applications. The Series 5 AUA78 fault-locating test adapter (FLTA) and a fault-locating test set are used to troubleshoot T1 digital lines using standard techniques.



NOTE:

The FAR END LOOP switch on the AUA78 does function in the INA-RT system.

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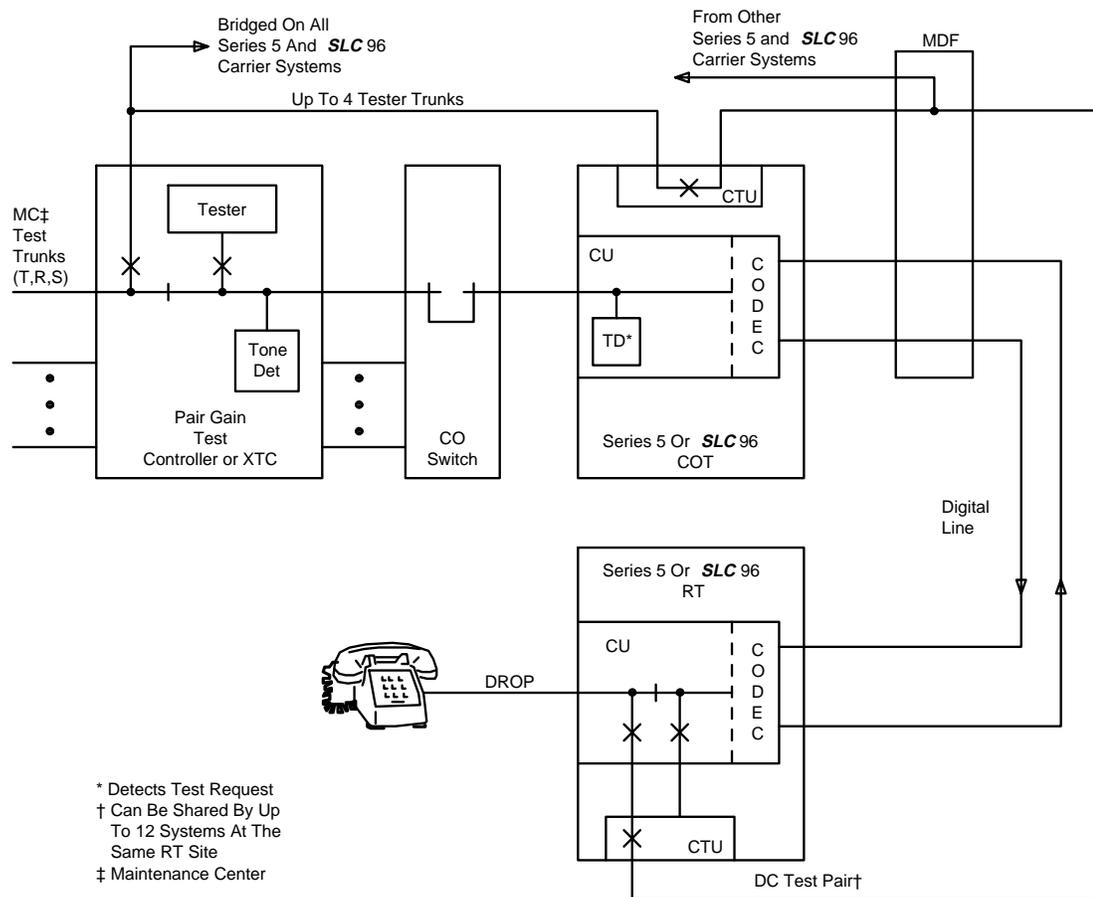
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Introduction

Automatic circuit test requirement

Automatic circuit testing of Series 5 channel units requires a pair gain test controller (PGTC) or extended test controller (XTC) at each central office that has one or more universal systems. The figure below shows a typical testing arrangement for a Series 5 system using the PGTC or XTC from the maintenance center.



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Introduction (Continued)

Automatic circuit test requirement (continued)

The PGTC provides test access for testing POTS, *SPOTS*[®] and M *SPOTS* units, coin, multiparty, and frequency selective ringing (FSR) channel units.

The XTC provides test access for testing POTS, *SPOTS* and M *SPOTS* units, coin, 2-wire special service (AUA42 and AUA43), 4-wire voice-frequency (VF) special service, and dataport channel units. When equipped with the MC97761A1 control unit (XCU) and the AUB63B data link unit (XDLU), the XTC can test multiparty, FSR, and direct inward dial (DID) channel units. In systems with Feature Package C (FPC), the XTC has additional test capabilities, described later in this chapter.

Between the COT and RT, a metallic pair may be required for subscriber loop testing. On request, the test controller will switch this DC test pair to any VF distribution pair (subscriber loop) beyond the remote terminal (RT). The maintenance center can then do standard testing of the VF subscriber loop via a test desk or the Mechanized Loop Testing System (MLT). A DC test pair may be shared by several Series 5 and *SLC*[®] 96 Carrier Systems at the same RT site (up to 12 systems).

Both test controllers can be used with *SLC* Carrier Systems operating on T1 digital lines (metallic) or on lightguide cable (via a multiplexer). If the carrier facility is lightguide cable, access to subscriber loop at the RT must be provided separately if there are no copper pairs provided with the lightguide cable.

The tester dials a specific subscriber loop to be tested and connects the test controller to the line. The channel is then tested automatically by the PGTC or XTC while the subscriber loop is being tested by the maintenance center. The results of the channel tests are given as a sweep-frequency burst and DC voltages that are interpreted by the tester. The COT single-party (POTS) channel units are compatible with automatic line insulation tests.

Remote Measurement Unit (RMU)

Description

The RMU is part of MLT-2 (MLT version 2) and is used to test loops served by *SLC* Carrier Systems. It does the same tests as the Loop Test System (LTS) of MLT-2. An RMU can be used in place of the LTS to extend the testing range to stations beyond the 3000-ohm DC test range of MLT. The RMU does not require a bypass pair and can be used when a DC test pair is not available between the RT and the nearest LTS. The RMU mounts in the enclosure or 80-type cabinet with the RT; one RMU usually serves all *SLC* Carrier Systems in the enclosure or cabinet. The Series 5 ordering guide, 363-205-000, has ordering information for the RMU.

Test Desk Operation

Procedures

Using normal test desk procedures (described in 662-505-507), a tester can verify central office wiring continuity and check for leakage up to the COT. To check channel operation and test the subscriber loop, the tester operates the + STA (positive station) key, the REV (reverse) key, and the G (ground) key (only for coin service). After test setup has been confirmed by the test controller, the tester is connected to the test pair that bypasses the *SLC* Carrier System. The test desk is now connected to the subscriber loop and may proceed with normal test desk procedures. While these tests are in progress, the test controller automatically checks the channel electronics for transmission and signaling. When tests on the subscriber loop are completed, the tester operates the 3WO key and M key to get the results of the automatic tests.

