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June, 1995

**DACS IV-2000 (256)
Digital Access and
Cross-Connect System IV-2000
Release 5.0**

Applications, Planning, and
Ordering

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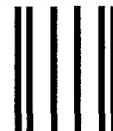
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About This Guide

Purpose

The *DACS IV-2000 (256) Release 5.0 Applications, Planning, and Ordering* guide describes the features, applications, ordering information, and technical specifications of the Digital Access and Cross-Connect System IV-2000 (DACS IV-2000). New features described in this guide include DS3 clear-channel cross-connection (DS3 cc); DS3 to STS-1 gateway cross-connection; full-time DS1 performance monitoring of DS1 tributaries on DS3 facilities that terminate on MUX3 circuit packs; unframed DS3; DS3 terminal loopbacks; and DS3 test access.

The DACS IV-2000 (256) Release 5.0 positions the customer to evolve to future releases of the DACS IV-2000.

This guide includes functional and physical overviews, system architecture, hardware and software information, and system configurations for the DACS IV-2000.

Audience

The *DACS IV-2000 (256) Release 5.0 Applications, Planning, and Ordering* guide is intended primarily for network planners and engineers. It assists in the planning and integration of a DACS IV-2000 into a network and can be used by anyone desiring specific information about the applications, ordering, and technical specifications of the DACS IV-2000 (256).

Document Summary

The parts of this document are summarized below.

- **About This Guide** includes the purpose, the audience, and a summary of this document. It also lists related documents and instructions for ordering the documents.
- **Chapter 1 - Introduction** offers a brief overview of the AT&T 2000 family of transmission products and an overview of the DACS IV-2000 and its benefits.
- **Chapter 2 - System Features** details major features of the DACS IV-2000.
- **Chapter 3 - Applications** describes how the DACS IV-2000 is used in conjunction with networking and other peripheral equipment.
- **Chapter 4 - Ordering Information** contains information to help you order the DACS IV-2000. The ordering information is grouped into logical ordering lists.
- **Chapter 5 - Product Support** includes AT&T product support contacts, training information, and warranty data.
- **Appendix A - Technical Specifications** contains technical specifications for the DACS IV-2000.
- **Glossary** gives definitions of terms used in this document.
- **Acronyms** expands the acronyms used in this document.
- **Index** gives page locations of information in this document.



NOTE:

Unless otherwise specified, references in this document to the DACS IV-2000 are to the DACS IV-2000 (256) Release 5.0.

Print Conventions

The following print conventions are used in this guide:

- *Italic type* is used for documentation titles, primarily AT&T customer documents and Bell Communications Research (Bellcore) technical references and technical advisories.
- `Constant width type` is used for output, primarily output messages and responses to input commands.
- **Constant width bold type** is used for information you input, primarily commands.

Related Documents

The following documents provide additional information about the DACS IV-2000, and can be ordered after the general availability date of this release:

- *DACS IV-2000 (256) Release 5.0 Reference Manual*,
AT&T 365-340-800

This manual provides in-depth, encyclopedic information about the DACS IV-2000 for craft, engineers, and system administrators.

- *DACS IV-2000 (256) Release 5.0 Operations and Maintenance*,
AT&T 365-340-801

This manual provides detailed procedures for daily operations, trouble-clearing procedures, and routine maintenance of the DACS IV-2000.

- *DACS IV-2000 (256) Release 5.0 Commands and Messages*,
AT&T 365-340-802

This manual gives a description of each command and its associated output response messages, including error codes. The appendices include command name, parameter, and state modifier acronym tables, activity menus, user privilege codes, state names, and state diagrams.

- *DACS IV-2000 (256) Release 5.0 Quick Reference Job Aids*,
AT&T 365-340-803

These aids are produced on laminated sheets and contain command names, error codes, fuse locations, test access, port addressing, loop-backs, and monitored parameter default and range values.

- *DACS IV-2000 (256) Release 5.0 Software Release Description*,
AT&T 365-340-805

This document contains upgrade procedures for the new software release. It relates the status of problems fixed or found in previous releases and operating issues for the current software release. (This document cannot be ordered as a stand-alone item; it only accompanies the software.)

Electronic Documentation

AT&T's DACS IV-2000 customer documentation is available on CD-ROM. Consult your AT&T account executive for details.

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To order copies of documents available for this release, send or call in an order using the title and its associated 9-digit document number as provided above.

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Introduction

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This chapter introduces the 2000 Product Family and positions the DACS IV-2000 within the network. It lists the benefits that the DACS IV-2000 (256) Release 5.0 offers and provides a system overview that includes architecture, hardware, and configurations.

2000 Product Family

AT&T is focused on a carefully planned and growing product family designed to provide total network solutions. The 2000 Product Family complies with the SONET (synchronous optical network) standard and builds on features that customers have found necessary to set up an efficient and successful network. It includes single-ended maintenance features and in-service upgrade capabilities. The system's modular design allows graceful in-service upgrades to accommodate both synchronous and asynchronous network communications.

The AT&T 2000 Product Family includes:

- **FT-2000 OC-48 Lightwave System.** The FT-2000 OC-48 lightwave system is a high-capacity synchronous digital transmission system.
- **DDM-2000 OC-3/OC-12 Multiplexer.** The DDM-2000 OC-3/OC-12 multiplexer is a low-capacity synchronous digital transmission system. It is designed for loop feeder and interoffice applications.
- **DACS III-2000 Digital Cross-Connect System.** The DACS III-2000 is a software-based, high-capacity, digital cross-connect system that automates many functions performed by manual DSX-3 cross-connect frames.

- **DACS IV-2000 Digital Cross-Connect System.** The DACS IV-2000 is a software-based, high-capacity, digital cross-connect system that merges cross-connect and multiplexer functions.
- **DACScan[®]-2000 Controller.** The DACScan-2000 Controller workstation automates control over diversely located network elements such as the DACS III-2000 and the DACS IV-2000.
- **SLC[®]-2000 Access System.** The SLC-2000 Access System supports standard switch interfaces such as TR08 and TR303, as well as standard feeder interfaces, at DS1 and SONET OC-3 rates.
- **Business Remote Terminal-2000 (BRT-2000).** The BRT-2000 provides access for businesses through fiber-optic telecommunications equipment.

Benefits

The key benefits offered by the DACS IV-2000 are SONET networking, cost effectiveness, flexibility, operating efficiency, revenue generation, and office modernization. These benefits are described in the following sections.

SONET Networking

The DACS IV-2000 provides the following SONET capabilities:

- Maintains end-to-end SONET connectivity between SONET network elements
- Allows grooming of VT1.5s within STS-1 signals
- Allows cross-connection of STS-1 signals
- Supports a wide range of performance monitoring for SONET signals
- Allows for asynchronous/SONET gateway connections, including DS3 to STS-1 and DS1 to VT1.5.

Cost Effectiveness

The DACS IV-2000 merges the functions of SONET add/drop and M13 multiplexers with manual DSX-1 cross-connects and performance monitoring systems, and allows centralized and automated operations, administration, maintenance, and provisioning.

The DACS IV-2000 performs VT1.5 grooming (the rearrangement of VT1.5 signals within STS-1 signals), thereby reducing the need for back-to-back SONET multiplexers and allowing interconnection of multiple SONET rings. It also supports a wide range of performance monitoring for SONET signals, and allows

asynchronous facilities to be connected to the SONET network. These capabilities significantly reduce equipment and operating costs.

The DACS IV-2000 is highly modular in design, thus allowing for incremental growth that makes it economical for small, medium, or large traffic cross-section applications. The DACS IV-2000 replaces existing multiplexing and manual cross-connection equipment, thereby facilitating office modernization.

The DACS IV-2000 reduces equipment costs for DS1 grooming by eliminating the need for back-to-back multiplexing equipment. Office space savings as well as significantly reduced cable congestion are also realized. Employing the DACS IV-2000 as a hubbing vehicle to combine and rearrange DS1s on incoming and outgoing DS3 facilities to central office locations results in better use of customer facilities.

Replacement of manual DSX-1 functions by the DACS IV-2000 provides significant operational cost savings. Cross-connections, test access, facility rolls, and maintenance can now be controlled electronically, significantly reducing operating costs.

Flexibility

The DACS IV-2000 design permits a wide range of network applications. With three basic modules (DS1, DS3, and STS1) and four types of interface bays (DS1, DS3, STS1/DS3/DS1, and STS1/DS3), the DACS IV-2000 can be expanded to meet current and future office needs. Its modular design allows incremental circuit pack growth and easy, in-service addition of interface bays. This allows its economical application in a wide range of office sizes and network applications.

Operating Efficiency

The DACS IV-2000 allows centralized control of the DS1, VT1.5, and STS1 operations, administration, maintenance, and provisioning functions. This centralized control opens up new service opportunities, permitting faster response time for facility and service order provisioning, and faster resolution of trouble reports.

Revenue Generation

The DACS IV-2000 can be used to restore DS1s, DS3s as groups of 28 DS1s, or STS-1s as groups of VT1.5s. The route-restoration capability alleviates concerns regarding service interruptions affecting critical voice and data traffic. This enhances service protection and provides new revenue opportunity. Faster provisioning results in earlier revenue flow, and faster trouble resolution helps ensure revenue retention.

Office Modernization

AT&T provides a complete office modernization service that allows the advantages of the DACS IV-2000 to be realized in the embedded DS1 facilities and services. Detailed procedures have been developed to "cut over" the embedded manual DSX-1s and discrete M13s to a DACS IV-2000 system. Special tools, provided as part of the service, have been developed to allow an in-service cutover for either wire-wrapped or connectorized network elements. All associated office equipment, including D banks, office repeaters, and digital switches, can be cut over on an in-service basis.

AT&T Network Systems offers engineering and installation expertise that provides experienced, comprehensive service with full assurance of quality. The DACS IV-2000 office cutover service is implemented with highly trained AT&T installers, who work as a team with your office operations staff.

System Overview

The DACS IV-2000 is a software-based, high-capacity, digital cross-connect system that merges cross-connect and multiplexer functions. It helps manage DS1, DS3, and EC-1 facilities more efficiently by automating network route restoration, remote service and facility provisioning, and remote surveillance and test access. Its software-controlled cross-connect facility allows centralization and automation of operation, administration, maintenance, and provisioning functions.

The DACS IV-2000 allows end-to-end SONET connectivity of both access and interoffice facilities, providing the advantages of a wide range of capabilities associated with SONET. The gateway capability of the DACS IV-2000 allows you to operate asynchronous and synchronous network elements as a single transparent network. Additionally, the equipment architecture reduces startup configuration costs, increases modular growth capability, and allows for reduced floor space.

System Architecture

The DACS IV-2000 system architecture (Figure 1-1) consists of DS1, DS3, and STS-1 signal interfaces; a nonblocking switch network that supports both DS1 and SONET virtual tributary (VT) rate signals; and a software-based controller. The controller provides the system intelligence, allowing centralized automated control, primary and secondary memory backup, and local and remote operations interfaces.

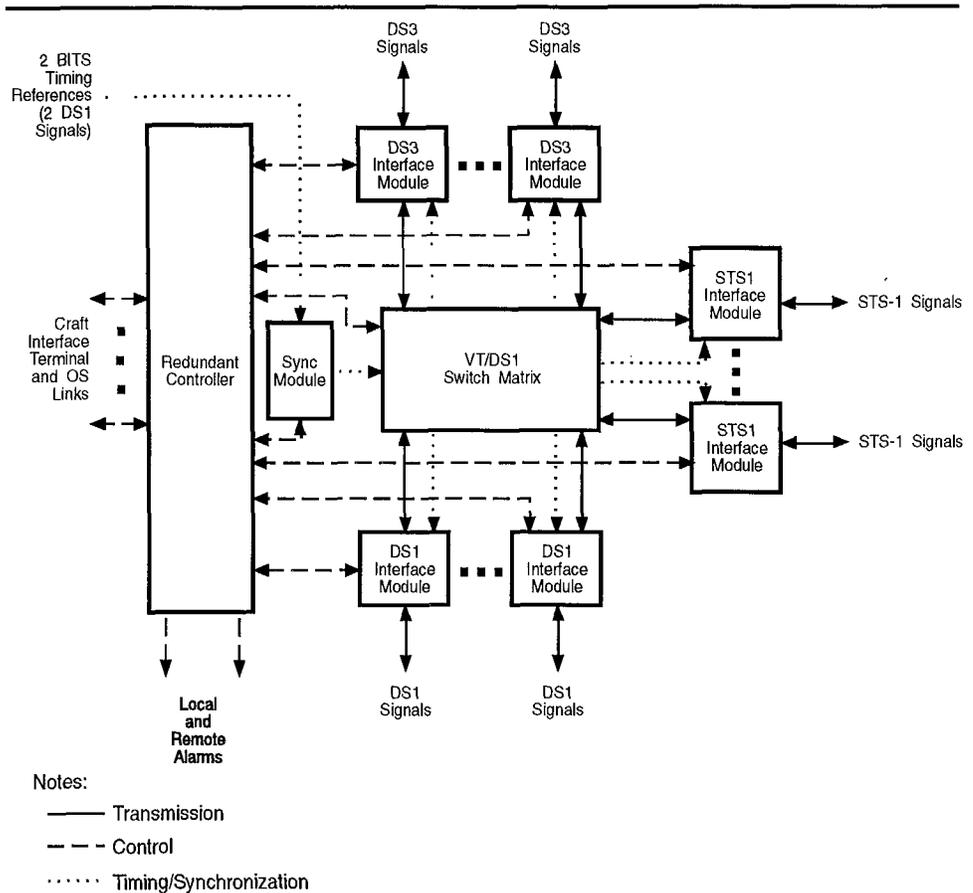


Figure 1-1. DACS IV-2000 System Architecture

Controller Architecture

The DACS IV-2000 architecture (Figure 1-2) is a distributed multiprocessor design that supports concurrent execution and performs real-time operations. The control architecture consists of two systems:

- **Redundant Controller System**
 - Two Control Complexes (CPU/MTC/SSC circuit packs)
 - Switch Communications Interface
 - Unit Interface
 - Enhanced Communications Interface (ECI)
 - Synchronizer Module

- Unit Controller System
 - Unit Controllers
 - Interface Circuit Packs

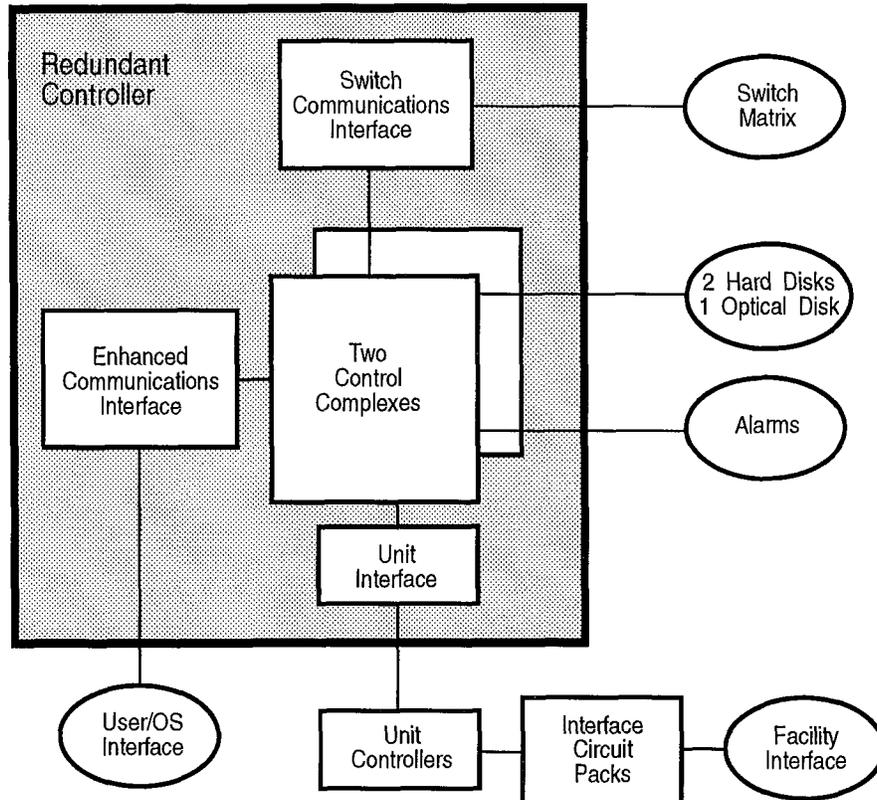


Figure 1-2. System Software Architecture

Redundant Controller System

The central components of the redundant controller system are the two control complexes (CCs). Each CC can:

- Run application software to perform all system administration functions including cross-connection, provisioning, test access, and synchronization for the SONET interfaces
- Serve as the central point of coordination for all system maintenance functions such as diagnostics, fault recovery, and alarms

- Perform all database management functions for the system, with the secondary storage controller providing the interface between the main processor and the nonvolatile storage devices (disk and optical drives).

The Enhanced Communications Interface (ECI) supports the user interface to the duplicated control complex. The ECI:

- Parses commands and generates messages to support the system interface languages: TL1 (Transaction Language 1), TABS (Telemetry Asynchronous Block Serial), and TBOS (Telemetry Byte-Oriented Serial)
- Provides the physical and electrical interfaces supporting synchronous (X.25) and asynchronous (Snider, telemetry) protocols.

The two ECI circuit packs can be configured to provide redundancy.

The DACS IV-2000 contains a Synchronizer Module, which accepts two external DS1 timing references. In the event of a timing reference failure, the synchronizer automatically switches to the secondary reference. If both references fail, the synchronizer operates in a stratum 3 holdover mode. The synchronizer is fully protected; if one synchronizer side fails, the system switches to the other side.

Unit Controller System

The unit controllers (UCs) maintain the DACS IV-2000 controller system facility interfaces by:

- Providing communications with the interface circuit packs
- Performing real-time maintenance functions, such as hardware fault detection.

Separate individual controllers on some of the enhanced interface circuit packs provide expanded real-time capabilities for features such as enhanced DS1, DS3, and SONET performance monitoring.

Hardware

The DACS IV-2000 Interface Bays are 2 feet 2 inches wide, 7 feet high, and 12 inches deep. The Switch Bay is 2 feet 2 inches wide, 7 feet high, and 13 inches deep. Both the Interface and the Switch Bays use the network bay framework. Equipment shelves that mount on these bays are factory installed. System capacity expansion is achieved by adding additional circuit packs and/or interface bays.