Integrated Systems Testing

Description

Testing of integrated Series 5 enhanced FPB systems is identical to integrated *SLC* 96 Carrier System testing. The *5ESS*[®] switch with the test bus control unit (TBCU) emulates the PGTC in testing the RT channel units. With the TBCU, the *5ESS* switch is compatible with MLT in offices that have integrated *SLC* Carrier Systems. The TBCU hardware consists of one power unit, one test bus unit, and one shelf. The test bus unit contains two circuits that can be used for two remote sites (each circuit is used with one DC test pair). 662-505-507 provides procedures for using the TBCU for test access to channels.

Pair Gain Test Controller (PGTC)

Description

The PGTC, the channel test units, and the channel unit allow test access to the channel and subscriber loop using the customer's telephone number. The PGTC switches office test trunks to a metallic test pair dedicated to the RT. The test pair may be shared by RTs at the same location. The PGTC can test up to four channels at the same time, as long as each channel is on a different system and each system uses a different test pair. At the RT, access to the VF subscriber loop is provided by relays in the channel test units (CTUs) and in the channel unit being tested. The PGTC is compatible with automated testing systems. To make the PGTC compatible with the Series 5 system, an SM88C control unit is used in place of the SM88B control unit. The PGTC description, operation, and maintenance are given in 363-202-300.

Extended Test Controller (XTC) Testing

Description

The PGTC can be upgraded to an XTC providing the same test features as the PGTC for monitoring and testing switched circuits (and the capability for enhanced testing). It connects test trunks from the maintenance center, local test desk (LTD), or local test cabinets to the subscriber loop beyond the RT and automatically verifies supervision, signaling, end-to-end loss, and noise of the carrier channel while the subscriber loop is being tested. The XTC uses shelves from the PGTC; these shelves are retained when upgrading from an existing PGTC installation to XTC (see description following the paragraph on PGTC Shelves). The XTC provides test access for the Series 5 system and the *SLC 96* Carrier Systems.

The XTC provides only PGTC test features for the following conditions:

- systems with enhanced FPB
- systems with FPC equipped with an AUB2B CTU at the COT and an AUB22 CTU at the RT
- when the maintenance center uses MLT-1.

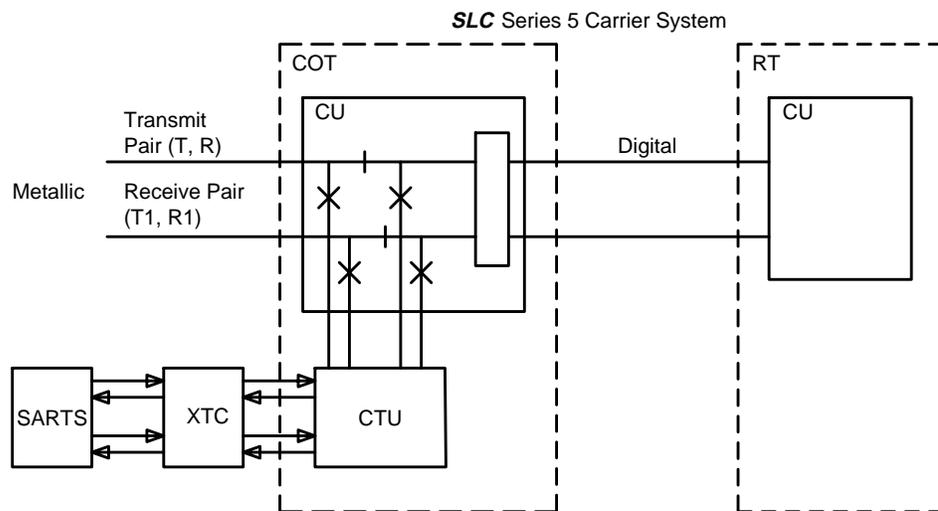
(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

XTC feature list

The XTC provides the features listed below, in addition to PGTC test features. These features are available only on Series 5 systems with FPC equipped with the AUB5 CTU at the COT and the AUB25 CTU at the RT.

- The XTC allows remote test access to Series 5 special service circuits for the special services center (SSC) using the Switched Access Remote Testing System (SARTS) without using Switched Maintenance Access System (SMAS) points. At the Series 5 COT, the XTC provides full splitting access to the metallic pairs, as shown in the figure below, of 2-wire VF special service (except *SPOTS*) channel units, 4-wire VF special service, and DS0 dataport channels.



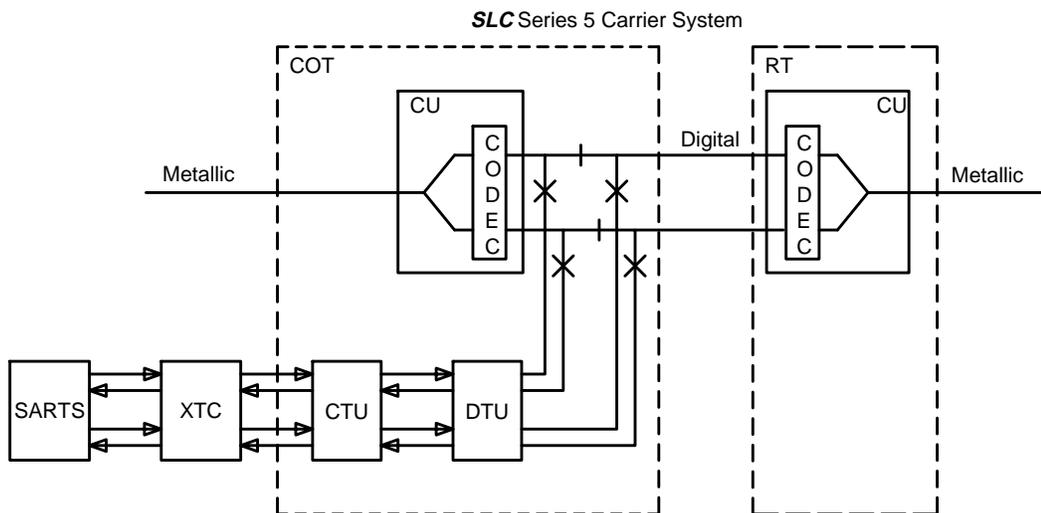
- The EXT provides SARTS with half-splitting access to the equipment side of an office channel unit (OCU) dataport channel unit in the COT.

(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

XTC feature list (continued)

- The XTC provides SARTS with full-splitting access to the digital side of a channel as shown in this figure.



A 64-kb/s bipolar digital interface or a VF-compatible interface is provided on request. The digital interface is used to test dataport channels. The VF-compatible interface is used for 2-wire (AUA42 and AUA43) and 4-wire channel units; bit stream access can also be requested for limited testing of channels equipped with POTS, SPOTS units, coin, multiparty, FSR, or DID channel units.

- The XTC allows the channel to be monitored without danger of hits to determine if it is busy before testing.
- Before testing can begin, the system and channel must be clear of any major alarm, and the channel must be properly provisioned. If MLT has requested test access, the XTC informs MLT of any major alarm on the system and whether the channel has been provisioned. If the request is from SARTS and testing is denied, the XTC gives SARTS some explanation.

(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

XTC feature list (continued)

- The XTC allows separate diagnostic tests of COT and RT channel units (except dataport) in Series 5 systems with FPC. The XTC reports results automatically to SARTS and on command to MLT. Diagnostic testing includes signaling and transmission performance. The MLT-2 system can request testing of all the channel units described in the table at the end of this section, whereas SARTS is limited to E *SPOTS* units, DID, and 4-wire VF channel units.

Even with the XTC, SARTS cannot access the following:

- A system with enhanced FPB or a system with FPC equipped with an AUB2B CTU at the COT and an AUB22 CTU at the RT.
- The metallic pairs of POTS, *SPOTS* units, coin, multiparty, or FSR channel units at the COT.
- A VF-compatible signaling interface (for example, loop-start/ground-start) for POTS, *SPOTS*, coin, multiparty, or FSR channel units for digital access (this feature is available only for 2-wire special service and 4-wire channel units).

XTC enhancements

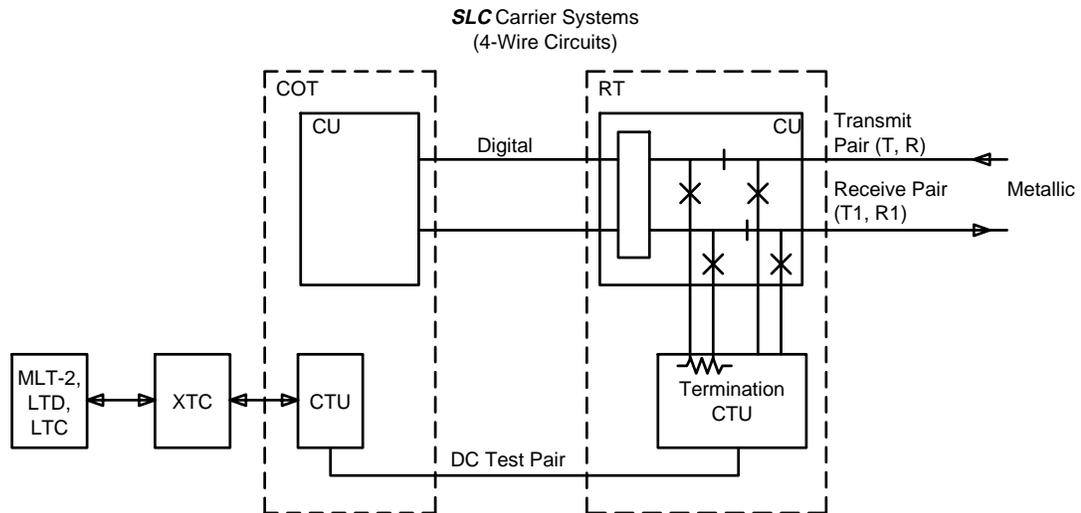
The XTC provides the following enhancements, in addition to PGTC test features. These features are available only when the maintenance center uses MLT-2, a local test desk, or a local test cabinet to test Series 5 systems equipped with the AUB5 CTU at the COT and the AUB25 CTU at the RT.

(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

XTC enhancements (continued)

- The XTC provides access at the RT channel unit to the subscriber loop on 4-wire circuits. The MLT-2 system or the local test desk or cabinet can request access to each loop, one at a time, using the DC test pair, as shown in this figure.



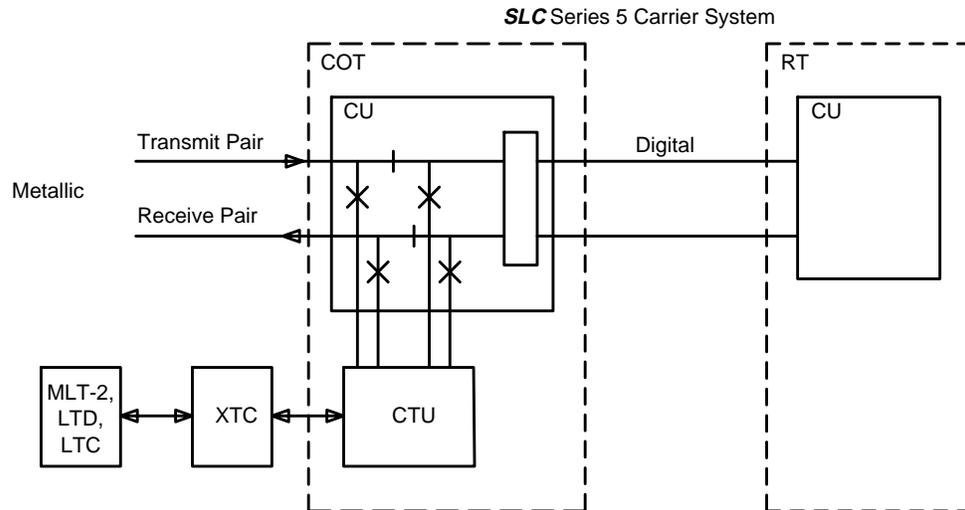
- The XTC performs separate diagnostic tests on COT and RT channel units (except dataport) and reports results on each channel unit when the tests are completed. Diagnostic testing includes the signaling and transmission performance of the channel units listed in the table at the end of this section.

(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

XTC enhancements (continued)

- For nonlocally switched circuits, the XTC provides access to the metallic pairs at the COT, as shown in the following figure. On a 4-wire circuit, MLT-2 or the local test desk or cabinet can request access to each loop, one at a time.



- For nonlocally switched 2-wire circuits, it provides access to the metallic pair looking into the channel towards the RT.
- It allows the channel to be monitored without danger of hits to determine if it is busy before testing.

(Continued on next page)

Extended Test Controller (XTC) Testing (Continued)

Channel unit table The XTC, on command, automatically provides test access for all the channel units listed in this table.

<u>Channel Unit Type</u>	<u>Channel Unit Code</u>
POTS	AUA38, AUA58(), AUA158()
<i>SPOTS</i> [®] unit	AUA32, AUA39, AUA159()
POTS and <i>SPOTS</i> unit	AUA150, AUA151
M <i>SPOTS</i> unit	AUA25B
Coin	AUA33, AUA53
Multiparty [*]	AUA35, AUA55
FSR [*]	AUA37, AUA57
DID [*] (2-Wire)	AUA36, AUA56
E <i>SPOTS</i> unit (2-Wire)	AUA42, AUA43
4W0 (4-Wire)	AUA54 (RT only)
4W1 (4-Wire)	AUA41
4W2 (4-Wire)	AUA44

^{*}Requires MC97761A1 XCU.