The Switch Bay and STS1/DS3 Interface Bays have forced-air cooling, while the DS1, DS3, and STS1/DS3/DS1 Interface Bays are cooled by free convection. The fan assembly at the bottom of the Switch and STS1/DS3 Interface Bays takes in air near the floor and exhausts it out the top rear of the bay. Unequipped circuit pack slots are not permitted. Functionally unused slots must either contain a circuit pack or be covered with filler assemblies. Heat baffles are used between the shelves on the free-convection-cooled Interface Bays to direct rising heat away from the circuit packs located above.

The initial or startup bay configuration consists of the Switch Bay, one Interface Bay, and two temporary cable end guard assemblies all bolted together as a unit for shipment. This initial configuration is 6 feet 6 inches wide. The Switch Bay is delivered with all its interbay cabling for maximum capacity. Consequently, the cable end guard assemblies are required to store and protect the cables until they are needed. The initial bays are bolted to the floor during installation.

When a growth Interface Bay is provided, the appropriate cable end guard assembly is moved to allow bay placement adjacent to the existing arrangement. The growth bay is bolted to the floor next to its adjacent bay, and the connections are made between it and the Switch Bay. The cable end guard assembly is discarded if all the stored cable has been used on that side of the Switch Bay. Otherwise, it is reattached to the new Interface Bay on the side away from the Switch Bay. Recommended growth is to the left of the Switch Bay until all the cables are used, then to the right of the Switch Bay.

Table 1-1 identifies the different types of bays and their associated modules.

New Modules for Release 5.0

Two new modules have been added to support the Release 5.0 features:

- Enhanced DS3 Interface-16 Module
- DS3 Clear-Channel Interface-16 Module.

The Enhanced DS3 Interface-16 Module contains at least one MUX2 circuit pack and at least one MUX3 and one MUX3P circuit pack; it cannot contain MUX1 or PMGR circuit packs. The Enhanced DS3 Interface-16 Module does not support scanned performance monitoring.

The DS3 Clear-Channel Interface-16 Module contains 15 MUX3 circuit packs and one MUX3P circuit pack; it cannot contain MUX1, MUX2, or PMGR circuit packs. The DS3 Clear-Channel Interface-16 Module does not support scanned performance monitoring.

The new modules are supported only in the DS3 Interface-16 Module, not in the DS3 Interface-32 Module. Module types can be mixed within a bay; e.g., the STS1/DS3/DS1 Interface Bay (Combo Bay) and the STS1/DS3 Interface Bay (S Bay).

Table 1-1. System Bays and Associated Modules

Bay	Module	Units Per Bay
Switch (SW)	Redundant Controller (RC)	1
	Redundant Controller Power (RC PWR)	1
	Switch Power (SW PWR)	1
	Auxiliary Power (AUX PWR)	1
	Synchronizer (SYNC)	1
	Switch (SW)	1
	Fuse and Alarm Panel (FS & ALM)	1
	Fan Assembly	1
DS1 Interface (INTFC)	DS1 Interface (INTFC)	3
	DS1 Interface-Protection (INTFC-P)	1
DS3 Interface (INTFC)	DS3 Interface-32 (INTFC)	2
STS1/DS3/DS1 Interface (INTFC)	DS1 Interface (DS1 INTFC)	1
	DS1 Interface-Protection (INTFC-P)	1
	DS3 Interface-32 (INTFC-32)	0 or 1*
	DS3 Interface-16 (INTFC-16)	0 or 1†
	Enhanced DS3 Interface-16 (ENH DS3 INTFC-16)	0 or 1†
	DS3 Clear-Channel Interface-16 (DS3 CC INTFC-16)	0 or 1†
	STS1 Interface-16 (INTFC-16)	0-2‡
STS1/DS3 Interface (INTFC)	DS3 Interface-16 (INTFC-16)	0-4‡
	Enhanced DS3 Interface-16 (ENH DS3 INTFC-16)	0-4‡
	DS3 Clear-Channel Interface-16 (DS3 CC INTFC-16)	0-4‡
	STS1 Interface-16 (INTFC-16)	0-4‡
	Fan Assembly	1

* STS1/DS3/DS1 Interface Bays can be equipped with an STS1 Interface-16 Module in place of the DS3 Interface-32 Module. When doing so, the capacity of the DACS IV-2000 is decreased by 16 DS3 equivalent signals per such conversion.

† STS1/DS3/DS1 Interface Bays can be equipped with a DS3 Interface-16, an Enhanced DS3 Interface-16, a DS3 Clear-Channel Interface-16, or STS1 Interface-16 Module in the bottom shelf (STS1/DS3 Interface-16 Shelf).

‡ STS1/DS3 Interface Bays can be equipped with any combination of DS3 Interface-16, Enhanced DS3 Interface-16, DS3 Clear-Channel Interface-16, and STS1 Interface-16 Modules, totaling four.

Bay Configurations

The flexibility afforded by the modular design of the DACS IV-2000 allows it to be set up for initial bay configurations based on traffic requirements. Later, it can be expanded to a number of bay layouts.

The four types of DACS IV-2000 interface bays provide many possible bay layouts for a fully configured system. Figure 1-3 shows six fully-configured systems and the typical order in which the systems are expanded. The six systems are not intended to limit the options, but rather represent the range of DS1 terminations, DS3 terminations, and Electrical Carrier-1 (EC-1) terminations. DS1, DS3, and EC-1 terminations can be combined by interchanging DS3 and STS1 Interface-16 Modules within STS1/DS3/DS1 and STS1/DS3 Interface Bays.

The DACS IV-2000 can be configured to accommodate any changing DS1, DS3, and EC-1 facility needs over time under the cabling constraint that no more than 124/120 equivalent DS3s/STS-1s can be connected on either side of the Switch Bay. Because of this cabling constraint, the Switch Bay is usually located at or near the center of the bay layout, as shown in Figure 1-3. A maximum of two STS1/DS3/DS1 Interface Bays, two DS3 Interface Bays or STS1/DS3 Interface Bays, or four DS1 Interface Bays can be located on either side of the Switch Bay.

When planning the bay layout, keep in mind that the capacity of a DS1 Interface Bay (32 equivalent DS3 signals) is one-half the capacity of an STS1/DS3/DS1 Interface Bay, an STS1/DS3 Interface Bay, or a DS3 Interface Bay.

Digital Systems Access Bay

For DS1 applications requiring 22-gauge cable, consider using a Digital Systems Access Bay (DSAB) to eliminate potential cable congestion. For more information on the DSAB, refer to the *Digital Systems Access Bay (DSAB) System Reference Guide* (AT&T 365-301-135).

For DS1 applications in EMC installations, 26-gauge cable must be used to enter the system. If distance dictates 22-gauge cable in the central office, DSAB bays are again recommended.

Bay Layout and Growth Order					DS1 Interface	DS3 Interface*	STS1 Interface*			
Minimum Startup										
1	2	3	4	5						
STS1/ DS3 INTFC Bay	STS1/ DS3 INTFC Bay	Switch Bay	STS1/ DS3 INTFC Bay	STS1/ DS3 INTFC Bay	0	0-240	240-0			
Minimum Startup										
1	2	3	4	5						
DS3 INTFC Bay	DS3 INTFC Bay	Switch Bay	DS3 INTFC Bay	DS3 INTFC Bay	0	248	0			
Minimum Startup										
1	2	3	4	5						
STS1/ DS3 INTFC Bay	STS1/ DS3/ DS1 INTFC Bay	Switch Bay	STS1/ DS3/ DS1 INTFC Bay	STS1/ DS3 INTFC Bay	840	62-212	150-0			
Minimum Startup										
1	2	3	4	5	6	7	8			
STS1/ DS3/ DS1 INTFC Bay	STS1/ DS3/ DS1 INTFC Bay	Switch Bay	DS1 INTFC Bay	DS1 INTFC Bay	STS1/ DS3/ DS1 INTFC Bay	2996	93-138	45-0		
Minimum Startup										
2	1	3	4	5	6	7	8			
DS1 INTFC Bay	DS1 INTFC Bay	STS1/ DS3/ DS1 INTFC Bay	Switch Bay	STS1/ DS3/ DS1 INTFC Bay	DS1 INTFC Bay	DS1 INTFC Bay	4312	62-92	30-0	
Minimum Startup										
3	2	1	4	5	6	7	8			
DS1 INTFC Bay	DS1 INTFC Bay	DS1 INTFC Bay	DS1 INTFC Bay	Switch Bay	DS1 INTFC Bay	DS1 INTFC Bay	DS1 INTFC Bay	6944	0	0

* The STS1/DS3/DS1 INTFC Bays are assumed to be equipped with a standard configuration of one DS3 Interface-32, one DS3 Interface-16 or STS1 Interface-16, one DS1 Interface, and one DS1 Interface-Protection Module.

† Adjacent bays can be added to either the left or right side.

Figure 1-3. Sample System Configuration

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This chapter introduces the new features that are available with the DACS IV-2000 (256) Release 5.0 and summarizes the features that were introduced with earlier releases.

New Features

With the introduction of the MUX3 circuit pack, the DACS IV-2000 (256) Release 5.0 offers the following new features:

- DS3 Clear-Channel Cross-Connection
- DS3 to STS-1 Gateway Cross-Connection
- Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals
- Unframed DS3 Signals
- DS3 Terminal Loopback
- DS3 Test Access
- Identification of VT1.5 or DS1 Tributaries within STS-1 Signals.

The DS3 Clear-Channel Interface-16 Module supports all the new features. The Enhanced DS3 Interface-16 Module supports all the new features except DS3 clear-channel cross-connection. The modules are equipped as described in the section "New Modules for Release 5.0" in Chapter 1.

DS3 Clear-Channel Cross-Connection

The current DACS IV-2000 DS3 interface circuit pack (MUX2) demultiplexes the received DS3 signal into DS1 tributaries before transmitting N-rate signals to the switch matrix.

The new DS3 interface circuit pack (MUX3) is provisionable to either demultiplex the DS3 into DS1 tributaries or to map the entire DS3 (including overhead bits) into N-rate signals for transmission to the switch matrix. In the latter mode, a clear-channel (cc) cross-connect of the DS3 signal is supported to another MUX3 or SMUX1 circuit pack.

DS3 clear-channel cross-connection capability is particularly valuable in smaller central offices where, for example, a separate DACS III-2000 is not cost-effective, but where a need exists for DS3 reconfiguration services. DS3 clear-channel allows a DACS IV-2000 to perform the functions of a DACS III-2000 for the DS3 ports equipped with the new circuit pack. This flexibility is particularly needed for ports that interface to signals from an end customer (for example, loop access to a business) because the end customer may want to use the same DS3 facility at times to carry DS1 signals and at other times to carry DS3 signals for applications such as video conferences.

The MUX3 circuit packs support DS3 clear-channel cross-connections to other MUX3 circuit packs or gateway connections to SMUX1 circuit packs. In a DS3 clear-channel cross-connection, all received bits in the incoming signal, including all overhead bits, are transmitted unchanged. If there is a LOS condition on the received DS3, a DS3 AIS signal is sent toward the switch matrix. A MUX3 circuit pack that is provisioned for DS3 cross-connection, but where no cross-connection has been established, can transmit a DS3 idle signal.

The DACS IV-2000 can bridge DS3 connections by cross-connecting the DS3 or STS1 input port of any connection to any DS3 or STS1 output port without affecting service in the existing path. This feature is used for DS3 facility rolling.

DS3 to STS-1 Gateway Cross-Connection

As telecommunications networks evolve to SONET, there is a mix of synchronous and asynchronous transport and a corresponding need to provide connections between them and facilitate rolls of DS3 facilities to SONET.

With Release 3.0, the DACS IV-2000 had the capability to gateway between synchronous and asynchronous signals at the VT1.5/DS1 level; it did not have the capability to extract a DS3 signal directly mapped into an STS-1.

The DACS IV-2000 Release 5.0 MUX3 circuit pack has the capability to map the incoming DS3 signal into the STS-1 format for cross-connection through the switch matrix to an SMUX circuit pack. In the opposite direction of transmission, an STS-1 signal is sent through the switch matrix and then mapped into the DS3 format. This provides the capability to connect DS3 signals that have been carried on SONET transmission systems as DS3-mapped STS-1s to existing asynchronous DS3 equipment.

The DACS IV-2000 Release 5.0 supports cross-connections between DS3s that interface to MUX3 circuit packs and STS-1s that interface to SMUX1 circuit packs. The received DS3 signal is mapped into the synchronous payload envelope (SPE) of an STS-1 in accordance with Bellcore GR-253, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria* (Issue 1, December 1994). The resulting STS-1 signal is then transmitted toward the switch matrix in the N-rate format compatible with the SMUX1 circuit pack. In the opposite direction of transmission, the STS-1 signal is extracted from the received pair of N-rate signals from the switch matrix. The DS3 signal is then extracted from the SPE of the STS-1 and transmitted toward the facility. Gateway cross-connections are denied if the incoming STS-1 has a signal label indicating that it is not carrying an asynchronous DS3.

If a gateway cross-connection exists between a MUX3 and an SMUX, and signal label match failure (SLMF) is detected by the MUX3 and/or SMUX, the DACS IV-2000 main controller reports the SLMF facility failure condition as an SMUX-detected failure condition. When SLMF is detected by a MUX3 cross-connected as a DS3 clear-channel circuit, the DACS IV-2000 main controller reports the SLMF facility failure condition as a MUX3 detected failure condition. If a MUX3 is provisioned for DS3 clear-channel but is not cross-connected, SLMF is not reported.

If a LOS condition exists on the received DS3, a DS3 AIS signal is mapped into the transmitted STS-1. If STS-1 AIS, STS-1 idle, or an STS-1 with other than DS3 mapping is received from the switch matrix, a DS3 AIS is transmitted toward the facility. If a DS3 LOS or LOF is detected by the MUX3 circuit pack, any existing DS1 alarms associated with this DS3 are retired. If a gateway cross-connect is present between a MUX3 and an SMUX, the MUX3 is able to detect the STS path yellow facility condition.

Bridging and one-way and two-way rolling are supported for DS3 signals interfacing to the MUX3 circuit pack when it is provisioned to support DS3 clear-channel cross-connections and DS3 to STS-1 cross-connections.

Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals

Performance monitoring (PM) of DS1 facilities has been a major customer application of the DACS IV-2000, replacing much more expensive stand-alone monitoring equipment. In addition to the SWIF2 and PMGR circuit packs, the MUX3 hardware supports monitoring of the DS1 tributaries received from the switch matrix and transmitted to the DS3 facility.

The MUX3 circuit pack provides full-time path PM of all 28 DS1 tributaries on the received DS3 facility with no need to bridge to a separate circuit pack (the PMGR circuit pack in previous releases) and thereby reduce the effective switch capacity. The MUX3 supports both the ANSI T1.403 standard and AT&T TR54016, *Requirements for Interfacing a Customer Installation to Services Employing the Extended Superframe Format* (Issue 2, 1989).

The MUX3 and MUXP3 circuit packs support full-time path PM of all DS1 tributaries in the incoming DS3 signal that are either superframe (SF) or extended

superframe (ESF) format. Received SF format tributaries are monitored by counting errors in the framing bits. Received ESF tributaries are monitored using the CRC-6 code and framing-bit errors. Far-end performance monitoring is supported on ESF format using either the ANSI T1.403 Performance Report Message (PRM) or the AT&T TR54016 protocol on the facility data link. For TR54016 protocol performance monitoring, the health of the facility data links is monitored and appropriate alarms are reported.

Unframed DS3 Signals

The unframed DS3 signal feature enables the DACS IV-2000 to support unformatted DS3 signals. The 45-MB data signals are sent through the DACS IV-2000 without wasting any bandwidth.

DS3 Terminal Loopback

The DACS IV-2000 supports DS3 terminal loopback for DS3 clear-channel or DS3-to-STS-1 cross-connection. When it is provisioned for DS3 clear-channel or DS3-to-STS-1 cross-connection, you can establish a terminal loopback for DS3 signals cross-connected as DS3 clear-channel signals. The incoming DS3 signal is bridged in the switch matrix to go to both the original cross-connect output port and the output port associated with the same input port (that is, on the same MUX3). Bipolar violations are not preserved for terminal loopbacks.

DS3 Test Access

The DACS IV-2000 supports test access for DS3 signals interfacing to the MUX3 circuit pack when it is provisioned to support DS3 clear-channel cross-connections and DS3-to-STS-1 cross connections.

Any MUX3 circuit pack that is not being used to carry traffic can be provisioned as a DS3 test access port. The same modes are available for the DS3 as are available for DS1 and STS1 test access.

Tributary Identification

The DACS IV-2000 identifies VT1.5 or DS1 tributaries within STS-1 signals as either the VT1.5 number within the STS-1 or as the VT group-VT number address on a per-user basis. The commands are `ED-SECU-USER` and `ENT-SECU-USER`. The user sets the parameters within the command to identify the numbering being used as port numbering or group numbering.

Other Features

The DACS IV-2000 (256) Release 5.0 supports the following features, which were introduced in previous releases:

- SONET Networking
- Duplex Power Configuration
- Upgrade
- Cross-Connections
- Special Service (Redlined) Connections
- Bridging and Rolling
- Loopbacks
- Test Access
- Link Association
- Performance Monitoring
- Redundant Controller
- Nonvolatile Backup Memory
- Secondary Storage Subsystem
- Synchronizer Module
- Alarm Reporting
- Deny UC Removal with Protected Circuit Pack
- Supported Operations Systems
- Communications and OS Interfaces
- Input Command Routing
- Security
- Facility Maintenance
- Frame Maintenance
- Protection Switching
- Automatic Circuit Pack Restoral.

SONET Networking

The DACS IV-2000 provides SONET networking, which is the ability to perform all of the functionality associated with SONET interconnection. The SMUX circuit pack terminates an EC-1 facility and allows for cross-connection of the entire

STS-1 SPE, demultiplexing of VT1.5-based STS-1s and cross-connection of VT1.5s to other SONET interfaces, or cross-connection of DS3s (when equipped with the MUX3 circuit pack) or DS1s. This same circuit pack also provides in-line performance monitoring of the SONET signal, including VT1.5 tributaries of the STS-1. Additional circuit packs are not required, and no deloading of switch capacity is required to accommodate the SONET performance monitoring feature.

The DACS IV-2000 also supports operational, maintenance, and administrative features necessary for full SONET networking capability.

SONET Interface

The DACS IV-2000 is fully compliant with SONET STS-1 industry standards, allowing interconnection with AT&T's transmission equipment (such as DDM-2000 and FT-2000) and any other vendor equipment that meets these standards. The DACS IV-2000 provides for EC-1 SONET termination on STS1 interfaces. STS1 interfaces are housed in STS1 Interface-16 modules located in the STS1/DS3 Interface Bay or the STS1/DS3/DS1 Interface Bay.