PGTC Shelves

Description

For testing through the XTC from MLT and local test desks or cabinets, the J1C142A (PGTC) shelves are cabled to the XTC shelves and form part of the XTC. The J1C142A shelves contain slots for trunk plug-in units that connect the XTC to no-test trunks at the switch. A J1C142A, L1 control shelf has slots that support up to 12 trunks; a J1C142A, L2 expansion shelf has slots that support up to 20 trunks. Trunk card plug-in units are installed in the PGTC control (if used) and expansion shelves as required to support the number of trunks required for each installation. Like the PGTC, the XTC supports up to 92 no-test trunks.

To save recabling and reconnecting trunks from the test facility to the switch, an existing PGTC control shelf can be modified and connected to form part of the XTC. However, in new XTC installations or installations where XTC shelves cannot be mounted immediately above or adjacent to the PGTC control shelf, the PGTC expansion shelf should be installed with the XTC.

The PGTC shelves are modified per SD-97760-01, Issue 4B or later. Equipment to modify the shelves is provided by J1C142A, L3 for the control shelf and J1C142A, L4 for the expansion shelves. 363-205-300, XTC description, turnup, and maintenance has procedures for modifying the PGTC control shelf and installing the XTC. Chapter 4 contains more information on PGTC and XTC equipment.

Craft Interface Unit (CIU) Testing

CIU channel test capabilities

Usually, end-to-end channel testing will require a tester at both ends. The CIU channel test capability includes the following:

- signaling monitoring (receive direction) and signaling injection (transmit direction) (bits must be set to A=C and B=D when injecting signaling)
- digital bit stream connection for dataport tests using the data test sets [requires that the Series 5 dual bank be equipped with digital test units (DTUs) AUA18 and AUA19]
- digital bit stream access for VF channels at 0.0 dB or D4 transmission levels (requires that the bank be equipped with the DTUs AUA18 and AUA19)
- monitor mode in transmit and receive directions without customer channel disruption
- tip and ring access to the analog signal from the metallic drop
- jack access to test E/M signaling capabilities of an E&M/PLR-type channel unit (AUA54 or AUA44).

Channel unit test extender channel test capabilities

Channel unit test extender channel test capability includes the following:

- monitor and splitting access to T/R and T1/R1 tip and ring
 - monitor and splitting access to E/M and SG/SB signaling leads
 - active circuitry for normal and reverse current limited battery feed and a hold function to supply DC termination.
-

INA-RT Channel Testing

Description

Because the D4 format has no data link, the INA-RT does not have PGTC or XTC capabilities. Local line testing is performed via the CIU and the 52A channel unit test extender. The CIU operations that reference the far end are not supported.

Integrated Services Digital Network (ISDN) Channel Unit Testing

Description

An ISDN circuit containing Series 5 BRITE channel units may be tested using the 950A test set or 5ESS switch maintenance procedures for basic rate interface transmission extension (BRITE) units.

For information on the ...	Refer to ...
950A test set	363-005-238
AUA90 T-BRITE channel unit	363-005-129
AUA92 BRITE II channel unit	363-005-130
AUA93 BRITE II channel unit	363-005-131

For installation and maintenance information on the ...	Refer to ...
AUA90 T-BRITE	363-205-106
AUA93 BRITE II	363-205-107
FPC BRITE II	363-005-116
AUA94 ISDN channel unit	363-205-113

Maintenance procedures from the 5ESS switch are given in 235-105-220, *5ESS Switch, Corrective Maintenance Procedures (5E6 generic)*.

SLC[®]-2000 MSDT Channel Testing

Description

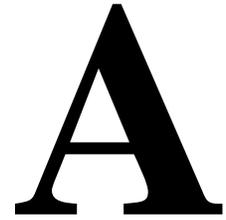
When the *SLC-2000* MSDT is equipped with the channel and drop test unit (CDTU), locally-switched channels can be tested using procedures that look like PGTC operations. The procedures allow end-to-end (central office line appearance to tip-ring at the *SLC-2000* MSDT channel unit) channel testing by the MLT system or its equivalent, usually in response to a customer trouble report.

While a locally-switched channel is being tested by the MLT system or its equivalent, the *SLC-2000* MSDT will conduct the following independent drop tests and report the PASS/FAIL results to the testing system using a programmable DC signature:

- hazardous voltage
- foreign electromotive force (FEMF)
- leakage
- continuity to ringer
- receiver off-hook (ROH).

In addition, the programmable DC signature will inform the test system that the channel being tested is MSDT-derived and will report the status (UP or DOWN) of the RT/MSDT fiber link.

Quick Reference Ordering Guide



Instructions

What to do

This section is reserved for 363-205-000, Appendix A, *Quick Reference Ordering Guide*. Appendix A is packaged separately and should be placed behind the tab for this chapter.

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Types of Documents

Overview

Documentation for Lucent Technologies Network Systems products may include some or all the following types of documents:

- sales/marketing brochures (presale)
- product announcement package
- 9-digit numbered documents (postsale)
- equipment/apparatus drawings.

The 9-digit numbered Lucent Technologies documents include: 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.

Practices

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 9-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 structured writing style has been developed. This format is part of the corporate standard that will specify the content and format for all Lucent Technologies documentation. Most new documents will be done with the structured writing format; documents to be reissued will be evaluated for conversion. This appendix has been produced using the structured writing format.

Series 5 System Documentation

Categories

The following categories of 9-digit numbered documents provide most of the Series 5 system documentation.

- indexes
- applications and planning guides
- ordering guides
- descriptive documents
- engineering documents
- data sheets
- task-oriented practices (TOPs)
- user guides/manuals
- customer information releases (CIRs).

See information under Outside Plant Documentation and under Drawings for additional documentation on the Series 5 system and related equipment.

Division 363 Document Index

Description

The numerical index for each division (first 3 digits of the 9-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. 363-000-000, *Numerical Index — Division 363, Loop Transmission Systems* lists all 9-digit numbered documents (that start with 363) for Series 5 and other loop transmission systems. The Division 363 Index layers (second 3 digits) include:

- data sheets (363-005)
 - CIRs (363-099)
 - *SLC*[®] 96 Carrier System documents (363-202)
 - Series 5 system documents (363-205).
-

Series 5 documents

The Series 5 documents include the following:

<u>Document Number</u>	<u>Document Title</u>
363-205-000	SLC <i>Series 5 Carrier System, Ordering Guide</i>
363-205-002	SLC <i>Series 5 Carrier System, Fiber-To-The-Home Feature User's Manual</i>
363-205-100	SLC <i>Series 5 Carrier System, General Description</i>
363-205-101	<i>Craft Interface Unit, Description</i>
363-205-103	SLC <i>Series 5 Carrier System, Centralized Operations and Provisioning, Installation, Test, and Maintenance</i>
363-205-104	SLC <i>Series 5 Carrier System, Integrated Network Access — Remote Terminal (INA-RT) User's Manual</i>
363-205-106	SLC <i>Series 5 Carrier System, AUA90 T-BRITE Channel Unit for ISDN, Installation and Maintenance</i>
363-205-107	SLC <i>Series 5 Carrier System, AUA93 BRITE II Channel Unit for ISDN, Installation and Maintenance</i>
363-205-113	SLC <i>Series 5 Carrier System, AUA94 U-DSL Channel Unit Installation and Maintenance</i>