- The STS1/DS3 Interface Bay can house any combination of the following, for a maximum total of four:
 - STS1 Interface-16 modules
 - DS3 Interface-16 modules
 - Enhanced DS3 Interface-16 modules
 - DS3 clear-channel Interface-16 modules
- The STS1/DS3/DS1 Interface Bay has a maximum capacity of 61 DS3 equivalents. This bay contains one of each module listed below:
 - DS1 Interface module (8 equivalent DS3s)
 - DS1 Interface protection module (7 equivalent DS3s)
 - DS3 Interface-32 module (31 DS3s)

And it can contain one of the following:

- Enhanced DS3 Interface-16 module (15 DS3s)
- DS3 clear-channel Interface-16 module (15 DS3s)
- DS3 Interface-16 module (15 DS3s)
- STS1 Interface-16 module (15 equivalent DS3s).

The DS3 Interface-32 module in the STS1/DS3/DS1 Bay can be replaced with an STS1 Interface-16 module; however, this results in a reduction of total system capacity, because 16 slots in the module must be left unequipped.

The capacity of the STS1/DS3 Interface-16 module is designed to support fifteen service circuit packs and one protection circuit pack. Each SMUX circuit pack terminates one EC-1 line and supports all of the SONET capabilities described in this chapter.

Duplex Power Configuration

Pre-Release 4.0 DACS IV-2000 (256) frames are powered by a single power plant (standard) through a Battery Distribution Fuse Board (BDFB). Starting with Release 4.0, the duplex power configuration option for new frame orders ensures optimum reliability.

With the duplex power architecture, the system receives power from one or two -48V diverse power plants. (A diverse power plant is one that does not share common components, such as BDFBs, rectifiers, batteries, and cable racks.) All -48V power feeds from the BDFB are fused separately at the BDFBs and connected to one or two independent central office battery plants in such a way that loss of one plant does not affect traffic or result in any loss of service (except in a one-battery plant). For more information, see "Power Specifications" in Appendix A.

New frame orders are wired for duplex power and contain the ED-9C114-30 Main Fuse Panel, which contains LEDs for each fuse.

Upgrade

You can upgrade from a DACS IV-2000 (256) Release 4.0 to a DACS IV-2000 Release 5.0. You cannot upgrade directly from a Release 3.0 or earlier to Release 5.0; you must first upgrade to Release 4.0. This upgrade may include the in-service replacement of the Main Controller Module with the Redundant Controller Module equipped with the enhanced Secondary Storage Subsystem (SSS).

Any configuration of the Release 4.0 system can be upgraded to Release 5.0. If new features are to be used, you must replace the existing MUX2 and MUXP2 circuit packs with the MUX3 and MUXP3 circuit packs. Any shelf that contains at least one MUX3 must contain a MUXP3 circuit pack. (See the section "Hardware" in Chapter 1.)

The system must be equipped with the Synchronizer Module if clear-channel cross-connection or DS3 to STS-1 gateway cross-connection is supported. If a synchronous module is used in Release 5.0, then the Clock Generator circuit pack must be upgraded to CLKGN3; the Synchronizer Module circuit packs may be version one or version two.

Release 5.0 software supports all features of Release 4.0 and all previously allowed combinations of interface bays and circuit packs.

Cross-Connections

The DACS IV-2000 provides end-to-end SONET cross-connections and SONET/asynchronous gateway connections. This feature allows SONET-to-SONET and SONET-to-asynchronous signal interworking.

The DACS IV-2000 electronically cross-connects DS1, VT1.5, and STS-1 signals. The cross-connections are implemented with a three-stage space division switch.

The DACS IV-2000 switch network is nonblocking and can perform the following types of cross-connections:

- STS-1 (clear-channel SPE) signals between SONET interfaces. By cross-connecting STS-1 (clear-channel SPE) signals, SONET end-to-end path connectivity is maintained via the DACS IV-2000.
- VT1.5 signals between SONET interfaces. VT1.5 end-to-end path connectivity is maintained through the DACS IV-2000 with this type of cross-connection.
- DS1 signals between SONET interfaces. DS1 signals are accessed by terminating the path of the VT1.5 signals and extracting the DS1 signal.
- DS1 gateway cross-connection between SONET and DS1/DS3 interfaces. These types of cross-connections provide the SONET/asynchronous gateway connection.
- DS1 signals between DS1/DS3 interfaces.
- DS3 gateway cross-connection between SONET and DS3 interfaces. These types of cross-connections provide the SONET/asynchronous gateway connection.
- DS3 clear-channel signals between DS3 or STS-1 interfaces.

Release 5.0 supports both one-way and two-way DS3 clear-channel cross-connections between any pair of MUX3 DS3 interfaces or between a MUX3 DS3 interface and a SONET STS-1 interface. DS3 signals can be demultiplexed into DS1 tributaries for cross-connection as individual DS1s, or the entire DS3 can be mapped into N-rate signals for transmission to the switch matrix.

The MUX3 circuit pack has the capability to map the incoming DS3 signals into the STS-1 format for cross-connection through the switch matrix to an SMUX circuit pack. This provides the ability to connect DS3 signals that have been carried on SONET transmission systems as DS3-mapped STS-1s to existing asynchronous DS3 equipment.

The DACS IV-2000 can perform one-way, two-way, and bridged cross-connections. These functions can be performed on DS1, DS3, VT1.5, and STS-1 signals. The DACS IV-2000 implements cross-connections from commands received over one of the administrative links from either a local terminal or from a centralized operations center. In addition to implementing cross-connections, commands are provided for map retrieval. These commands are used to retrieve more data about input ports that are mapped to output ports. In addition, data can be retrieved about DS1 ports that are transmitting quasi-random signals.

Special Service (Redlined) Connections

Circuits that are sensitive or require special care when changing or deleting (such as 911) should be made as special service connections to prevent inadvertent changes in status. When entering cross-connections (one-way, two-way, or broadcast), the connections can be specified as a special service (redlined) connections.

Connections specified as special service can only be deleted or modified if they are identified as special service connections using the RDL D value in the Special Service Type parameter, or the YES value in the inclusive parameter.

Bridging and Rolling

The DACS IV-2000 can bridge DS3 connections by cross-connecting the DS3 input port of any connection to any DS3 output port on a DS3 of an EC-1 facility without affecting service in the existing path. Bridging and one-way and two-way rolling is supported for DS3 signals interfacing to the MUX3 circuit pack when it is provisioned to support DS3 clear-channel cross-connections and DS3 to STS-1 cross-connections. This feature is used for DS3 facility rolling.

The DACS IV-2000 can bridge DS1 connections by cross-connecting the DS1 input port of any connection to any DS1 output port on a DS1, DS3, or EC-1 facility without affecting service in the existing path. This feature is used for DS1 facility rolling.

The DACS IV-2000 can bridge any VT1.5 connection by cross-connecting the VT1.5 input port to a VT1.5 output port without affecting service in the existing path. This feature allows for VT1.5 facility rolling.

The DACS IV-2000 can bridge any STS-1 connection by cross-connecting an STS1 input port to an STS1 output port without affecting service in the existing path.

To roll a facility is to break an existing connection while simultaneously establishing a new connection in less than 1 ms. The DACS IV-2000 supports one-way rolls (each direction of transmission rolled separately) and two-way rolls (both directions rolled together).

Loopbacks

The DACS IV-2000 supports loopbacks for DS1, DS3, and VT1.5/STS-1 signals.

DS1 Loopbacks

DS1 loopbacks can be operated on a specified DS1 port or range of DS1 ports. The loopback may be towards the facility, towards the switch, or through the switch matrix of a DS1 Interface Module, a DS3 Interface Module, or a VT1.5 (DS1) tributary of an STS-1 signal within the system.

DS1 loopbacks can be one of the following four types:

- Line Loopback (LPBKL): The signal from the input port is looped to the output port (towards the facility) at the DS1 Interface Module.
- Terminal Loopback (LPBKT): The signal from the input port is looped to the output port through the switch matrix in the switch module. DS1 terminal loopbacks are valid for DS1IF1, MUX1, MUX2, MUX3, or SMUX1 circuit packs.

- **Internal Loopback (LPBKI):** The signal from the output port is looped to the input port (towards the switch) at the DS1 Interface Module.
- **Tributary Loopback (LPBKM):** A DS1 tributary signal within a MUX2 or MUX3 circuit pack is looped from the input port to the output port (toward the facility) at the DS3 Interface Module. DS1 tributary loopbacks are valid for either near-end or far-end on MUX2 or MUX3 circuit packs only.

DS3 Loopbacks

DS3 loopbacks can be one of the following:

- **Line Loopback (LPBKL):** The MUX3 (and MUXP3) DS3 interface circuit pack can retransmit an incoming signal back to the output. The DS3 line loopback is supported in both clear-channel and DS1 cross-connection modes. The DS3 line loopback regenerates the signal to conform to the standard pulse shape and voltage. The entire DS3 bit stream is looped back without modification, and bipolar violations in the incoming signal are preserved at the output. [DS3 line loopbacks can be operated on an incoming DS3 signal directly to the outgoing direction of the same port. This loopback happens directly in the MUX2 or MUX3 circuit pack and keeps the signal from entering the switch matrix; it thus keeps the amount of hardware encountered to a minimum.]
- **Terminal Loopback (LPBKT) — MUX3 circuit packs only:** When provisioned for DS3 clear-channel or DS3-to-ST5-1 cross-connection, the MUX3 circuit pack also supports DS3 terminal loopbacks, in which the incoming signal is bridged in the switch matrix to go to both the original cross-connect output port and the output port associated with the same input port (that is, on the same MUX3). Bipolar violations are not preserved for terminal loopbacks.

VT1.5/ST5-1 Loopbacks

The loopback feature allows VT1.5s within incoming ST5-1 signals to be looped back through the switch (on a per-tributary basis) to the outgoing ST5-1 of the same ST5-1 signal. The ST5-1 line loopback feature allows incoming ST5-1 signals to be looped back in the output direction, and maintains all incoming signal code and format violations and timing. Both loopback features are performed without changing any bits in the looped-back signal.

VT1.5 loopbacks can be operated on a specified VT tributary of an ST5-1 signal as a terminal loopback (LPBKT), which loops the VT1.5 signal from the input port to the output port through the switch matrix in the switch module.

ST5-1 Loopbacks can be operated on a specified ST51 port or range of ST51 ports, either towards the facility or through the switch matrix of an ST51 Interface Module.

ST5-1 loopbacks can be one of the following types:

- **Line Loopback (LPBKL):** The signal from the input port is looped to the output port (towards the facility) at the ST51 Interface Module.

- Terminal Loopback (LPBKT): The signal from the input port is looped to the output port through the switch matrix in the switch module. STS-1 terminal loopbacks are valid for near-end on SMUX circuit packs.

STS-1/VT1.5/DS3/DS1 loopbacks are shown in Figure 2-1.

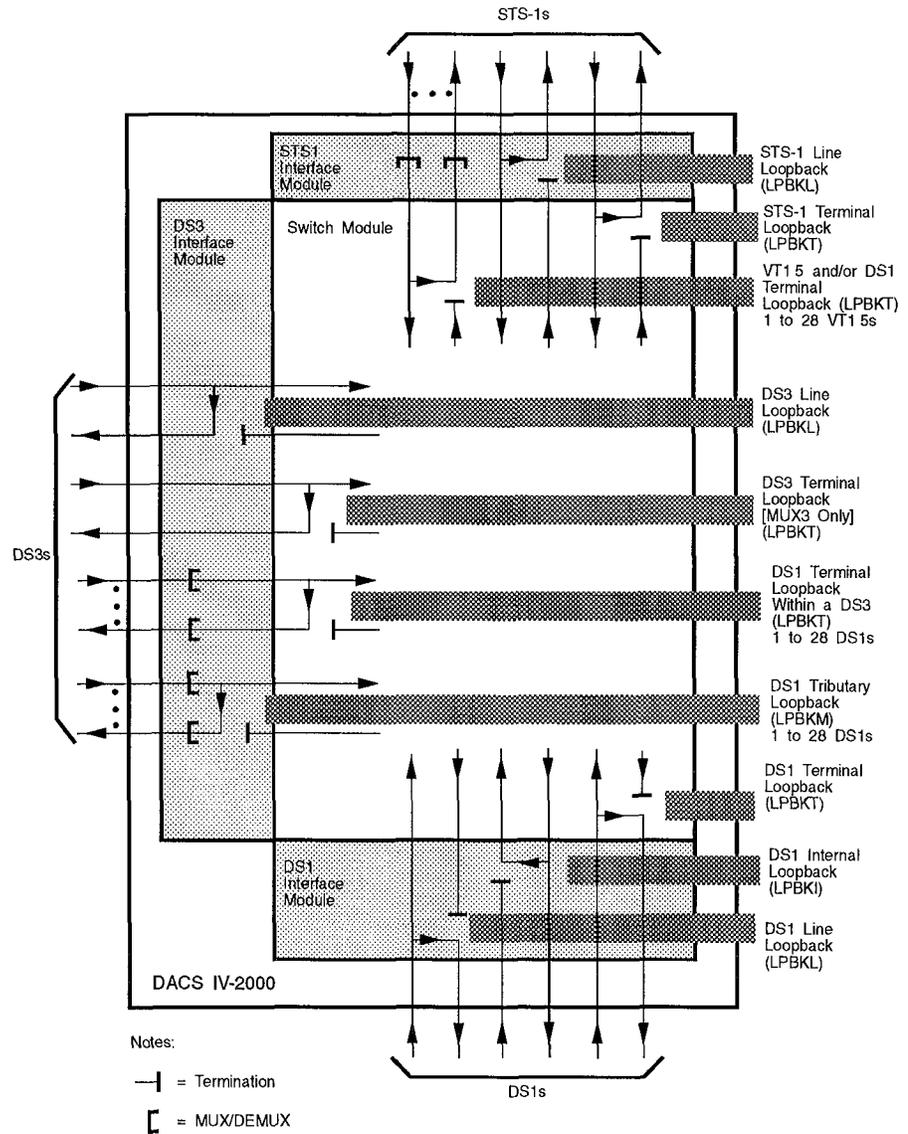


Figure 2-1. DS1, DS3, STS-1, and VT1.5 Loopbacks

Test Access

The DACS IV-2000 supports test access for DS3 signals interfacing to the MUX3 circuit pack when it is provisioned to support DS3 clear-channel cross-connections and DS3-to-STS-1 cross-connections. In addition, the DACS IV-2000 supports all the DS1, VT1.5, and STS-1 test access modes specified in Bellcore TR-NWT-000818, *OTGR Section 6.1: Network Maintenance: Access and Testing - Generic Test Architecture* (Issue 1, November 1992). The test access modes supported are MONE, MONF, SPLTA, SPLTB, SPLTE, SPLTF, LOOPE, LOOPF, MONEF, and SPLTEF. With these capabilities, the system can act as a digital test access unit (DTAU).

VT1.5 and STS-1 test access connections are accessed via the SONET interface. Individual VT1.5 tributaries must be accessed externally from an STS-1, for which test access is provided.

The ability to supply and monitor DS3, DS1, VT1.5, and STS-1 test signals, split connections, and perform loopbacks can simplify facility turnup and assist in trouble isolation.

Any MUX3 circuit pack port that is not being used to carry traffic can be provisioned as a DS3 test access port.

Link Association

When making test access and loopback connections, you can specify that the connection is associated with the user ID and link. When a connection is associated with the link, the connection is automatically disconnected or removed when the user that created the connection logs off. When a test access or loopback connection not associated with a link is made, the connection remains when the user that created the connection logs off. The connection is removed with a **DISC-TACC** (**t**est **a**ccess) or **RES-LPBK** (loopback) command.

Performance Monitoring

Prior to Release 5.0, DS1 performance monitoring (PM) capability allowed monitoring of DS1 tributaries within DS3 facilities (terminated by MUX1 or MUX2) by bridging the signal to a separate PMGR1 circuit pack (via camp-on monitoring or scan monitoring), which reduced the effective system capacity.

In addition, far-end DS1 PM was only available for facilities that support ANSI T1.403, and not for AT&T TR54016, *Requirements for Interfacing a Customer Installation to Services Employing the Extended Superframe Format* (Issue 2, 1989) protocol. Therefore, the full path performance of the DS1 tributaries of DS3 signals could not be monitored for the substantial embedded base of DS1 terminal equipment that only supports the older standard.

TR54016 also provides greater functionality because it allows DS1 PM information to be obtained from any intermediate network elements that support

this standard, rather than only from network terminating elements at the ends of the DS1 path. This allows sectionalization of trouble conditions.

The MUX3 circuit pack provides full-time monitoring of all 28 DS1 tributaries on the received DS3 facility with no need to bridge to a separate circuit pack and thereby reduce the effective switch capacity. In Release 5.0, only the DS1 tributaries on the received DS3 facility are monitored. However, the hardware of the MUX3 also supports monitoring of the DS1 tributaries received from the switch matrix and transmitted to the DS3 facility. This allows further enhancement of the DS1 PM capabilities in future releases.

This section describes STS-1/VT1.5, DS1, and DS3 performance monitoring.

STS-1 and VT1.5 Performance Monitoring

The DACS IV-2000 provides SONET performance monitoring capabilities for intermediate points on the STS-1 and VT1.5 paths as well as at termination points. In this way, the DACS IV-2000 provides a centralized point for monitoring the health of the SONET network.

The MUX3 circuit pack implements the asynchronous-to-SONET gateway function by internally "wrapping" the DS3 signal into an STS1 signal before sending it through the switch matrix. In the opposite direction (from the switch matrix), the MUX3 circuit pack monitors the received STS1s for certain impairments to ensure that the integrity of the cross-connected signal is maintained.

The MUX3 circuit pack detects the following:

- STS1 path yellow
- STS1 path trace
- STS1 signal label mismatch
- Internal CRC-6 errors.

For the VT1.5 path, near-end performance monitoring is provided by counting the BIP-2 coding violations using V5 bits 1-2. From these counts, the DACS IV-2000 derives the following parameters:

- Errored Second (ES)
- Errored Second A (ESA)
- Errored Second B (ESB)
- Severely Errored Second (SES)
- Alarm Indication Signal/Loss of Pointer (AIS/LOP) Second (ALS)
- Unavailable Second (UAS).

For the STS-1 path, the DACS IV-2000 provides both near-end and far-end performance monitoring. Near-end STS-1 performance monitoring is accomplished by counting the bit interleaved parity-8 (BIP-8) coding violations using the B3 byte. These counts are used to derive the STS path performance monitoring parameters. The far-end parameters are derived by counting the far-end block errors (FEBEs) using G1 bits 1-4.

The DACS IV-2000 provides all of the line performance monitoring and provides the section performance monitoring required for network elements supporting non-repeated applications (Severely Errored Frame Seconds and Loss of Signal Seconds).

In its implementation of the SONET networking feature, the DACS IV-2000 extends its performance monitoring capabilities of asynchronous signals to SONET signals. Performance monitoring thresholds in the DACS IV-2000 are selectable on a per-parameter, per-channel basis. Threshold crossing alerts are generated when thresholds are reached or exceeded. Performance monitoring reports are available on a scheduled or demand basis. For the SONET signals, the DACS IV-2000 stores 15-minute bins for up to 8 hours, and performance monitoring totals for the current and previous day.

Monitored Parameters

This section lists the performance monitoring parameters.

Near-End Section Parameters

The following section parameters are available for SONET:

- Severely Errored Frame Second (SEFS)
- Loss Of Signal Second (LOSS).

Line Parameters

The following line parameters are monitored by the DACS IV-2000:

- Coding Violation (CV)
- Errored Second (ES)
- Errored Second A (ESA)
- Errored Second B (ESB)
- Severely Errored Second (SES)
- AIS/LOP Second (ALS)
- Unavailable Second (UAS).

Near-End Path Parameters

The following near-end STS and VT path parameters are monitored by the DACS IV-2000:

- Coding Violation (CV)
- Errored Second (ES)
- Errored Second A (ESA)
- Errored Second B (ESB)
- Severely Errored Second (SES)
- AIS/LOP Second (ALS)
- Unavailable Second (UAS).

Far-End Path Parameters

The following far-end STS path parameters are monitored by the DACS IV-2000:

- Coding Violation (CV)
- Errored Second (ES)
- Errored Second A (ESA)
- Errored Second B (ESB)
- Unavailable Second (UAS).

DS1 Performance Monitoring

The DS1 performance monitoring feature allows the DACS IV-2000 to monitor the health of DS1 facilities by collecting performance data for those facilities. The incoming DS1 facilities are continuously monitored in the full-time dedicated mode. Full-time performance monitoring is provided for those DS1 facilities that pass through a SW1F2 or a MUX3 circuit pack. The MUX3 supports full-time monitoring of DS1 tributaries within the DS3 signals; MUX1 and MUX2 circuit packs do not.

The parameters that are monitored and measured to determine the health of a facility depend on the framing format and the performance monitoring option. The parameters that are monitored and measured also depend on whether near-end (monitored directly by the DACS IV-2000) or far-end (as updated by the upstream NTE) performance monitoring data are requested.



NOTE:

The DACS IV-2000 monitors a DS1 only in the facility-to-switch direction. It does not provide performance monitoring data for the switch-to-SWIF2/MUX3-facility direction.

Framing Format

Framing format may be extended superframe, superframe, or unframed.

- Extended Superframe (ESF) provides path performance monitoring using cyclic redundancy code (CRC) error checking to monitor the health of the incoming DS1 signal path. The CRC code checks for errors in all the bits of the DS1 signal. ESF format also provides a 4-kbit/s data link for communication between network elements connecting the DS1 facility which can be used to send Performance Report Messages as required by the ANSI T1.403 standard.
- Superframe (SF) provides path performance monitoring using DS1 signal framing bits.
- Unframed (UNF) provides line performance monitoring for all DS1 signal formats coded with alternate mark inversion (AMI) or bipolar with 8-zero substitution (B8ZS). Line performance monitoring is performed using bipolar violation counts to monitor the received signal on the facility; this excludes the bipolar violations that are part of the B8ZS code.

Performance Monitoring Options

Performance monitoring may be full-time, camp-on, or scanned.

Full-Time Monitoring

In the full-time dedicated mode, the health of the DS1 facilities is continuously monitored. Full-time performance monitoring is provided for those DS1 facilities that pass through a SWIF2 or a MUX3 circuit pack. The MUX3 circuit pack supports full-time monitoring of DS1s within the incoming DS3 signals; MUX1 and MUX2 do not.

When using the full-time monitoring option, the software monitors the health of incoming DS1 facilities continuously. It supports both DS1s that terminate on DS1 interfaces and DS1 tributaries within a DS3.

With Release 5.0, DS1 uses full-time path monitoring to check the health of the enhanced DS3. The MUX3 and MUXP3 circuit packs support full-time path monitoring of all DS1 tributaries in the incoming DS3 signal that are either SF or ESF format.

The DACS IV-2000 offers two types of full-time monitoring: dedicated and bridged.

- Dedicated full-time monitoring continuously checks the health of DS1 tributaries within a DS3 terminating on a MUX3 circuit pack as well as DS1 facilities terminating on a DS1 interface (DS1IF). All 28 of the DS1s associated with the MUX3 circuit pack or any of the 28 DS1s associated with the SWIF2 circuit pack can be provisioned for dedicated full-time performance monitoring. Dedicated full-time monitoring does not reduce the capacity of the DACS IV-2000.
- Bridged access full-time monitoring can continuously check the health of DS1 tributaries within a DS3 as well as DS1 facilities terminating on a DS1 interface (DS1IF). The DACS IV-2000 monitors these signals by bridging the DS1s to a performance monitoring generator and receiver (PMGR) circuit pack.

Camp-on Monitoring

The camp-on monitoring option allows the DACS IV-2000 to monitor a specified DS1 or group of DS1s. The system provides two camp-on monitoring options: manual and automatic.

- Manual: Selected ports have a bridge of a DS1 signal passing through a SWIF2 or MUX1 or MUX2 circuit pack to a port on a PMGR circuit pack; established using a command.
- Automatic: Occurs when the performance monitoring scanning option detects that a DS1 port has degraded service; that port is automatically connected to an available designated automatic camp-on port.

Scanned Monitoring

The DACS IV-2000 provides scanned monitoring for those DS1 signals that do not need to be monitored on a full-time basis. This option is ideal for checking general network and facility performance health. You can also use scanned monitoring when you require more cost-effective performance monitoring measures. With this method, one PMGR circuit pack can monitor up to 420 DS1 signals whereas one PMGR can monitor only a maximum of 28 DS1 signals when operating in the camp-on mode.

Scanned performance monitoring is not available for DS1 signals within VT1.5 signals or DS1 tributaries of DS3 signals on MUX3 circuit packs in enhanced DS3 or DS3 clear-channel modules.

Monitored Parameters

The DACS IV-2000 monitors and reports both path and line performance parameters to verify that service quality objectives specified in terms of these parameters are being met. Performance monitoring only occurs during available time because service quality assessments cannot be determined during a period of service outage.

In addition to the path and line parameters that are monitored and reported, the DACS IV-2000 can detect incoming trouble condition indicators on SF- and ESF-formatted DS1 signals.

Near-End Path Parameters

Path performance monitoring parameters apply only to ESF- and SF-formatted signals; they do not apply to UNF signals. The path parameters are:

- Path Code Violation (CVP)
- Path Out-of-Frame Second (OOFs)
- Path Errored Second (ESP)
- Path Bursty Errored Second (BESP)
- Path Severely Errored Second (SESP)
- Severely Errored Frame Second (SEFS)
- Controlled Slip Second (CSS)
- Failure Count (FC)
- ESF Error Event (EEE)
- Unavailable Seconds (UAS).

Near-End Line Parameters

DS1 line parameters only apply to DS1 signals that terminate on DS1 interface circuit packs in a DACS IV-2000. Line performance parameters are determined using bipolar violations. The line parameters are:

- Line Code Violation (CVL)
- Line Errored Second (ESL)
- Line Severely Errored Second (SESL).

DS1 AIS is detected by a MUX3 circuit pack from the switch matrix when a DS3 LOS, LOF, or AIS occurs at the other end of a cross-connection.

Far-End Parameters

Far-end parameters are collected in the system by reading the Extended Superframe (ESF) data link. The ANSI T1.403 standard specifies that the equipment that terminates an ESF DS1 facility monitors the performance of the incoming signal and transmits a performance report to the far end once per second. The report contains performance data for each of the previous four 1-second intervals. The DACS IV-2000 is capable of reading this report and maintaining a database of the far-end performance data.

AT&T TR54016, *Requirements for Interfacing a Customer Installation to Services Employing the Extended Superframe Format* (Issue 2, 1989), specifies that far-end performance data be retrieved by sending request messages on the transmitted ESF.

When an ESF DS1 tributary is provisioned per AT&T TR54016, the user must specify the near-end and far-end addresses.

When an ESF DS1 with far-end performance monitoring is not a tributary of a DS3 terminating on a MUX3 circuit pack, AT&T TR54016 is not supported as a far-end protocol.

The parameters defined for near-end paths (except OOFS) are also available for far-end paths.

Trouble Condition Reporting

Facility alarm messages are generated if there is a loss-of-signal (LOS) condition or if the Bit Error Rate (BER) threshold is reached or exceeded. The BER is based on BPVs, the framing bits of the SF format, or the CRC-6 bits of the ESF format. The BER alarm threshold can be provisioned to any one of the following rates: 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} , or 10^{-9} errors per second.

A DS1 on a SWIF2 circuit pack provisioned as unframed uses the CVL algorithm to calculate the BER. An unframed signal riding within a DS3 (a DS1 tributary) does not have its BER calculated.

In addition to reporting the LOS and BER alarms, the DACS IV-2000 reports incoming alarm indication signal (AIS), yellow alarm, and loss-of-frame (LOF) status conditions.

DS1 PM Data Reporting

The system database maintains running tallies of all the parameters monitored by the DS1 performance monitoring feature. When a parameter count is changed, data is collected based on the parameter and the collection interval previously selected. Each parameter has a predetermined threshold established by the system administrator. If a threshold is reached or exceeded, the system generates a Threshold Crossing Alert (TCA) message over the administrative links. Records of the processed performance monitoring data can be generated. The system also provides the capability to schedule performance reports to be generated according to a defined timetable.

For each DS1 facility provisioned to support AT&T TR54016, the MUX3 maintains a "current status" register, in addition to the registers of PM parameter counts.

If a MUX3 is deprovisioned via the `DLT-EQPT` command, performance monitoring for all DS1 tributaries of that DS3 stops and the collected PM data on that circuit pack are lost. If a MUX3 is extracted from its slot, performance monitoring for all DS1 tributaries of that DS3 stops and the collected PM data on that circuit pack are lost.

If a MUX3 circuit pack is provisioned in the clear-channel mode (to support DS3 clear-channel or gateway connection), DS1 performance monitoring is not supported on the tributaries.

DS3 Performance Monitoring

DS3 performance monitoring provides the following:

- DS3 performance data based on path as well as line parameters, but not both simultaneously.
- Processed performance data in compliance with Bellcore TR-TSY-000820, *OTGR Section 10.1: Network Maintenance: Transport Surveillance - Generic Digital Transmission Surveillance* (Issue 2, February 1988), and *AT&T Compatibility Bulletin Number 149 (CB-149)*.
- Performance monitoring data available on all message-based administrative links.
- DS3 performance monitoring is supported on the received DS3 facility in the same way whether the facility is being cross-connected as a DS3 clear-channel (either DS3 to DS3 or DS3 to STS-1) or as DS1 tributaries.
- In addition to supporting asynchronous and C-bit parity formats, the MUX3 circuit pack terminates unframed DS3 signals.

Monitored Parameters

The DACS IV-2000 processes performance data in compliance with CB-149 (PSET#1) and Bellcore TR-TSY-000820, *OTGR Section 10.1: Network Maintenance: Transport Surveillance - Generic Digital Transmission Surveillance* (Issue 2, February 1988) (PSET#2). This applies to the M13 line and C-bit parity formats, and to line monitoring (LCV and DS3 parity) and path monitoring (DS3 F- and M-bits, DS3 CP-BITS, and DS3 far-end block error bits).

The following performance BER metric parameters can be monitored:

- Bipolar Violations (BPV); BPVs monitored but not stored
- Parity (PTY)
- Copy of Parity Bits (CP-BITS)
- F and M Bits Adjusted (FMA-BITS)
- F and M Bits Nonadjusted (FMN-BITS).

For unframed DS3, the MUX3 circuit pack is not required to provide any functionality that requires it to be able to frame on the DS3 signal, so only line performance parameters can be monitored using B3ZS code violation.

At any given time, only one primitive (BER metric parameter) can be monitored on a DS3 port. The CP-BITS primitive is valid only for the C-bit parity format (not for

the M13 line format). In addition, the BER alarm threshold can be provisioned to any one of the following rates: 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} , or 10^{-9} errors per second.

The BER for a DS3 signal is measured simultaneously between 10^{-3} through 10^{-9} for BER primitives except parity (P bits). For P-bit metric, 10^{-4} through 10^{-9} is supported. Irrespective of what BER metric is chosen for MUX1/MUX2/MUX3 circuit packs, the DS3PM circuit pack receives (from the MUX circuit pack) DS3 performance monitoring information based on CP-bits primitive only. Thus, asynchronous DS3s are not monitored by the DS3PM circuit pack.

With DS3 performance monitoring, the software reports all performance parameters and alarm conditions over any of the DACS IV-2000 administrative links. DS3 performance parameters monitored by the DACS IV-2000 are described below.

Parameter Set # 1

The DACS IV-2000 complies with Parameter Set # 1 (PSET#1), as specified by CB-149 requirements. The PSET#1 parameters are:

- Block Error Count (BEC)
- Out-Of-Frame Second (OOFS)
- Errored Second Type A (TPA)
- Errored Second Type B (TPB)
- Errored Second Type C (TPC)
- Unavailable Second (UAS).

The DACS IV-2000 maintains a counter to track UASs. This parameter measures the duration (in seconds) for which service is unavailable. A UAS condition is declared at the onset of ten consecutive TPCs; it is cleared at the onset of ten consecutive seconds that contain no TPCs. The DACS IV-2000 also maintains a counter to track FEVASs and FEOODS. TPA and TPB counters are frozen while a UAS is declared.

A UAS condition is declared immediately at the onset of a LOS condition. The UAS condition is cleared when the LOS clears.

Parameter Set # 2

The DACS IV-2000 complies with Parameter Set # 2 (PSET#2), as specified in Bellcore TR-TSY-000820, *OTGR Section 10.1: Network Maintenance: Transport Surveillance - Generic Digital Transmission Surveillance* (Issue 2, February 1988). The PSET#2 parameters are:

- Out-Of-Frame Second (OOFS)
- Coding Violation (CV)
- Errored Second (ES)
- Severely Errored Second (SES)
- Unavailable Second (UAS).

The number of received FEBEs is the total number of errored M-frames (that is, the total number of block errors) detected at the far-end. The information is transported to the near-end via the FEBE bits. In the outgoing direction, the transmitted FEBE bits are set whenever a near-end block error occurs. (This is

true when the MUX3 is in DS1 mode only; in clear-channel mode, transmitted FEBE bits are not modified.)

The DACS IV-2000 allows the user to access performance data stored in 1-day and SHORTINT intervals. (SHORTINT may be 15 minutes or 1 hour.) In addition to the SHORTINT and day counts, and under normal working conditions, the DACS VI-2000 stores: the last 96 15-minute intervals for the previous 24 hours, hourly data for the previous 24 hours, and total daily counts for the previous seven days.

If a MUX3 is deprovisioned via the `DLT-EQPT` command, or if it is extracted from its slot, performance monitoring for that DS3 stops and the collected PM data on that circuit pack are lost. If a MUX3 circuit pack is pulled and reinserted, the PM function on the circuit pack is reinitialized and restarted when the MUX3 circuit pack is inserted and auto-provisioned.

When a MUX3 is reprovisioned from unframed to framed format or from framed to unframed format, all PM-related parameters and provisioning parameters related to the signal type before the reprovisioning are saved in the database. This information can be subsequently retrieved by the user by appropriate `RTRV-xx` commands.

Redundant Controller

The DACS IV-2000 is provided with two control complexes, which maximize control availability and reliability by providing redundancy in the critical parts of the Main Controller and autonomous recovery from controller failures. The following sections describe additional features provided with the Redundant Controller (RC) Module.

Administrative Links

Two ECI circuit packs are provided, allowing for twelve administrative links (six per ECI circuit pack). The ECI circuit packs can provide administrative link redundancy by establishing separate links to critical operating systems from each ECI. The links are identified as CILINK-1-1 through CILINK-1-6 and CILINK 2-1 through CILINK 2-6.

Redundant Power

Duplicated power circuit packs provide redundant power to the RC Module circuit packs, thereby increasing reliability.

Nonvolatile Backup Memory

The two hard disks are the primary (PRI) nonvolatile backup memory devices for the DACS IV-2000. All database changes are automatically recorded on the disks. A removable read/write optical disk is used to download new software and perform periodic, scheduled system database backups.

The DACS IV-2000 provides an option to enable automatic database backups from the primary backup medium to the secondary medium. Automatic database backups can be scheduled to execute once in a 24-hour period on selected days or on every day of the week. The disk database can also be manually backed up to the secondary disk.

Secondary Storage Subsystem

The Secondary Storage Subsystem (SSS) consists of a Secondary Storage Controller (SSC), one per Controller Complex; two Primary Storage devices (PRI-1 and PRI-2); and a Secondary Storage device (SEC). Introduced in Release 4.0, the enhanced SSS incorporates a new architecture, which allows the existing SSS to be upgraded to the industry-standard Small Computer System Interface (SCSI) and improves the overall system performance of the SSS. Functionally, the SSS is responsible for database backup and storage.

The SSS includes two hard disks and a removable optical disk to:

- Upgrade the volatile RAM memory to store relevant system information (such as switch settings and cross-connect maps)
- Increase the primary nonvolatile memory (PRI-1 and PRI-2) to 248 Mbytes
- Enhance the SEC by replacing the tape drive with an optical disk drive, which:
 - increases storage capacity to 128 Mbytes
 - increases speed
 - stores system database and the program control out of the equipment or off-site for backup purposes.

With the addition of the optical disk, you are positioned for growth; that is, you are able to advance to Release 5.0 and beyond.

The SSS:

- Improves controller reliability
- Provides faster access and data transfer times
- Increases database capacity for future feature enhancements
- Improves input/output availability.

The increased input/output availability permits acceptance, processing, and execution of incoming commands even during manual or autonomous backups between the primary and secondary nonvolatile memory devices. Cross-connect commands can be executed during backups from working memory to the primary disks.

The SSS uses the industry-standard SCSI interface for both the primary and secondary nonvolatile memory storage devices.