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Division 363 Document Index (Continued)

Series 5 documents (continued)

Document Number	Document Title
363-205-116	SLC <i>Series 5 Carrier System, Feature Package C BRITE II Channel Unit Installation and Maintenance</i>
363-205-300	<i>Extended Test Controller, Description, Installation, and Maintenance</i>
363-205-400	SLC <i>Series 5 Carrier System, COT Acceptance and Turnup (TOP)</i>
363-205-401	SLC <i>Series 5 Carrier System, RT Acceptance and Turnup (TOP)</i>
363-205-402	SLC <i>Series 5 Carrier System, Channel Unit Installation (TOP)</i>
363-205-406	SLC <i>Series 5 Carrier System, End-to-End Tests (TOP)</i>
363-205-500	SLC <i>Series 5 Carrier System, Trouble Clearing (TOP)</i>

Applications and Planning Guides

What they contain These documents provide guidelines for network planners for system applications. The applications and planning guide provides a high-level description of system features, arrangements, interfaces, components/equipment, and operations, administration, maintenance, and provisioning (OAM&P). 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. 363-205-010, Series 5 System applications and planning guide, contains a network overview, system applications, equipment description, channel unit information, OAM&P, references, and training.

Ordering Guides

What they contain The ordering guide provides ordering information (equipment and apparatus codes) for the system. It 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. 363-205-000, Series 5 system ordering guide, has tables listing the units for the system feature packages, some discontinued availability (DA) equipment, common and channel units, cabinet arrangements, miscellaneous equipment, and channel and digital line test equipment.

Descriptive Documents

What they contain Descriptive documents usually include physical and functional characteristics and features in a technical style. Depending on the unit, descriptive information may be combined with engineering, installation, and/or operation information. Descriptive documents may contain procedural information in the step-procedure format (used mainly for short, simple procedures) or flowchart format (used typically for trouble clearing). The data sheet is a descriptive document that may contain procedures. Some Lucent Technologies practices use the step-procedure format. 363-205-100, Series 5 system general description, includes an overview of the system features, a functional description at the block-diagram level, a description of the physical features of the channel bank and plug-in units, maintenance information, and a summary of system specifications.

Engineering Documents

What they specify Engineering documents specify requirements for engineering a system. The requirements may include equipment constraints, customer considerations, circuit or facility design information, physical design constraints, etc. In digital and loop transmission systems, engineering is covered in two separate documents: one for facility design or system engineering, and one for circuit design (prescription setting).

The Series 5 system has two engineering documents. 915-710-115, Series 5 system engineering, covers central office considerations, remote terminal arrangements, system alarm requirements, digital facility engineering (including fault locating and order wire requirements), test facility engineering, distribution (loop) considerations, circuit assignment for nonprovisionable channel units, and miscellaneous considerations (forms/records and acceptance testing). 915-710-116, Series 5 channel unit application and prescription setting (structured like the D4 channel unit engineering document), covers special service and data applications, prescription setting for the provisionable channel units, and a summary of carrier serving area (CSA) guidelines.

Data Sheets

What they provide The 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 figures showing a functional block diagram of the unit and a line drawing of the faceplate and circuit board. Some data sheets may contain details on unit maintenance including test procedures. For example, 363-005-132, *AUA75 2-Wire PLAR Channel Unit Data Sheet*, has procedures to set the option switches on the channel unit and test channel unit transmission and signaling end-to-end.

The Series 5 data sheets (363-005-101 through 363-005-304) cover the common units, channel units, *SLC-2000* Multi-Services Distant Terminal (MSDT) units, extended test controller (XTC) units, and miscellaneous units (adapters, test extenders, etc.). Each data sheet is assigned a unique 9-digit number within the range of numbers for the system (Series 5 data sheets are within the range 363-005-101 to 363-005-399).

Task-Oriented Practices (TOPs)

TOPs described

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 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. The TOP system is explained in a 10-page training package (always coded TNG-893) in the back of every TOP.

The Series 5 TOPs are listed below:

- | | |
|--------------------|---|
| 363-205-400 | Central Office Terminal Acceptance and Turnup TOP — procedures for accepting the Series 5 COT, installing the common units for each feature package, converting feature packages, and turning up the system. |
| 363-205-401 | Remote Terminal Acceptance and Turnup TOP — procedures for accepting the Series 5 RT, installing the common units for each feature package, converting feature packages, and turning up the system. |
| 363-205-402 | Channel Unit Installation TOP — procedures for installing channel units for each system configuration and testing channel unit transmission and signaling from COT to RT for nonprovisionable channel units and end-to-end for provisionable channel units. |
| 363-205-406 | End-To-End Tests TOP — procedures for changing the system status from preservice to in-service and verifying that the system works end-to-end. |
| 363-205-500 | Maintenance and Trouble-Clearing TOP — procedures for clearing alarms on the system, trouble isolation on the digital facility, and clearing channel failure. |
-

User Guides/Manuals

Definition

The definition given here for user guides/manuals differs from the definitions given in the new Lucent Technologies documentation standards. As the standards are implemented, this category should become more consistent. In the definition given here, the words "guide" and "manual" have the same meaning.

What they contain

For a stand-alone product (for example, the DDM-2000 multiplexer) or independent system feature (for example, the Series 5 INA-RT), the user's guide/manual provides a single document containing all the information needed to use the product or feature. It explains when, why, and how to use the feature or product, briefly describes the product's hardware, software, and features, and may provide step-by-step instructions for installation, operation, and maintenance. A user guide/manual may be part of a documentation package that includes one or two other documents, such as an applications, planning, and ordering guide.

363-205-002, *Series 5 Fiber-To-The-Home Feature User's Manual*, contains applications, a physical and functional description, system engineering, operations and administration, construction and installation, maintenance, and appendixes (ordering information, data sheets, etc.).

Customer Information Releases (CIRs)

Purpose of CIRs

The purpose of CIRs is to provide customers with timely information. CIRs were developed after divestiture to replace the general department letters (system letters, recommendation letters, and engineering letters). CIRs may be updated at the discretion of project management, or the information from the CIR may be incorporated into the system documentation as the system documents are reissued.

Styles of CIRs

Several different styles of CIRs are used:

- marketing information letter (ML)
- product sheet (PS)
- network planning letter (NP)
- information release (IR)
- technical description (TD)
- technical specification (TS)
- maintenance/operations release (MG/MA/MR).