The Secondary Storage Controller circuit packs (SSC5, PRI5, and SEC5) are fully compatible with the Redundant Controller shelf; that is, no hardware or wiring

changes are required to accommodate these circuit packs. The SSC5, PRI5, and SEC5 circuit packs are plug-compatible with the SSC2, PRI2, and SEC2 circuit packs. They occupy the same physical space, size, and location as the SSS of Release 3.0.

Synchronizer Module

DACS IV-2000 synchronization (first introduced in Release 3.0) allows the DACS IV-2000 to act as a gateway between synchronous and asynchronous networks. The DACS IV-2000 Release 4.0 provided enhancements to the Synchronizer Module that comply with Bellcore TR-NWT-001244, *Clocks for the Synchronized Network: Common Generic Criteria* (Issue 1, June 1993) and Bellcore GR-253, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria* (Issue 1, December 1994).

Alarm Reporting

The DACS IV-2000 provides three levels of office alarms: critical, major, and minor.

- A critical alarm indicates a severe, service-affecting condition.
- A major alarm indicates a service-affecting failure, main or unit controller failure, or power supply failure.
- A minor alarm indicates an abnormal condition that is not service-affecting.

Alarms are reported in three places: in the central office (office alarms), in the remote maintenance center (remote alarms), and on the circuit packs (circuit pack alarms). The three types of alarms are described below.

Office Alarms

The DACS IV-2000 provides the following local office alarm outputs:

- Critical audible
- Critical visual
- Major audible
- Major visual
- Minor audible
- Minor visual
- Main controller failure (processor major) visual.

Local status indicators are provided on the status panel. Detailed alarm information is provided over administrative links. Software-controlled alarms can

be delayed to suppress spurious alarms. (The delay is programmable from 1 to 30 seconds.)

The alarm level of incoming DS1, DS3, and EC-1 facility failures can be changed on a per-port basis to major, minor, or no alarm.

The system's Alarm, Scan, and Control (AS&C) points are used with the TABS and TBOS protocols to interface the DACS IV-2000 with operations systems such as Transport Maintenance Administration System (TMAS) and TRANSVU. Three distinct classes of AS&C points exist: alarm points, status points, and control points.

NOTE:

Please check the *DACS IV-2000 (256) Release 5.0 Software Release Description* (AT&T 365-340-805) when it becomes available with the software for updates to the AS&C points associated with this release.

An alarm cutoff (ACO) for turning off the audible alarms is provided both on the status panel and at a remote location. Contact closures for visual alarms remain on until the condition causing the alarm is corrected. Parallel alarm closures are also provided by the system.

Remote Alarms

The DACS IV-2000 provides four remote alarms: critical, major, minor, and processor major, with local status indicators on the status panel circuit pack. Detailed alarm information is provided over administrative links. Software-controlled alarms can be delayed in order to suppress spurious alarms. (The delay is programmable from 1 to 30 seconds.)

The alarm level of incoming DS1, DS3, and EC-1 facility failures can be changed to major, minor, or no alarm on a per-port basis.

AS&C telemetry points and parallel alarm closures and remote reset are provided by the system. The AS&C points are collected by a telemetry remote in the local office and transmitted to the appropriate operations system (OS).

Circuit Pack Alarms

All circuit packs, except BXA and version one synchronizer circuit packs, contain a red LED to aid in trouble isolation. Some circuit packs also contain a green LED to indicate that the circuit pack is active. The LED is mounted so that it is visible while the circuit pack is plugged into the equipment. The power supply circuit packs activate their respective red LEDs when a fault exists, and, because the LEDs are powered from the primary power supply, they light even if logic level power is lost. An alarm indication message is generated for each circuit pack failure.

The Synchronizer Module is a fully duplex module with each synchronizer side comprising three circuit packs: DS1TX2 (DS1 timing extractor 2), TBS32 (stratum

3 time base oscillator 2), and DPLL2 (digital phase lock loop 2). Each circuit pack has a green LED and a red LED.

- The red LED (labeled ALM) indicates circuit pack failures. The red LED on any synchronizer module circuit pack (DPLL2, DS1TX2, TBS32) lights continuously while the circuit pack is in a failed condition.
 - The red LED remains lit for the duration of the failure or 2 seconds, whichever is longer.
 - The red LED on the DS1TX2 blinks (1 second on, 1 second off) continuously when a reference failure exists on either timing link. The blinking starts immediately upon failure detection and continues as long as the reference failure exists. The blinking stops as soon as the failure is cleared and the reference is declared valid.
- The green LED (labeled ACT) indicates whether the circuit pack is active.
 - For the DPLL2 and TBS32 circuit packs, the green LED remains lit while the circuit pack is active; that is, the circuit pack is on the active SYNC side. It is extinguished if the circuit pack is not active.
 - For the DS1TX2 circuit pack, the green LED remains lit while the circuit pack is active; that is, the circuit pack is on the active SYNC side and the SYNC is either in normal or fast mode. It is extinguished if the circuit pack is not active.



NOTE:

Whenever the red LED on any synchronizer circuit pack is lit due to any circuit pack failure, the green LED on that circuit pack is extinguished and the circuit pack is removed from service.

Multiple Alarm Processing

This feature improves the correlation and readability of alarm report messages and enhances system performance. The Multiple Alarm Processing and Reporting feature collects multiple alarms that occur within 1 second into a single alarm message. This reduces system overhead and makes alarm messages easier to read and interpret.

Alarm Clear Messages

For each alarm condition reported, a message is sent when the alarm is cleared, regardless of any other active condition on the same report.

CB-149 Alarm Compliance

The DACS IV-2000 software provides a clear delay capability that specifies the length of time from the time a condition clears until the associated TABS/TBOS point is cleared and a message is issued to indicate the cleared condition. The

clear delay time is provisionable from 1 to 20 seconds. The alarm is cleared if the condition clears and remains clear for the provisioned clear delay time.

Deny UC Removal with Protected Circuit Pack

You cannot manually request removal of a unit controller (UC) from service if any interface circuit pack in that interface module is protected. Denying the removal of the UC when an interface circuit pack is protected prevents the interface circuit pack from being unprotected under certain situations.

Supported Operations Systems

The DACS IV-2000 provides for communications with various Bellcore and AT&T Operations Systems (OSs). The DACS IV-2000 command message set complies with the current Bellcore TL1 specifications. This message set allows for communicating with Bellcore's OPS/INE and NMA.

Bellcore Operations Systems

The DACS IV-2000 can communicate with the following Bellcore OSs:

- Facility and Equipment Planning System (FEPS) is used by capacity planners to plan equipment and facility usage and to forecast demand for new equipment and facilities.
- Trunks Integrated Record Keeping System (TIRKS) maintains a database of equipment and facilities in the interoffice network to design end-to-end circuits for service provisioning.
- Operations System/Intelligent Network Element (OPS/INE) implements cross-connections in the DACS IV-2000 based on information received from the provisioning system.
- Network Monitoring Analysis (NMA) collects alarms and performance monitoring data from the DACS IV-2000.
- FLEXCOM/linc supports end-customer control of the DACS IV-2000.
- Integrated Test System (ITS) supports facility testing.

The interface to OPS/INE and NMA is through X.25 links to Bellcore's Operations Communications System (OCS).

In addition to the alarm data from the DACS IV-2000 that are sent to a central OS through TL1 messages, the remote MUX capabilities of the DACS IV-2000 support the communication of alarm data from a DDM-1000 [or any vendor's M13 multiplexer compliant with the Bellcore TR-TSY-000009, *Asynchronous Digital Multiplexer Requirements and Objectives* (Issue 1, May 1986) or ANSI T1.107 specifications] to an alarm-monitoring OS such as NMA. Because of this capability, communications links directly to the remote M13 for alarm data are not required.

In order for the DACS IV-2000 Release 5.0 to interface with current Bellcore OSs and for full support of the Release 4.0 features, the following releases (or later) of the NMA, OPS/INE, and TIRKS software must be used:

- NMA - Release 5.1
- OPS/INE - Release 2.1
- TIRKS - Release 17.1

Figure 2-2 depicts a typical Bellcore environment.

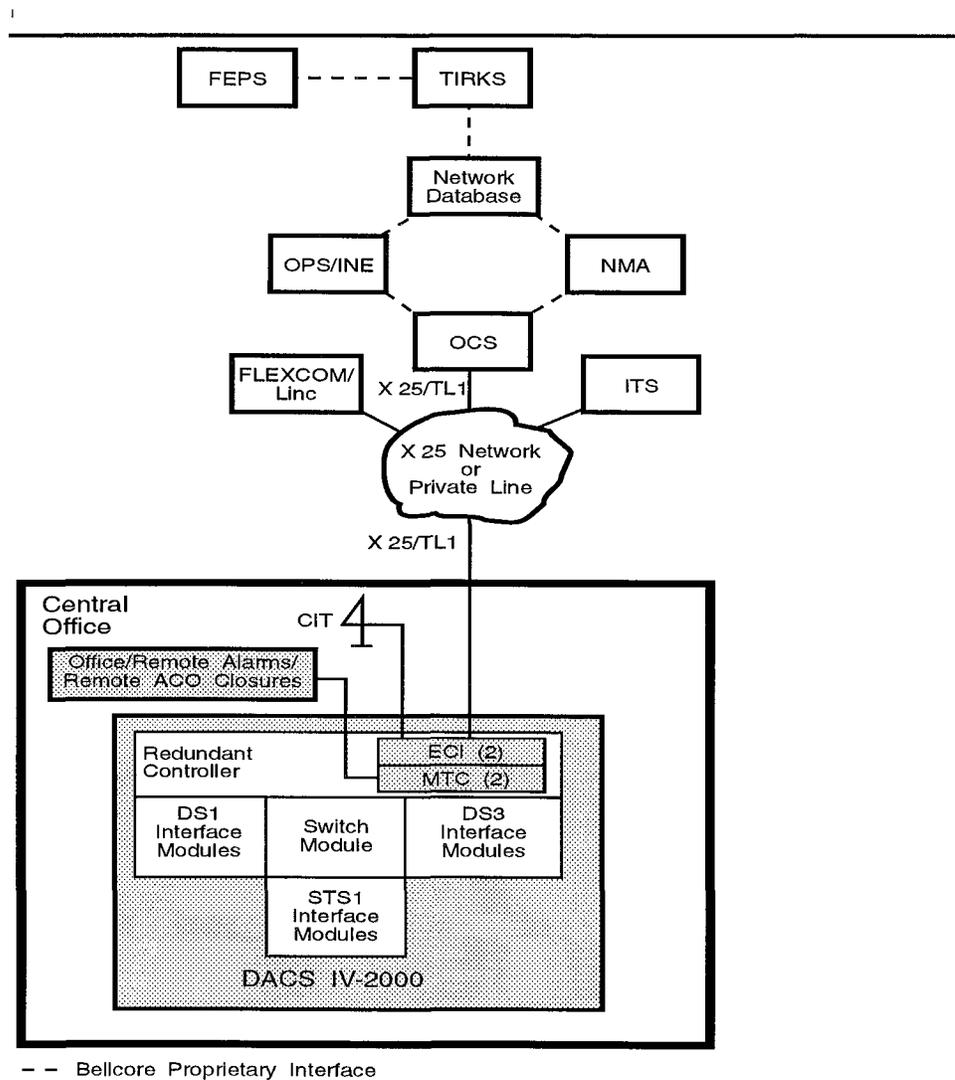


Figure 2-2. Typical Bellcore Operations Systems Environment

AT&T Operations Systems

The DACS IV-2000 can communicate with the following AT&T Operations Systems:

- DACScan-2000 Controller automates control over diversely located network elements, such as the DACS III-2000 and the DACS IV-2000.
- Remote Measuring System - DS1/Switched Access Remote Testing System (RMS-DS1/SARTS) provides remote testing, executes access commands, and provides performance monitoring (on demand) by the DACS IV-2000.
- Switching Control Center System (SCCS) provides management and surveillance of network elements.
- Total Network Management (TNM) provides management and surveillance of network elements. TNM is a migration of the existing SCCS architecture to the AT&T Star Server[®] FT Release 2 fault-tolerant computer platform.

In order for the DACS IV-2000 to interface with current AT&T OSs and for full support of the current DACS IV-2000 features, the following releases (or later) of the DACScan-2000 Controller, RMS-DS1/SARTS, and SCCS/TNM software must be used:

DACScan-2000 Controller - Release 5.2

RMS-DS1/SARTS - Release 5.0.1.6

SCCS - Release 13.3

TNM - Release 4.0

Figure 2-3 depicts a typical AT&T environment.

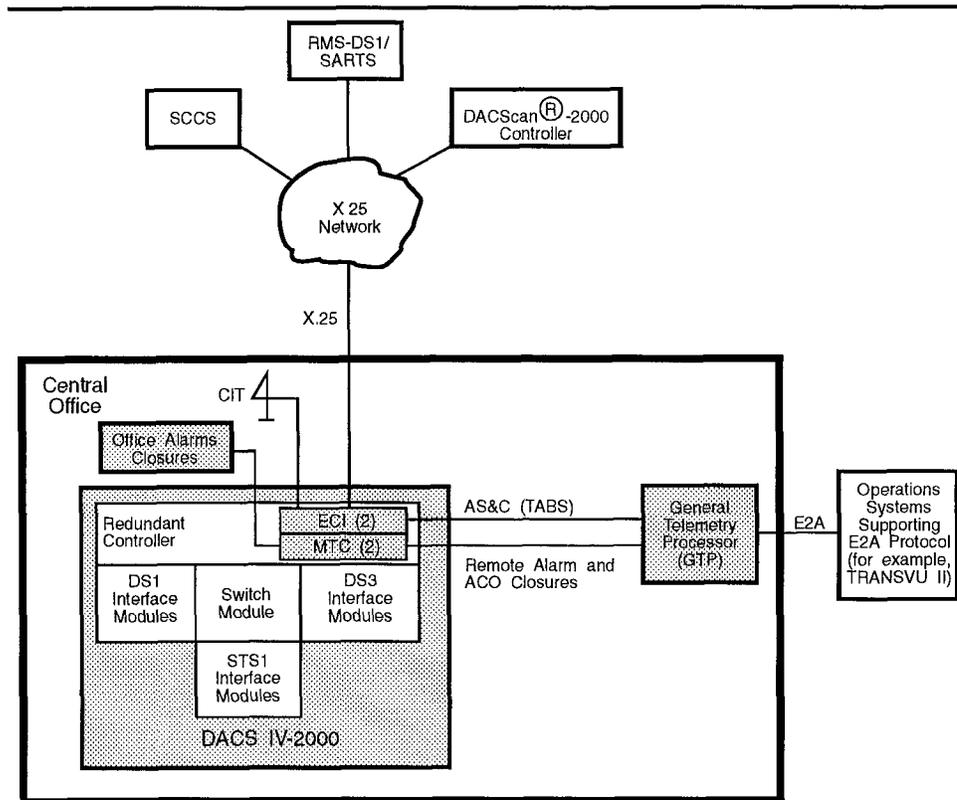


Figure 2-3. Typical AT&T Operations Systems Environment

Communications and OS Interfaces

The communications and OS interfaces of the DACS IV-2000 are used in the operations, administration, maintenance, and provisioning of the system. The interfaces are described in the "Interface Specifications" section in Appendix A.

Input Command Routing

This feature allows input commands and acknowledgment codes from any administrative link at the DACS IV-2000 frame to be echoed to a specified link. Input commands and acknowledgment codes are echoed through autonomous messages (REPT LOCL IN). The following commands support this feature:

- **ACT-ECHO-LINK** activates echoing of input commands from the specified link to another link.
- **CANC-ECHO-LINK** cancels the echoing of input commands from the specified link to another link.
- **RTRV-ECHO-LINK** retrieves the status of echoing of input commands for the specified link

Security

The DACS IV-2000 provides a security feature that offers secured access to the Main Controller (MC). This feature includes login and password protection, manual logout, and super-user access to administer logins for MC access. Super users can restrict access of other users to only that subset of commands they need to do their job. For example, technicians who only need to perform various system queries can be assigned user logins that restrict them from executing potentially service-affecting commands.

Security Audit

To help system administrators determine whether system security has been compromised, the DACS IV-2000 software provides the Security Audit feature to maintain a record of the following security-related events:

- User logins and all autonomous and manual user logouts
- Login creations, deletions, and changes
- Failed login attempts that result in a link lockout
- Input commands issued by a user with the incorrect security level
- Changes of the system time or date
- Edited link security parameters

- Deleted security audit records.

The audit log maintains the most recent 100 security-related events in nonvolatile memory.

Message Screening

Five message screening values can be provisioned on a per-link and a per-user basis. When logged into a link, the user value has precedence over the link value. The five message screening values are:

- INPUT specifies that the user or link receives responses to its own input commands.
- AUTO specifies that the user or link receives responses to its own input commands and to autonomous messages except for report database change messages due to manual command input.
- ALL specifies that the user or link receives responses to its own input commands, to autonomous messages except for report database change messages due to manual command input, and to responses to input commands from other users.
- DBAUTO specifies that the user or link receives responses to its own input commands and to autonomous messages including report database change messages due to manual command input.
- DBALL specifies that the user or link receives responses to its own input commands, to autonomous messages including report database change messages due to manual command input, and to input commands from other users.

User Priority Levels

Super users can assign priority levels to user logins so that commands entered by users are processed according to the priority level assigned. When commands are entered over the administrative link, the software places each command in a queue. This allows the processor to execute each command one at a time. If a number of commands are in the queue, the processor executes them according to the priority assigned to the user who entered the command.

There are five user priority levels defined as 1 to 5, with 5 being the highest priority level. For example, if the queue contains three commands with the first two entered by a user with a priority level of 3 and the last command entered by a user with a priority of 4, then the processor executes the last command first. If two commands have the same priority, then the processor executes the commands in the order received. This feature is useful in circumstances that require immediate processing of commands, such as enabling cross-connections for restoration.

Command Verification

The DACS IV-2000 contains a command verification feature that reduces the chance of error. The software displays a warning message and requires a confirmation before allowing the processor to execute commands that can affect service or prevent access to the system for extended periods of time. After receiving the warning message, the user has the option to modify, cancel, or execute the command. This feature is disabled for machine-to-machine connections, allowing the OS to operate unimpeded by command reviews and warning messages.

The expanded command verification warning messages also inform you when the execution of a `CPY-MEM` command takes longer than 10 minutes.

X.25 Links

The DACS IV-2000 supports the X.25 Packet Assembler/Disassembler and provides X.25 flow control.