Each CIR has a 9-digit number; a different suffix identifies each style. The maintenance/operations release (MOR) uses a color-coded heading to identify the importance of the information. Some styles of CIRs provide additional information in an attachment.

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Customer Information Releases (CIRs) (Continued)

CIR formats

The format for each CIR style is given in this table. The table states how many sheets (one sheet is two pages) are used for the CIR and attachment (if applicable).

CIR Type	Number of Sheets*	
	CIR	Attachment
ML	5	Not Applicable
PS	1	Not Applicable
NP	2	Multipage
IR	1	Multipage
TD	1	Multipage
TS	1	Multipage
MOR:		
MG (Routine)	1	Multipage
MA (Caution)	1	Multipage
MR (Emergency)	Multipage	Not Applicable

*1 sheet = 2 pages (front and back)

Marketing information letters

Marketing information letters provide information on how to best present Business Services products. These letters are aimed at telephone company marketing personnel and provide the following:

- product news about service offerings
- portray end-user advantages.

Product sheets

Product sheets are quick overviews that include benefits, features, applications, and a brief technical description. The PS is designed to stimulate customer interest in the product so that the customer will request more information.

(Continued on next page)

Customer Information Releases (CIRs) (Continued)

Network planning letters Network planning letters provide news on product developments. The NP suggests how a product will fit into the network by describing general characteristics, primary features, potential benefits, and applications. As development continues, additional product information is supplied for planning and scheduling.

Information releases Information releases are general announcements on a wide range of topics, from training programs to new generic releases or special service arrangements. The IR may be used to announce availability of more information on a product.

Technical descriptions Technical descriptions provide technical detail to help the customer select a product. The TD provides a functional description, site preparation data, operations and maintenance considerations, ordering, and training information. The TD should be updated when standard ordering information is available.

Technical specifications Technical specifications provide physical, functional, environmental, and interface characteristics, and performance objectives of the product. The TS may provide the following:

- product description
- interface information
- the basis for product inspection
- the technical basis for the warranty.

(Continued on next page)

Customer Information Releases (CIRs) (Continued)

Maintenance/ operations releases

The maintenance/operations release emphasizes information about upgrades or changes in operations and maintenance procedures associated with current products. The maintenance/operations release has three different levels of importance:

<u>Level</u>	<u>Coded</u>	<u>Color</u>
routine	MG	green
caution	MA	amber
emergency	MR	red

Outside Plant Documentation

Divisions

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 Series 5 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, *9-Digit Numbered Documents Master Index*, for other divisions of outside plant documentation.

Series 5 related documentation

Outside plant documentation (a partial list) on the Series 5 system includes the following:

<u>Document Number</u>	<u>Document Title</u>
622-506-052	<i>KS-23038 Controlled Environment Vault Description</i>
622-506-235	<i>Concrete Hut ED-7C285-30, Description and Installation</i>
622-506-236	<i>KS-23038 Controlled Environment Vault Installation</i>
622-506-237	<i>KS-23038 Controlled Environment Vault Operation and Maintenance</i>
631-600-240	<i>80 B, C, and D Size Cabinets, Installation</i>
631-600-241	<i>80 B, C, and D Size Cabinet, Splicing Information</i>
640-250-223	<i>80-Type Cabinet Remote Terminal, Installation and Splicing (Metallic Systems)</i>

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Outside Plant Documentation (Continued)

Series 5 related documentation (continued)

<u>Document Number</u>	<u>Document Title</u>
640-250-224	<i>Remote Terminal Splicing, Precabled Structures Using Bulk Protection</i>
640-250-237	<i>51A RT Cabinet (ED-7C601-30) Placement, SLC Series 5 System</i>
640-250-247	<i>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</i>
640-250-248	<i>Precabled Structure Using Bulk Protection Metallic Remote Terminal Splicing SLC Series 5 Carrier System</i>
640-250-250	<i>Precabled Structures Using Bulk Power and Protection, Splicing, and Cabling Arrangements (Metallic and Fiber SLC Carrier Systems)</i>
640-250-251	<i>16-Foot and 24-Foot Platforms Description SLC Series 5 Carrier System</i>
640-250-252	<i>80D Cabinet (Fiber) Group 80 Description, Installation, and Splicing, SLC Series 5 Carrier System</i>
640-250-255	<i>80D Cabinet (Fiber) Group 90, 91, 92 Description, Installation, and Splicing, SLC Series 5 Carrier System</i>
640-250-256	<i>80E Cabinet (Fiber) Group 90 and 91, Description, Installation, and Splicing, SLC Series 5 Carrier System and SXSS Repeater Shelf</i>
640-250-325	<i>80 D Cabinet Description, Installation, and Splicing SLC Series 5 Carrier System</i>
640-250-327	<i>80E Cabinet Remote Terminal, Description, Installation, and Splicing</i>
640-252-310	<i>Concrete Hut (ED-7C285-30) Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems</i>

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Outside Plant Documentation (Continued)

Series 5 related documentation (continued)

<u>Document Number</u>	<u>Document Title</u>
640-252-311	<i>C Equipment Platform Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems</i>
640-252-312	<i>80-Type Cabinets, Description, Installation, and Splicing, Combined SLC 96 and SLC Series 5 Carrier Systems</i>
644-203-155	<i>80-Type Cabinet, Repair and Replacement Parts</i>

Drawings

Drawing types

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.

Series 5 related drawings

The following drawings contain detailed information on Series 5 equipment and related systems.

Drawing Number	Drawing Title
ED-7C628-10	SLC Series 5 Carrier System Ordering Guide
ED-30335-70	Writing Shelf
SD-/CD-7C115-01	Central Office Terminal Channel Bank Schematic
SD-/CD-7C116-01	Central Office Terminal Application and Bay Wiring Schematic
SD-/CD-7C117-01	Remote Terminal Dual Channel Bank Schematic
SD-/CD-7C118-01	Remote Terminal Application and Bay Wiring Schematic
SD-/CD-7C119-01	Remote Terminal Power Shelf Schematic
FPD 801-450-106-1	Floor Plan Data Sheet, SLC Series 5 Carrier System Central Office, Terminal, 11-foot 6-inch Frame (Six Dual Channel Banks)
FPD 801-450-106-2	Floor Plan Data Sheet, SLC Series 5 Carrier System Central Office Terminal, 11-foot 6-inch Frame (Five Dual Channel Banks)
FPD 801-450-106-3	Floor Plan Data Sheet, SLC Series 5 Carrier System Central Office Terminal, 9-foot 0-inch Frame (Four Dual Channel Banks)

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Drawings (Continued)

Series 5 related drawings

Document Number	Document Title
FPD 801-450-106-4	<i>Floor Plan Data Sheet, SLC Series 5 Carrier System Central Office Terminal, 7-foot 0-inch Frame (Three Dual Channel Banks)</i>
FPD 801-450-106-5	<i>Floor Plan Data Sheet, SLC Series 5 Carrier System Remote Terminal, 7-foot 0-inch Frame (Two Dual Channel Banks)</i>
FPD 801-450-106-6	<i>Floor Plan Data Sheet, SLC Series 5 Carrier System Remote Terminal, 7-foot 0-inch Frame [Three Dual Channel Banks (DC Bulk Power)]</i>
SD-/CD-7C127-01	<i>Extended Test Controller Control Shelf</i>
SD-/CD-97760-01	<i>Pair Gain Test Controller Control Shelf</i>
SD-/CD-99503-01	<i>Patch and Cross-Connect Panel</i>
SD-/CD-1P112	<i>Data Link Interface</i>
SD-/CD-1P113-01	<i>Metallic Interface Unit</i>

Related Documentation

Systems and equipment documentation

The following documents contain information on systems and equipment related to the Series 5 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 documents in that division. Refer to the numerical index for availability of documents listed below.

Document Number	Document Title
000-100-100	<i>Practices, Description</i>
100-101-401	<i>197A Battery Load Test Set, Description and Operation</i>
157-627-101	<i>Storage Battery, KS-21906 Sealed, Rechargeable, Lead-Acid, Description, Installation, and Maintenance</i>
235-019-102	<i>General Growth Procedures</i>
235-190-029	<i>Pair Gain Interface to Nonintegrated SLC Carrier System</i>
235-190-036	<i>Integrated SLC Carrier System</i>
332-610-100	<i>Customer Premises Facility Terminal for Metallic Facility Terminal Plug-In Equipment, General Description</i>
363-005-zzz	SLC Series 5 Carrier System Data Sheets
363-200-001	<i>T-Type Digital Line Preservice Testing</i>
363-200-005	<i>Integrated SLC Carrier System, Recent Change</i>
363-200-010	<i>DCLU Integrated SLC Carrier System, General Information Manual</i>
363-201-216	<i>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</i>
363-202-300	<i>Pair Gain Test Controller, Description and Installation</i>
363-202-525	SLC Carrier System, Remote Power Feed Terminal (RPFT) Description, Installation, and Maintenance

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Related Documentation (Continued)

**Systems and
equipment
documentation
(continued)**

Document Number	Document Title
363-202-602	<i>Bulk Protected Remote Terminals Installation of Shelves, SLC Series 5 Carrier and SLC 96 Carrier Systems</i>
363-203-100	<i>Subscriber Loop Interface Module (SLIM), General Description</i>
363-203-101	<i>Subscriber Loop Interface Module (SLIM), Installation and Maintenance</i>
363-205-002	<i>SLC Series 5 Carrier Fiber-To-The-Home Feature, User's Manual</i>
363-205-003	<i>SLC-2000 Multi-Services Distant Terminal Feature, Applications, Planning, and Ordering Guide</i>
363-206-100	<i>DDM-1000 Multiplexer User's Manual</i>
363-206-200	<i>DDM-2000 Network Multiplexer, Applications and Planning Guide</i>
626-100-006	<i>CD and DD Series of MUP (Multiunit Pulp) Cable, Description, Use, and Maintenance</i>
626-101-005	<i>Air Core PIC and DEPIC Cables, Nonscreened and Screened, Description, Use, and Reel Lengths</i>
626-101-010	<i>Waterproof Nonscreened and Screened Plastic, Insulated Cables, Description, Use, and Reel Lengths</i>
626-759-400	<i>Superseded Exchange Cables</i>
626-800-095	<i>Screened Air Core and Waterproof Plastic - Insulation Conductor Cable, Description, Use, and Reel Lengths NS/LA (Nonstandard/Limited Availability)</i>
631-400-102	<i>Cable and Terminal Grounding in Subscriber Building, General Description</i>
640-010-005	<i>Splicing T Carrier Cables, General Description</i>
640-250-206	<i>478-Type Apparatus Case, Description, Installation, and Maintenance</i>

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Related Documentation (Continued)

**Systems and
equipment
documentation
(continued)**

Document Number	Document Title
640-250-221	<i>Remote Power Feed Terminal (RPFT), Installation and Wiring of Shelves</i>
640-525-108	<i>475F2, 475G2, and 475G2F Apparatus Cases, Description and Installation</i>
640-525-220	<i>Pair Loss Measurements Using 113A and/or 113B Test Sets, Digital Transmission Systems</i>
640-525-304	<i>T1 and T1/OS Carrier 46806 Apparatus Case, Description and Maintenance</i>
640-525-307	<i>818- /819-Type Repeater Cases, Description, Installation, Splicing, and Maintenance</i>
640-525-308	<i>809-Type Repeater Cases, Description, Installation, Splicing, and Maintenance</i>
640-525-309	<i>841B or 841C Type Repeater Cases, Description, Installation, Splicing, and Equipping</i>
640-525-315	<i>T1, T1C and T1/OS Apparatus Cases and Associated Plug-in Equipment</i>
640-527-220	<i>J98725AA Test Set Pair Loss Measurements</i>
640-527-225	<i>J98725AB Test Set, Bipolar Violation Detector for T1, T1C, or T1 Outstate</i>
662-400-500	<i>Testing Customer Lines, Operation and Test Procedures</i>
662-505-507	<i>Test Desk Procedures</i>
801-438-150	<i>J98710 Specifications, T1 Carrier Repeater Line Equipment</i>
801-440-001	<i>J1C142 Specifications, Pair Gain Test Controller</i>
801-523-150	<i>T1 Carrier, System Requirements and Repeater Bay Equipment</i>

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Related Documentation (Continued)

**Systems and
equipment
documentation
(continued)**

Document Number	Document Title
801-523-153	<i>T1C Carrier, System Requirements and Repeater Bay Equipment</i>
855-350-104	<i>T1, T1 Outstate, and T1C and T1D Fault Locate System Engineering Design, Digital Transmission System Carrier Engineering Application</i>
855-350-106	<i>DSX-1 and DSX-1C Retrofit</i>
855-350-107	<i>T1, T1 Outstate, T1C, T1D, and T2 Order-Wire System Engineering Design</i>
855-351-101	<i>Transmission and Outside Plant Design Procedures, T1 Digital Line Carrier Engineering System Application</i>
902-200-110	<i>Digital Line Design and Pair Selection Rules, Subscriber Carrier Systems</i>
902-200-115	<i>Digital Line Engineering Program (DILEP)</i>
915-710-110	SLC <i>96 Carrier System Application Engineering, Facility Design Systems</i>
919-240-302	<i>16-Foot Controlled Environment Vault Engineering Considerations</i>

Bell Communications Research (Bellcore) Documents

Series 5 related documentation

The following are Series 5 related documents available from Bell Communications Research.