X.25 Packet Assembler/Disassembler

Using an external Packet Assembler/Disassembler (PAD), an X.25 link can be converted into multiple asynchronous terminal interfaces. The PAD can be used to connect asynchronous terminals to the system for local operation, or to modems for remote (networking) operation. (See Figure 2-4.) The recommended PAD is a MICOM[®] box Type 2 X.25 asynchronous PAD.

X.25 Flow Control

With the X.25 flow control feature, commands are never dropped because of full input buffers if the OSs have been suitably coded. Without the X.25 flow control feature, the DACS IV-2000 cannot accept commands when the input buffers are full; it drops commands and sends back the input acknowledgment `RL` (retry later). With X.25 flow control, the DACS IV-2000 stops acknowledging X.25 commands when the input buffers are full. By not acknowledging commands, back pressure is applied through the X.25 network and stops the sending system from transmitting commands until the DACS IV-2000 is ready to accept them again.

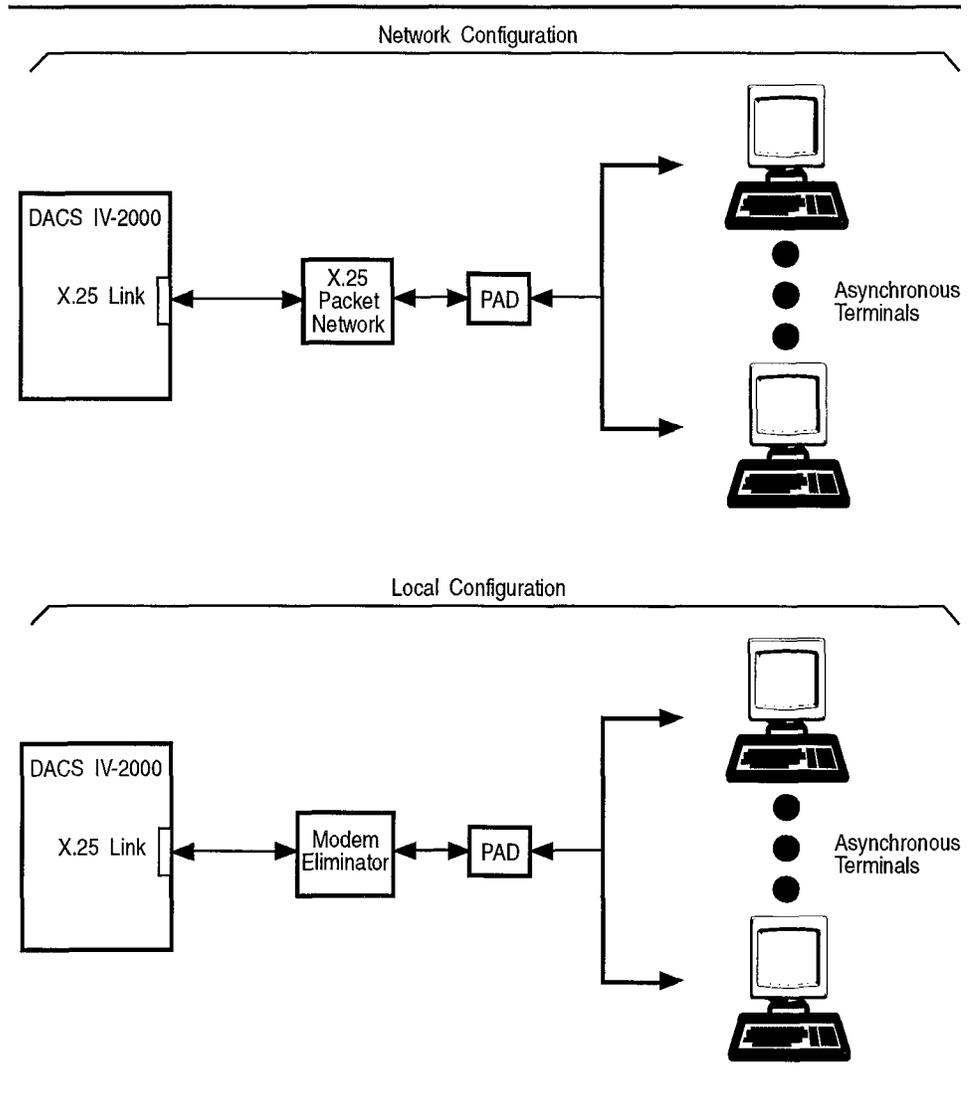


Figure 2-4. X.25 PAD Applications

Facility Maintenance

Facility maintenance consists of monitoring incoming DS1, DS3, and STS-1 signals; generating alarms and messages when failures are detected; and auditing system security. Facility maintenance features provided by the DACS IV-2000 are described in this section.

Application of Special Signals

The DACS IV-2000 automatically supplies a DS1, VT1.5, or STS-1 idle signal to the output ports to drive facilities through the switch. If all 28 DS1 tributaries in a DS3 are idle, the system can be provisioned to transmit a DS3 idle signal on the output port. When an incoming signal failure condition is detected at an input port of the switch, a DS1, VT1.5, or STS-1 AIS is supplied to the corresponding output port to replace the failed signal.

The DACS IV-2000 can be provisioned to provide a DS1 test signal supplied by an external test generator, such as a QRSS. One of the DACS IV-2000 DS1 system ports must be connected to this generator. A command given to the system, using the broadcast capability of the switch matrix, makes this signal available to any outgoing DS1 port (DS1 or DS3 interface circuit pack). The QRSS can be substituted for normal DS1 data (via user command) when needed for test purposes.

The DACS IV-2000 can insert two special signals onto a specified outgoing facility without taking down the established cross-connection. This feature can be used for verification of facility routing or for testing. The two signals that can be applied are an idle (AIS) signal (unframed all ones) or a DS1 test signal from the external signal generator.

Facility Failure Detection

Both DS1 and DS3 ports are monitored for LOS and for BERs that reach or exceed a user-selectable threshold (10^{-3} through 10^{-9} , user-programmable on a per-port basis). BER is determined by checking bipolar violations or parity violations (optionally on DS3 ports). DS3 ports are also monitored for the OOF condition. The occurrence of any of these conditions is indicated by a system alarm, an appropriate facility failure report over the administrative links, and a flashing LED on the interface circuit pack associated with the incoming signal.

DS1 and DS3 Idle Signals

The DACS IV-2000 automatically supplies a DS1 idle (AIS) signal to any output port that is not cross-connected through the DS1 switch. (A DS1 idle signal is identical to a DS1 AIS signal.) If all 28 DS1 tributaries in a DS3 are idle, the system can be provisioned to transmit a DS3 idle signal on the output port. If an incoming signal failure is detected at an input port of the DS1 switch, a DS1 AIS is supplied to the corresponding output port to replace the failed signal.

The detection of signal loss, out-of-frame, or AIS on an incoming DS3 facility causes activation of DS1 AIS on all DS1 tributaries in the DS3 signal.

When an IDLE signal is received, the MUX2/MUX3 circuit pack continues to monitor the transmission path. Because the IDLE signal has valid P-bit, CP-bit parity, and framing bits, the code violation (CV) counter must be incremented for every errored M-frame received. (The CV counter is not incremented for any second in which an LOS condition is detected.)

DS3 AIS and Idle Signals

If a DS3 facility fails before getting to an upstream network element (such as a DACS III-2000), that network element sends a DS3 AIS over the facility to the DACS IV-2000. The AIS inhibits the DACS IV-2000 from generating misleading facility alarms and activates status indications along the path of the DS3 facility. Similarly, if a facility fails coming into the system, the system transmits an AIS to the next network element downstream.

A network element upstream (such as a DACS III-2000) supplies a DS3 idle signal on the DS3 facility if no other signal is connected to the facility at the network element. For example, a DS3 facility can be connected to an incoming port on the DACS IV-2000 coming from a DACS III-2000.

The DACS IV-2000 monitors incoming DS3 ports for DS3 AIS, idle signal, and out-of-frame conditions on the constituent DS2 signals. If the DACS IV-2000 detects any of these conditions, the software does the following:

- Inhibits incoming signal failure alarms
- Provides status indications through serial telemetry and over administrative links, which indicate detection of AIS or idle signals
- If AIS, indicates the type of DS3 AIS format. The system can detect two different formats of AIS. Bellcore TR-TSY-000191, *Alarm Indication Signal Requirements and Objectives* (Issue 1, May 1986), specifies that DS3 AIS signals have valid DS3 framing bits set to a repeating 1010 pattern. An alternate CCITT DS3 AIS format specifies an unframed, all-ones signal.

For DS3 facilities requiring any of these capabilities, the MUX2 and MUXP2 (or MUX3 and MUXP3) circuit packs must be used. For DS3 Interface-32 Modules, you must also use Unit Controller 2 (UC2) and Power E3 (PWRE3) circuit packs.

STS-1 and VT Signal Paths

The DACS IV-2000 uses STS-1 and VT path AIS for the idle signal.

DS1 Signal Pattern

The DACS IV-2000 can be provisioned to provide an outgoing DS1 signal supplied by an external signal generator. This signal can be quasi-random or another signal pattern. One of the DS1 ports must be connected to the external generator. A command given to the system (using the broadcast capability of the DACS IV-2000 switch matrix) makes this signal available to any outgoing DS1 port. The signal from the external generator is transmitted from all DS1 output ports that are provisioned with an output mode of QRSS.

DS1 Input Port Status

The input port status is provisioned in the DACS IV-2000 to mark DS1 input ports as:

- Driven (DRVN): A good signal is expected and an alarm occurs if the signal is bad.
- Not driven (NDRVN): No valid signal is expected at the port, and the port is not monitored for failures. If the port is formatted, performance monitoring data are accumulated.
- Initialized (INIT): The port is considered nondriven until a valid signal is detected, and when a valid signal is received, status automatically changes to driven.

The input status values for a DS1 tributary within a MUX3 DS3 are DRVN and NDRVN. INIT is not supported.

DS3 Input Port Status

For a MUX3 DS3 port, the input port status values are DRVN, NDRVN, and INIT.

DS3 Mismatch Detection

Each DS3 port is provisioned for either an M13 or a C-Bit Parity signal type. In previous software releases, when a signal that was not in the provisioned format was received on a port, the DACS IV-2000 generated an alarm. The invalid signal was indicated by one or more DS2 Out of Frame (DS2OOF) or All DS2s Out of Frame (ALLDS2OOF) alarms. With the DS3 Mismatch Detection feature, the system reports the invalid signal, identifies the source of the problem, and indicates that the invalid DS3 signal is due to a C-Bit Parity/M13 format mismatch. This feature requires that Multiplexer 2 (MUX2) or Multiplexer 3 (MUX3) circuit packs be installed in the DS3 Interface Module.

Per-Frame Database Change Reports

This feature allows the system to report database changes on a per-frame basis. This feature is provisionable at the frame level.

Port Information Retrieval

The DACS IV-2000 provides a parameter for use when retrieving the status of provisioned ports. Ports are selectable that transmit normal signals, or transmit idle signals, or transmit AIS signals, or transmit a signal from an external DS1 generator.

Automated Facility Turnup Test

Built-in test signal generators and receivers in the DS1 Interface circuit paths can be used during facility turnup to test facility continuity. A new facility is looped back at the distant end, a test signal is applied at the DS1 signal rate, and the presence of the looped-back signal is verified by the test receiver. The system must be equipped with a DS1 Interface Module to have this capability. DS1 and DS3 facilities can be tested, but DS3 facilities are tested as 28 DS1s on an individual DS1 basis. Figure 2-5 provides examples of the automated facility turnup test.

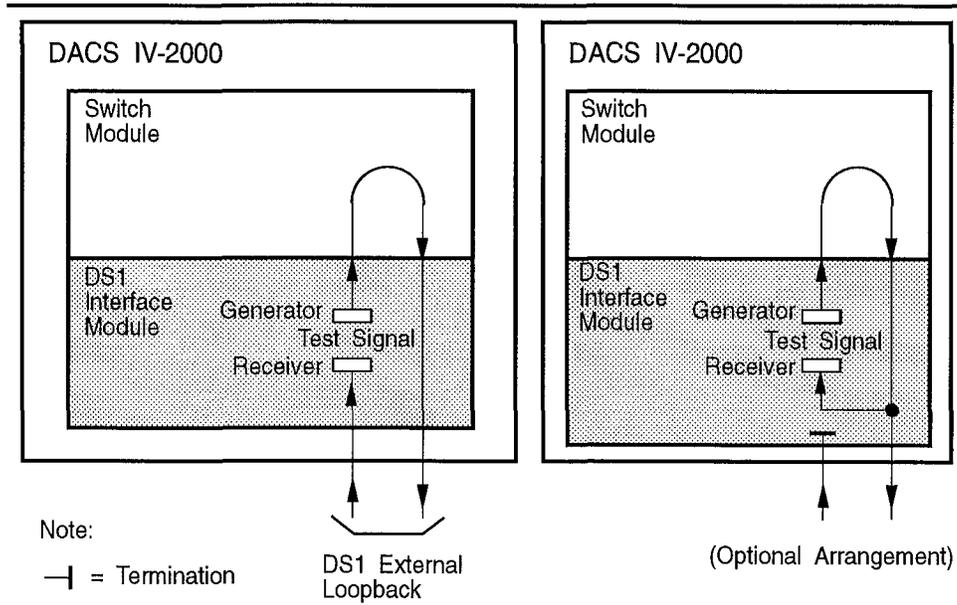
Remote Multiplexer Communications

This feature enables the DACS IV-2000 to communicate with far-end multiplexers by using DS3 overhead bits. It allows:

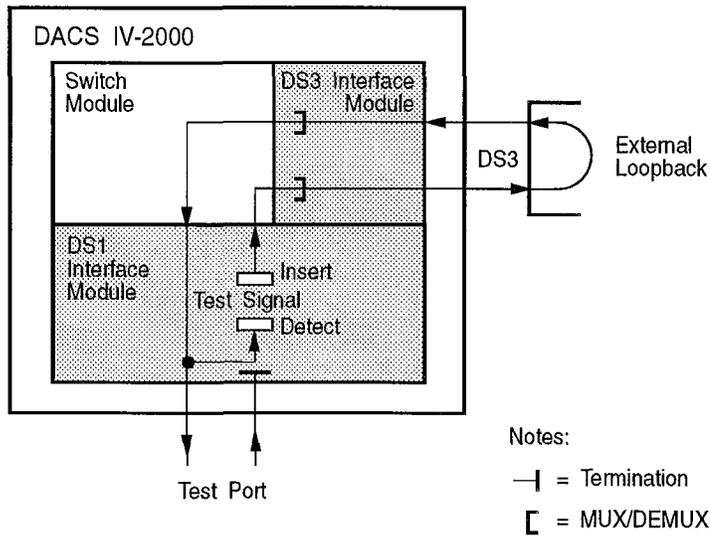
- Far-end loopback control
- Response to far-end loopback commands
- Signaling of alarm conditions to the far end
- Generation of alarms/status messages on far-end conditions.

This feature supports the following protocols for communications with multiplexers at the far end of the DS3 facilities:

- DS3 X-bit signaling that indicates far-end DS3 alarm conditions
- DS2 X-bit signaling that indicates far-end DS2 out-of-frame conditions
- DS1 loopback control using the DS2 C-bits as specified in Bellcore TR-TSY-000009, *Asynchronous Digital Multiplexer Requirements and Objectives* (Issue 1, May 1986).



A. Automated Loopback Transmission Test on a DS1 Port



B. Automated Loopback Transmission Test on a DS3 Port

Figure 2-5. Automated Facility Turnup Test

- C-bit parity format far-end alarm and control link for control of DS1 and DS3 loopbacks and reporting of far-end facility and equipment alarm conditions as specified by ANSI T1.107a-1989
- S-bit (DS3 stuff bit) communications link used by AT&T DDM-1000 multiplexers for DS1 loopback operations and reporting far-end and near-end equipment and facility failure conditions.

Function and protocol are specified on a per-port basis. This allows the DACS IV-2000 to match capabilities of the far-end multiplexers. For DS3 facilities requiring the remote multiplexer communication feature, the facility must be equipped with MUX2/MUX3 and MUXP2/MUXP3 circuit packs.

Frame Maintenance

The features and capabilities of the frame maintenance mechanism are described in this section.

Incorrect Secondary Disk Load Message

When an attempt is made to copy the database from secondary disk to primary disk, system identifiers (system type, system release, and TID) are compared to the system identifiers in memory (WKG). If the identifiers differ, a warning message is generated and the database transfer is not completed.

AS&C Activation on Secondary Disk Failures

This feature facilitates remote operations by providing an AS&C point, which is activated whenever a **CPY-MEM** request to the secondary disk (SEC) fails. These failures may not be confined to failures of the secondary disk. The alarm points are held active until the DACS IV-2000 is polled at Link 4. After being polled, the alarm points are cleared. In addition, if a **REPT BKUP** message is issued with the status parameter set to **FAIL**, the AS&C points are set.

Empty Primary Database Check

An empty database is defined as a database with no interface modules provisioned, but otherwise correct. If the frame is instructed to boot a database with this characteristic, the boot fails and the MC is placed into the **OOS-MCOND** state. A failure message indicates the nature of the failure. (The MC state can be changed to **IS** state if necessary.)

Disk Verification

This feature automatically verifies and checks the system's ability to access the hard disk at least once every 15 minutes. This process detects and reports hard disk access failures.

Fault Isolation and Reporting

The DACS IV-2000 can isolate a fault to the incoming facility or equipment. In the case of an equipment failure, the DACS IV-2000 identifies the failed circuit pack by lighting a red LED on the faceplate and generating alarms and administrative link messages.

LED for Manual Protection Switch

To aid in identifying a circuit pack that has been manually switched to protection, this feature lights the red ALM LED on the interface or switch circuit packs (SWIF, MUX, SWIO, SMUX, or SWCS) when the circuit pack has been manually switched to protection. This is a provisionable feature.

When a manual protection switch has been performed, the red ALM LED on the circuit pack that was switched to protection is constantly lit for the duration of the protection switch. The output response to the command that was used to manually switch the circuit pack to protection contains a warning message that the red ALM LED on the protected circuit pack is lit as a result of this operation.

Fan Filter Replacement Indication

For ED-2C906-30 or ED-2C816-30 fan assemblies, the DACS IV-2000 provides a periodic autonomous message alerting you that the fan filter in the switch bay needs to be replaced. An autonomous message is generated when the recommended replacement period of 91 days has expired. The message must be acknowledged manually.

For ED-9C130-30 fan assemblies, the DACS IV-2000 generates an alarm for a clogged filter condition or a high preset temperature value.

BNC Connectors

The DACS IV-2000 can be equipped with BNC connectors that allow connections to DS3 and EC-1 facilities. BNC connector panels can be ordered with STS1/DS3/DS1, DS3, or STS1/DS3 interface bays. The BNC connector panel is provided as part of the electromagnetic compatibility (EMC) enclosure to meet the FCC Class A criteria for EMC, but can be provided optionally without the enclosure.

Advantages of the BNC connectors are:

- The coaxial connections are collected in a single place at a convenient and consistent location.
- A quick, positive connection/disconnection is provided.
- Risks are reduced when handling coaxial lines, since they are kept from the backplane areas.
- A more robust connection is available.

- The coaxial splice is eliminated because the 734A and 735A cables can be brought directly to the frame. The need to downsize to a smaller diameter is eliminated.
- Cable routing and precabing are facilitated. Cables can be pulled from either end with less risk, and if necessary, can be trimmed and re-terminated easily. This minimizes the excess slack problem.
- Standard industry-wide hardware is available, and such items as connectors, tools, and cabling can be stocked as necessary.

EMC Enclosures

When fitted with the optional EMC enclosures, the DACS IV-2000 meets the EMC FCC criteria and the electrostatic discharge (ESD) requirements specified in Bellcore GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 1, November 1994).

NOTE:

Enclosures must be ordered with any new frame and cannot be field retrofitted.

With the EMC option to help eliminate electromagnetic interference (EMI), the entire front of the DACS IV-2000 is covered with EMC doors. Because of this, the visual alarm indicators are only visible when viewed from the front. However, the EMC enclosure provides a Header Designation Assembly (HDA) at the top of the switch bay to house duplicate status panel alarm indicators so they are fully visible to the technician.

Protection Switching

The DACS IV-2000 system architecture divides the circuit packs associated with signal transmission (interfaces and switch matrix) into a number of protection groups. A single failure within a protection group is protected, but additional failures within a single group are not protected. Multiple failures occurring in multiple groups are protected independently within the individual protection groups.

An STS1 interface protection group consists of an STS1 interface module. The protectable entity in an STS1 interface protection group is the SMUX circuit pack, which supports one STS1 facility. Each STS1 module has 16 SMUX equipment locations, with 15 of these locations used for service and one used for protection.

A DS3 interface protection group consists of either a DS3 Interface-32 (protected on a 1 x 31 basis), a DS3 Interface-16 Module, an enhanced DS3 Interface-16 module, or a DS3 clear-channel Interface-16 module (all of which are protected on a 1 x 15 basis). The protectable entity in a DS3 interface protection group is the MUX circuit pack, which supports one DS3 facility.

A DS1 interface protection group consists of all the DS1 Interface Modules within the same bay. The protectable entity in a DS1 interface protection group is a set of three circuit packs (two DS1IF circuit packs and a SWIF circuit pack), which in combination support 28 DS1 facilities.

The switch protection group consists of the switch module and the Clock Distributor (CLKDR) circuit packs in the interface modules. The protectable entity in the switch protection group is either an SWIO/CLKDR circuit pack pair or an SWCS circuit pack. When an SWIO or CLKDR circuit pack fails, it is protected by its mate circuit pack. In addition, the associated SWIO or CLKDR circuit pack is switched to protection. To support the additional load that is switched onto the mate circuit packs, additional paths through the switch matrix are used, and these are provided by the spare 32nd SWCS circuit pack.

Protection switching in the switch protection group requires remapping connections. To perform this within the required time interval, the system maintains prestored maps that are used to protect failures of SWIO and SWCS circuit packs. These prestored maps are updated whenever connections in the switch matrix are changed. Mapping is allowed on all circuit packs while they are protected.

In an interface protection group, there is a single protectable entity and a single protection bus available. Therefore, only one protection switch can be performed at a time in that protection group. The DACS IV-2000 protects a single failure in each interface protection group independently of failures in other interface protection groups.

The DACS IV-2000 circuit packs do not protection switch automatically unless they are carrying traffic. This applies to DS1IF, SWIF, MUX, SMUX, and SWIO circuit packs, but it does not apply to SWCS circuit packs because these circuit packs are not associated with specific facilities and because 31 of the 32 SWCS circuit packs must be available at all times to guarantee nonblocking.

The autolock state exists to prevent excessive protection switching caused by an intermittent problem. A circuit pack is put into the autolock state when n protection switches occur within m minutes. All autolocks are automatically released every x hours by the system. The values of n , m , and x are provisionable by the user.

Automatic Circuit Pack Restoral

When a failed circuit pack is replaced, it is automatically returned to service if it passes all system diagnostic tests. This feature applies to all circuit packs except the redundant controller module and synchronizer module circuit packs.

The UC circuit packs are automatically restored when the system is reset. The system may be reset by pushing the RESET button, issuing an initialization command, or performing a power-on restart.

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This chapter describes the major network applications of the DACS IV-2000. The DACS IV-2000 allows centralization and automation of many network functions currently implemented manually and thus provides an efficient means of managing DS1, DS3, VT1.5, and EC-1 circuits and facilities.

The modularity of the system, both in bay and circuit pack design, provides a high degree of flexibility in its deployment in a network. This flexibility allows the DACS IV-2000 to be used economically in a variety of applications to match service needs and to allow cost sharing over those applications.

The major applications of the DACS IV-2000 are:

- SONET connectivity
- SONET/asynchronous gateway
- DS1/VT1.5 grooming
- Broadband STS-1 cross-connection
- Broadband DS3 clear-channel cross-connection
- Electronic DSX (EDSX)
- Test access and performance monitoring
- Networking
- Digital switch cutover.

SONET Connectivity

The DACS IV-2000 maintains SONET paths while allowing grooming and rearrangement of VT1.5 signals and rearrangement of STS-1 signals. (See Figure 3-1.) Both the STS-1 and VT1.5 signals can be cross-connected while maintaining continuity of the path overhead. To support STS-1 path connectivity, the DACS IV-2000 provides an STS-1 clear-channel Synchronous Payload Envelope (SPE) cross-connect function. In addition, the DACS IV-2000 provides a VT1.5 clear-channel SPE cross-connect for maintaining the VT1.5 path.

The ability to groom and maintain VT1.5 paths through a central office is attainable only by using a DACS IV-2000-like SONET digital cross-connect system. Using alternatives, such as back-to-back multiplexers, requires demultiplexing the signal down to asynchronous levels with cross-connection at a DSX-1; this consequently terminates the SONET path. The DACS IV-2000 cross-connects the VT1.5 signal, thus maintaining end-to-end SONET connectivity.

SONET/Asynchronous Gateway

The DACS IV-2000 provides cross-connection of a DS1 signal from a DS1 or DS3 interface to an STS1 interface. At the STS1 interface, the DS1 signal is mapped into a VT1.5 within the STS-1, and SONET overhead is added. In Release 5.0, the DACS IV-2000 also provides cross-connection of a DS3 signal from a DS3 interface to an STS1 interface. Thus, the DACS IV-2000 serves as a gateway between an asynchronous network (incoming DS1s and DS3s) and a synchronous network (outgoing STS-1s), as shown in Figure 3-2.

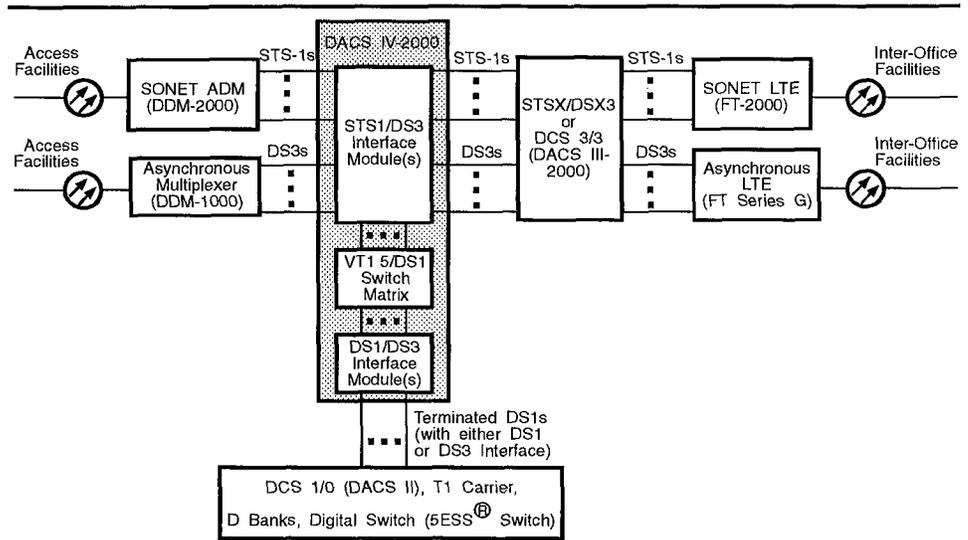


Figure 3-1. SONET Office Architecture with the DACS IV-2000

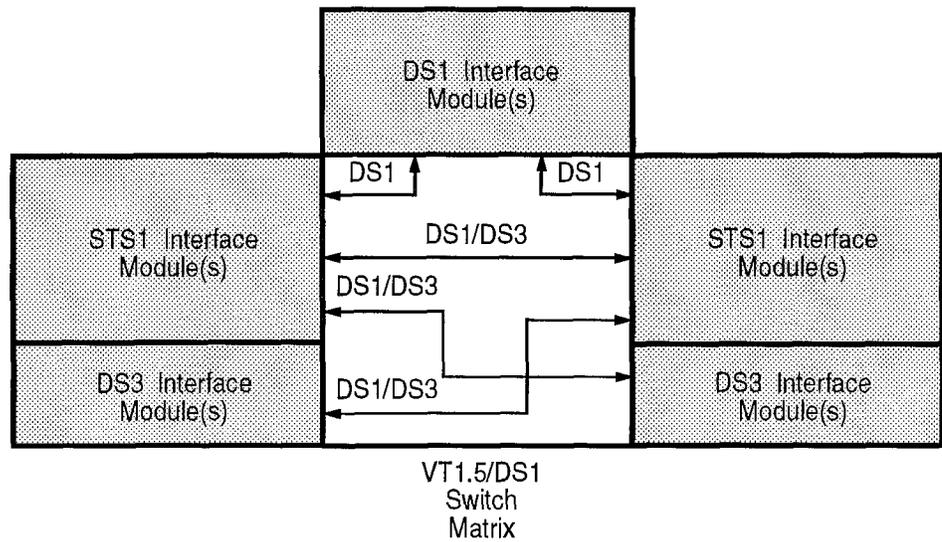


Figure 3-2. DACS IV-2000 Asynchronous Gateway to SONET

Grooming

Grooming is the process of adding or dropping signal tributaries (such as DS1 or VT1.5 signals) to or from a terminating facility (such as a DS3 or EC-1). Grooming is used to maximize the use of high-speed facilities. Grooming can be performed on any signal transmitted under the following conditions:

- From a customer or remote terminal site to an interoffice facility (access grooming)
- From one central office to another (interoffice grooming)
- From one piece of equipment to another within a central office (intraoffice grooming)
- Between carriers at a point of interface.

Figure 3-3 illustrates the grooming application.

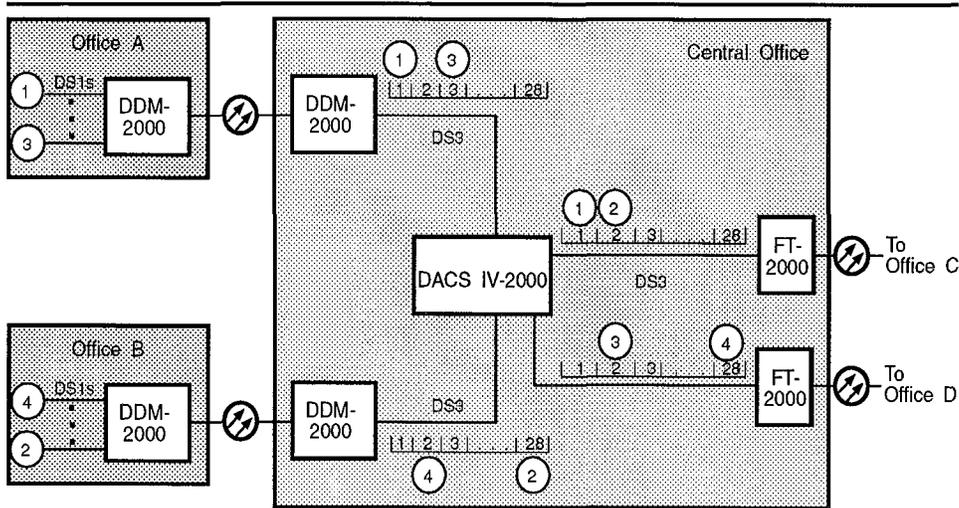


Figure 3-3. DACS IV-2000 Grooming Application

Access Grooming

Access grooming is the rearrangement of tributaries on terminated facilities that come into central offices from customer sites or remote terminals. The DACS IV-2000 offers access grooming for both synchronous and asynchronous facilities.

The increasing use of fiber facilities for loop access and the rapid growth of DS1 services make the DACS IV-2000 economically advantageous for access grooming applications. DS1 signals on SONET EC-1 facilities or DS3 facilities are groomed at the VT1.5 or DS1 signal rate in the DACS IV-2000. DS1 signals terminating on transmission or switching equipment located in the office are cross-connected to the appropriate facility-terminating equipment. Those services not requiring local termination are cross-connected directly to the appropriate interoffice facility transmission equipment. By performing the grooming function of the VT1.5/DS1 signals, the DACS IV-2000 allows efficient packaging of these signals into higher-rate STS-1/DS3 interfaces for connection to both loop and interoffice facilities and to central office equipment. This allows significant equipment cost savings.

The DACS IV-2000 can also groom SLC-2000 carrier system circuits. DS1 signals associated with a remote terminal (RT) that carries only locally switched circuits can be directly routed to the switch. The SLC-2000 carrier system RTs supporting nonlocally switched circuits or a mixture of locally and nonlocally switched circuits can be routed to a DACS II or central office terminal for DS0 signal processing.

Figure 3-4 shows the manual way of terminating fiber from the loop. Figure 3-5 shows the arrangement with a DACS IV-2000.

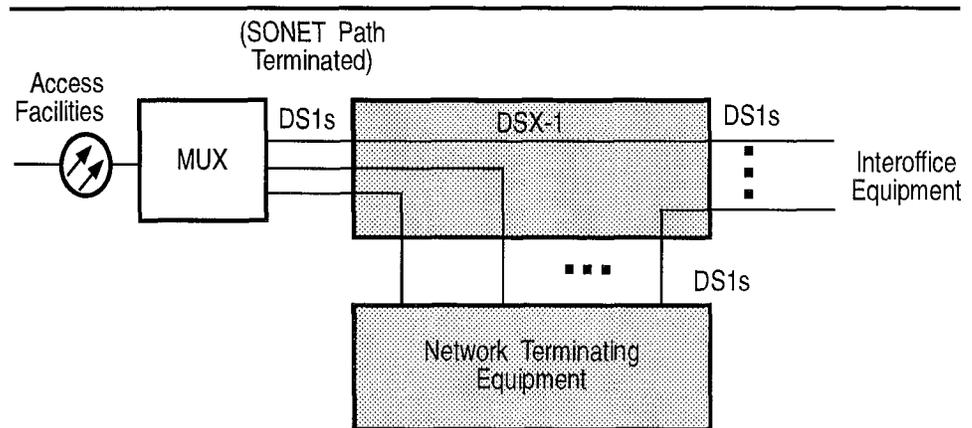


Figure 3-4. Manual Fiber Loop Access Arrangement

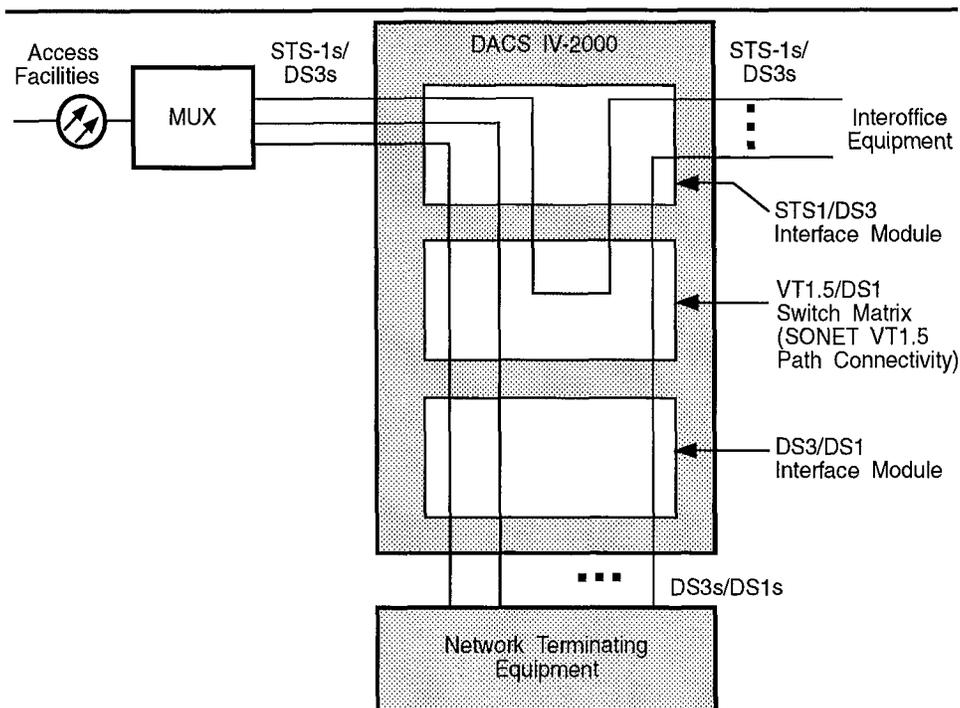


Figure 3-5. Fiber Loop Access with the DACS IV-2000

Interoffice Grooming

Interoffice grooming is the rearrangement of VT1.5 or DS1 tributaries on terminated interoffice EC-1/DS3 facilities. Because the DACS IV-2000 provides multiplexing and demultiplexing functionality and cross-connections at the VT1.5/DS1 signal rates, the need for back-to-back multiplexers for through signals is eliminated.

The availability of interoffice grooming means that the VT1.5/DS1 signals on one interoffice EC-1/DS3 facility can be cross-connected in the DACS IV-2000 to other interoffice EC-1/DS3 facilities without a DS1 interface in the office. The system can groom VT1.5/DS1 signals from incoming facilities and consolidate those signals destined for the same remote office on a minimum number of facilities. This functionality allows for efficient use of both incoming and outgoing facilities while reducing the amount of equipment needed in an office.