Document Identification	Document Title
Bellcore Technical Reference TR-TSY-000008 Issue 2, August 1987	<i>Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch</i>
Bellcore Technical Reference TR-TSY-000057 Issue 1, April 1987	<i>Functional Criteria for Digital Loop Carrier Systems</i>
Bellcore Technical Reference TR-TSY-000303 Issue 2, December 1992, and all Revisions and Supplements	<i>Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface.</i>
BR-680-203-023	Assignment Procedures for the Series 5 Carrier System
BR-902-200-120	Outside Plant Engineering, Digital Line Engineering Program II (DILEP II)

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Course and Scheduling

Training program Lucent Technologies Customer Training and Information Products offers a training program for the Series 5 system. Course TR4601 is designed for central office technicians and maintenance personnel who are involved in operating the *SLC*[®] Series 5 Carrier System.

Schedule Courses are available now and will be offered several times each month. To obtain schedule details follow the registration procedure in the following section.

Registration and Information Procedures

How to register and obtain information

To register for a class or obtain scheduling information, call your company's training coordinator. If your company does not have an assigned training coordinator, call this toll-free number to order a product training catalog, get more information on a course, find out about new courses, or register for a class:

1-888-LUCENT8

When you call 1-888-LUCENT8, you will be given four options. Press the appropriate option.

- Option 1:** To place or check on orders, check item prices and availability, PRESS 1.
- Option 2:** To register for Lucent Technologies product training, PRESS 2.
- Option 3:** To check on self-paced course orders and status, PRESS 3.
- Option 4:** To order documentation via the World Wide Web, PRESS 4.

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Registration and Information Procedures (Continued)

Catalogs

Catalogs can be requested from the following sources:

- on the Internet

<http://www.lucent.product-training.com/catalog>

- by telephone

Call: 1-614-764-5539

- by FAX

FAX: 1-614-764-5502

- via COMCATS

dial: 1-800-662-0662

login: comcats

password: lucent1

TR4601 — SLC[®] Series 5 Carrier System Turnup and Test

General	<p>Course TR4601 covers the identification and functions of the Series 5 system central office and remote terminal equipment, modes of operation, associated turn-up and test procedures, special service channel unit provisioning, channel unit testing, and system maintenance.</p> <p>The course addresses the latest available service offerings and their associated equipment. Students gain hands-on experience performing turnup and test procedures. They provision special service channel units using the craft interface unit, or the special channel administration tool (SCAT) PC program and perform, maintenance procedures for special service channel units.</p>
Who should take TR4601?	<p>This course is designed for central office technicians, and outside plant and maintenance personnel. Also, the course may be beneficial for staffers, planners, sales people, and managers.</p>
Length of the class	<p>The length of course TR4601 is 4 days.</p>
Prerequisites	<p>Students should have a general knowledge of transmission principles.</p>
Media	<p>Course TR4601 is a combination of instructor lectures and group discussions reinforced with 50 percent hands-on exercises on operational systems that are typical of those in the field.</p>
Location	<p>Course TR4601 is taught at the Lucent Technologies National Product Training Center in Dublin, Ohio.</p>
Class Size	<p>Classes are limited to twelve students.</p>

Glossary

A

ADU

Alarm Display Unit

A/FCU

Alarm/Fan Control Unit

AIU

Alarm Interface Unit

ALE

Automatic Line Evaluation

ASU

Alarm Suppressor Unit

B

BCU

Bank Control Unit

BFU

Bank Fuse Unit

BP

Bulk Power

BRI

Basic Rate Interface

BRT

Business Remote Terminal

BRITE

Basic Rate Interface Transmission Extension

C

CATV

Community Antenna Television

CEU

Circuit Enabler Unit

CEV

Controlled Environment Vault

CFU

Channel Fuse Unit

CGA

Carrier Group Alarm

CIU

Craft Interface Unit

CLF

Carrier Line Failure

CMIP

Common Management Information Protocol

COT

Central Office Terminal

CPC

Circuit Provisioning Center

CPE

Customer Premises Equipment

CSA

Carrier Serving Area

CTU

Channel Test Unit

CU

Channel Unit

D

DCB

Dual Channel Bank

DCU

Digital Connectivity Unit

DDS

Digital Data Services

DID

Direct Inward Dialing

DLC

Digital Loop Carrier

DP

Distribution Power

DRR

Dual Ringing Repeater

DT

Distant Terminal

DTM

Drop Test Module

DTU

Digital Test Unit

E

EEE

Electronic Equipment Enclosure

EEPROM

Electronic Erasable Programmable Read Only Memory

EOC

Embedded Operations Channel

ESF

Extended Superframe

F

FACS

Facility Assignment and Control System

FCU

Fan Control Unit

FDI

Feeder Distribution Interface

FITL

Fiber in the Loop

FL/OW

Fault Location and Order Wire

FLTA

Fault Locating Test Adapter

FPB

Feature Package B

FPC

Feature Package C

FPF

Feature Package F

FSR

Frequency - Selective Ringing

FTTH

Fiber-To-The-Home

FWB

Fixed Wiring Board

I

IACS

Integrated Access and Cross-Connect System

IDCU

Integrated Digital Carrier Unit

ISDN

Integrated Services Digital Network

L

LAN

Local Area Network

LDS

Local Digital Switch

LDU

Load Distribution Unit

LEC

Local Exchange Carrier

LFU

Line Fuse Unit

LIU

Line Interface Unit

LSU

Line Switch Unit

LT

Loop Terminal

LTA

Line Test Adapter

LTD

Local Test Desk

M

MAN

Metropolitan Area Network

MC

Maintenance Center

MCC

Master Control Center

MDF

Main Distribution Frame

MLT

Mechanized Loop Testing

MSDT

Multi-Services Distant Terminal

N

N/A

Not Applicable

NCI

Network Channel Interface

NIU

Network Interface Unit

O

OHT

On Hook Transmission

ORB

Office Repeater Bay

OS

Operations System

OTU

Office Timing Unit

OU

Optical Unit

P

PAM

Pulse Amplitude Modulation

PC

Personal Computer

PCM

Pulse Code Modulation

PCU

Power Converter Unit

PGTC

Pair Gain Test Controller

PLAR

Private Line Auto Ring

PLR

Pulse Link Repeater

POTS

Plain Old Telephone Service

PRU

Positive Ringing Unit

PWB

Printed Wiring Board

R

RCU

Ring Control Unit

RGU

Ring Generator Unit

RHC

Regional Holding Company

RMU

Remote Measurement Unit

RSU

Ring Switch Unit

RT

Remote Terminal

RTAC

Regional Technical Assistance Center

S

SARTS

Switched Access Remote Testing System

SCEC

Second Channel Error Correction

SF

Super Frame

SLIM

Subscriber Loop Interface Module

SLM

Subscriber Loop Multiplexer

SMAS

Switched Maintenance Access System

SS

Special Service

SSC

Special Service Center

T

TCU
Transcoder Unit

TLWS
Trunk-Line Workstation

TRU
Transmit Receive Unit

V

VF
Voice Frequency

X

XTC
Extended Test Controller

Z

ZBS
Zero Bit Suppression