Figure 3-6 shows a grooming method using back-to-back multiplexers and DSX-1 frames. Figure 3-7 shows how the DACS IV-2000 eliminates the need for back-to-back multiplexers and can provide first-cost savings in equipment, reduced floor space, and reduced DS1 cabling and DSX-1 congestion, as well as significant reductions in operating costs.

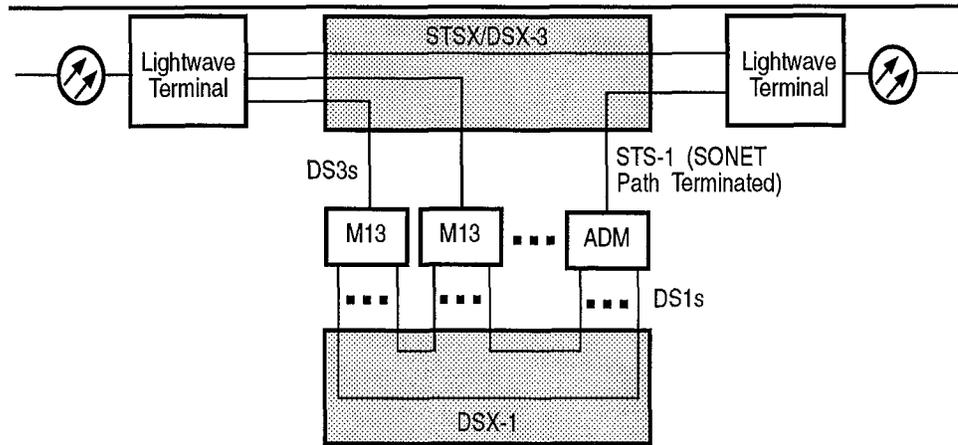


Figure 3-6. Interoffice DS1 Grooming with Back-to-Back Multiplexers

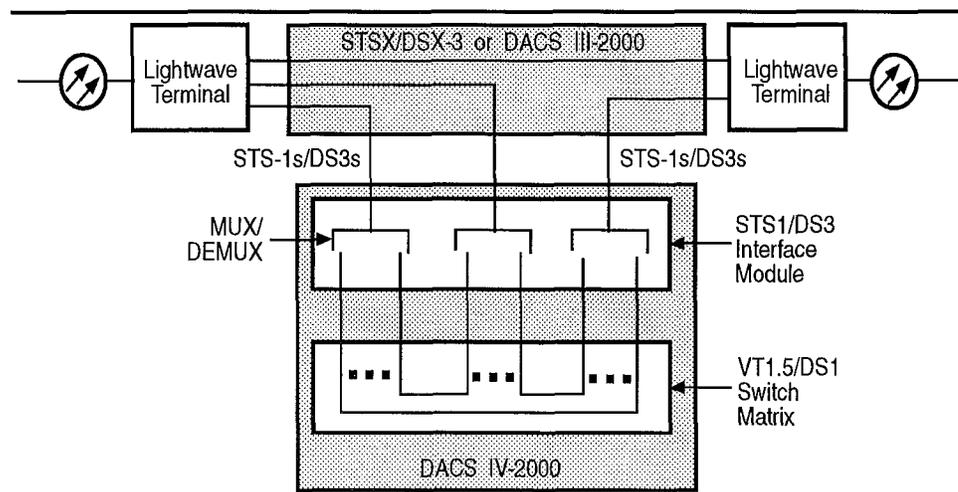


Figure 3-7. Interoffice Grooming with the DACS IV-2000

Because the VT1.5 signals carried within an EC-1 facility fiber are usually destined for several locations, VT1.5 grooming is required to use the SONET interoffice facilities efficiently. A DACS IV-2000 in the local central office allows all these signals to be put on a single STS-1 signal. Grooming of the VT1.5s cannot be done in a manual cross-connect environment.

Without the DACS IV-2000 VT1.5 cross-connect capability, grooming below the STS-1 signal level requires that the SONET signals be terminated and cross-connected at the DS1 signal level. This break in SONET end-to-end path continuity is shown in Figure 3-8.

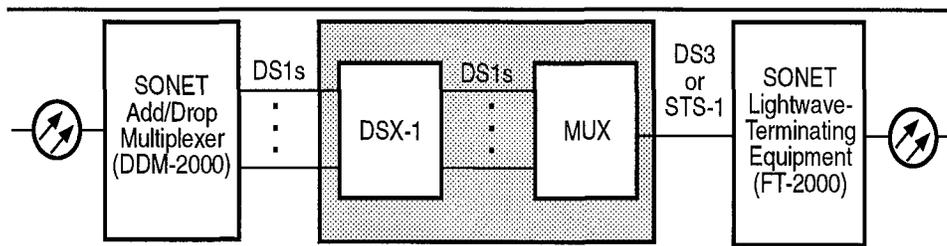


Figure 3-8. Tributary Grooming without the DACS IV-2000

The DACS IV-2000 allows VT1.5 grooming of both the access and interoffice facility while maintaining full SONET path continuity, as shown in Figure 3-9.

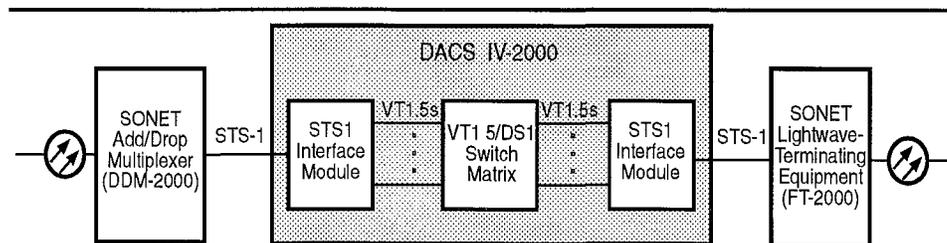


Figure 3-9. End-to-End Path Connectivity with the DACS IV-2000

Intraoffice Grooming

As other network elements (such as the DACS II) are enhanced to provide STS1 interfaces, the VT1.5/DS1 cross-connect capabilities of the DACS IV-2000 can be used to perform intraoffice grooming economically. The DS1 and VT1.5 tributaries on the incoming facilities can be consolidated onto the appropriate intraoffice EC-1/DS3 facility. This office architecture provides cost savings by allowing the use of lower-cost STS1/DS3 interfaces, reducing DS1 cabling, and eliminating the need for DSX-1s.

Point of Interface

The DACS IV-2000 can provide a flexible and economical point of interface for inter-LATA (inter-Local Access and Transport Area) circuits. The point of interface can be at the DS1, DS3, or STS-1 signal level. When it is at the DS1 signal level and the associated access circuits are on fiber (see "Access Grooming" in this chapter), the DACS IV-2000 provides an economical way to groom the locally terminated DS1s from the interexchange carrier (IEC) facilities.

When the point of interface is at the DS3 or STS-1 signal level, the DACS IV-2000 allows DS1 or VT1.5 grooming of the interexchange carrier DS3s or STS-1s to separate those tributaries terminating on the local switch from those terminating on other network elements or going directly to a carrier serving area (DS1 or VT1.5 services). In general, the point of interface is migrating from a DS1 or VT1.5 signal level to a DS3 or STS-1 signal level. When the original DS1 or VT1.5 facility is provided on the DACS IV-2000, rolling to the new facilities can be greatly simplified. The new DS3 or EC-1 facility is terminated on the DACS IV-2000, tested, and the DS1 or VT1.5 services can be rolled to the new DS3 or EC-1 facility. The original interface can then be removed.

Broadband Cross-Connection

The DACS IV-2000 can cross-connect the entire STS-1 SPE while maintaining the path overhead. This capability allows the DACS IV-2000 to provide the functions of a Broadband Digital Cross-Connect System (BDCS) as well as the functions of a Wideband Digital Cross-Connect System (WDCS). This is particularly advantageous in smaller offices where the number of STS-1-level services is not sufficient to justify a separate BDCS.

The DACS IV-2000 can also cross-connect the entire DS3 payload (DS3 clear-channel) while maintaining the overhead. The DS3 clear-channel cross-connection capability is particularly valuable in smaller central offices where, for example, a separate DACS III-2000 is not cost-effective but where a need exists to provide a reconfiguration capability for DS3 services.

Electronic DSX (EDSX)

The operations cost savings provided by the centrally controlled DACS IV-2000 for provisioning, administration, and maintenance allow it to be used as an economical replacement for a manual DSX cross-connect frame and to provide the equivalent functions for the VT1.5 signals. Figure 3-10 shows this configuration.

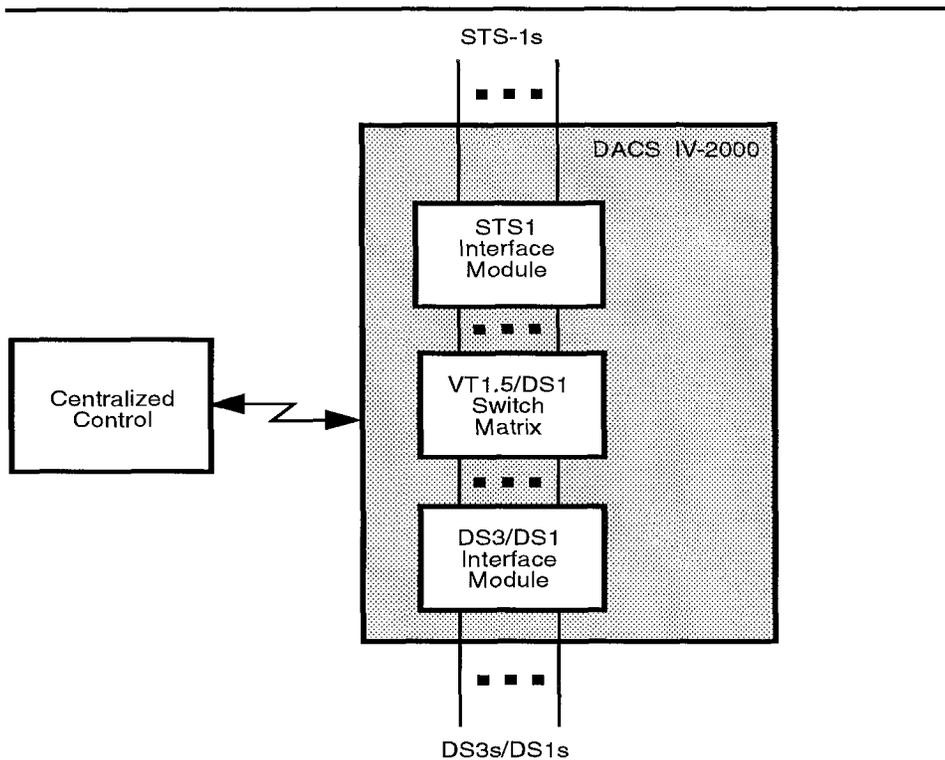


Figure 3-10. The DACS IV-2000 as an Electronic DSX (EDSX)

The DACS IV-2000 provides all functions now performed at manual DSX cross-connect frames and provides these functions for the SONET VT1.5 signals. These functions include cross-connection, facility rolling, patching, loopbacks, and test access. The DS1 signals interface to the DACS IV-2000 at the DS1 or DS3 signal level, and the VT1.5 signals interface at the STS-1 level.

Centralized control allows faster response times for facility and service orders and faster resolution of trouble reports. This arrangement permits you to use cable distances of up to 1310 feet to network elements, thereby removing the need, in most cases, for intraoffice repeater ties.

In practice, the manual cross-connect replacement application is combined with the grooming and add/drop applications because of the significant cost savings provided by these latter applications. (Figure 3-10 shows this combined application of the DACS IV-2000.)

Test Access and Performance Monitoring

Detailed Performance Monitoring (PM) data must be available for through-facilities and terminating facilities. This is especially necessary when DS1 high-capacity services are provided with DS1 signals terminating on customer equipment, and when DS1 signals terminate on older network elements that do not provide that capability.

To facilitate quick response to customer trouble reports, centralized test access capabilities must be provided. To accomplish this with manual DSX-1 frames, expensive access equipment must be provided externally. (See Figure 3-11.)

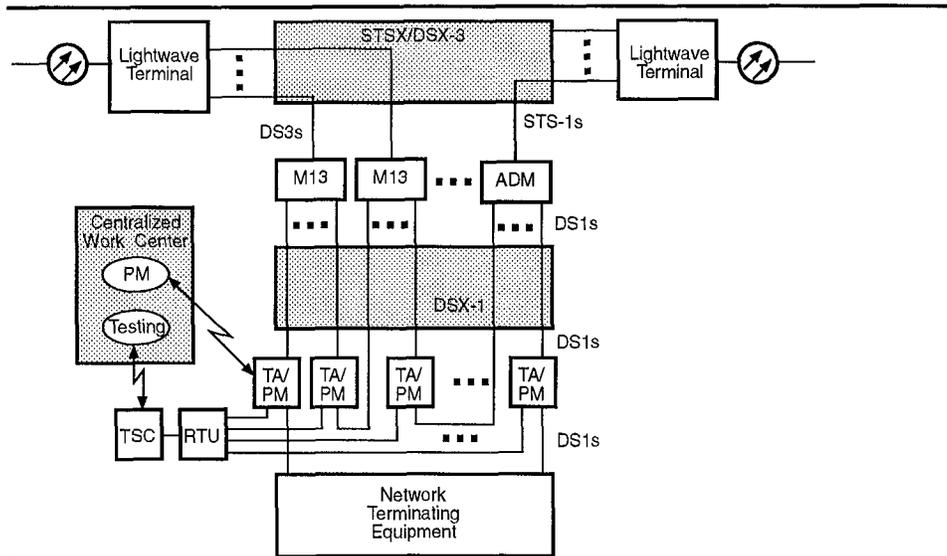
Expensive access equipment can be avoided by using a DACS IV-2000. As shown in Figure 3-12, the DACS IV-2000 provides detailed performance monitoring data and test access configurations under centralized control.

Full-Time DS1 Performance Monitoring

Performance monitoring data of the DS1 as received at the far end of the DS1 path supports AT&T TR54016, *Requirements for Interfacing a Customer Installation to Services Employing the Extended Superframe Format* (Issue 2, 1989), which is used for sending and receiving DS1 PM data over the extended superframe facility data link. This capability is provided by the MUX3 and SWIF circuit packs.

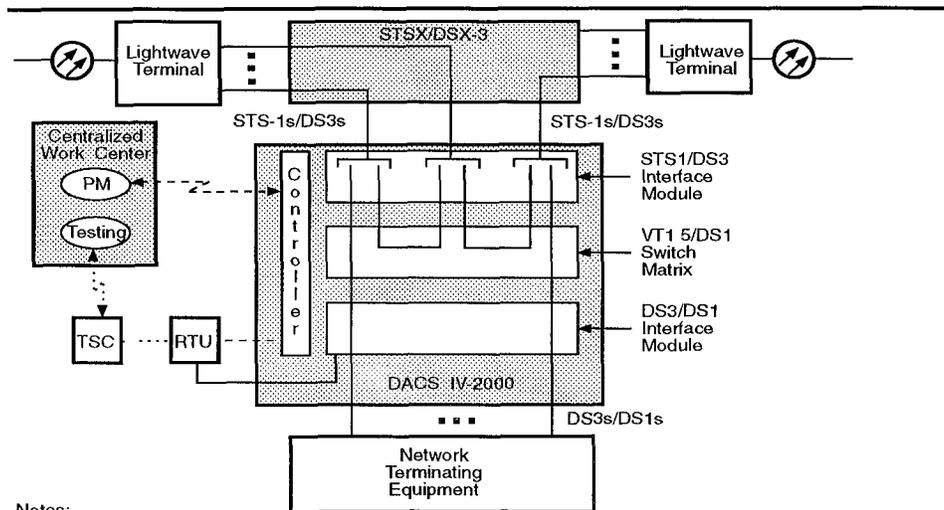
The MUX3 circuit pack provides full-time path performance monitoring of all DS1 tributaries on the received DS3 facility, with no need to bridge to a separate circuit pack and thereby reduce the effective switch capacity. You can monitor all DS1 tributaries in the incoming DS3 signal that are either superframe (SF) or extended superframe (ESF) format.

- Received SF-format tributaries are monitored by counting errors in the framing bits.
- Received ESF-format tributaries are monitored using the CRC-6 code and framing-bit errors.



Notes:
 RTU = Remote Test Unit (for example, RMS-DS1)
 TSC = Test System Controller
 TA/PM = Test Access and PM Device

Figure 3-11. DS1 Test Access and Performance Monitoring with DSX-1s



Notes:
 RTU = Remote Test Unit (for example, RMS-DS1)
 TSC = Test System Controller
 = Test System Control
 --- = DACS IV-2000 Control

Figure 3-12. DACS IV-2000 Test Access and Performance Monitoring

SONET Performance Monitoring

As the asynchronous network evolves to SONET, performance monitoring is a required feature for both VT1.5 and STS-1 networks. SONET networking with the DACS IV-2000 provides VT1.5 path performance monitoring as well as STS-1 section, line, and path performance monitoring. In the DACS IV-2000, performance monitoring is integrated into the product. Therefore, the performance data are sent directly from the DACS IV-2000 to a centralized work center via one of its administrative links. (See Figure 3-13.)

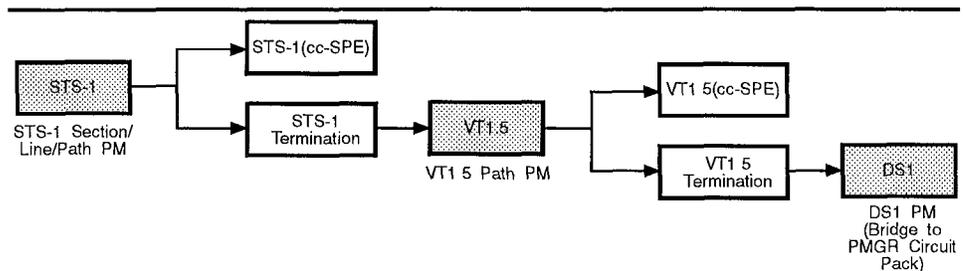


Figure 3-13. DACS IV-2000 SONET Performance Monitoring

The SONET signal enters the DACS IV-2000 at the STS-1 rate. The STS-1 section and line performance monitoring is performed. The STS-1 is either clear-channel SPE cross-connected or terminated and demultiplexed into its VT1.5 tributaries. Regardless of how the STS-1 is processed, the DACS IV-2000 provides STS-1 path performance monitoring data to the user.

- If the STS-1 is clear-channel SPE cross-connected, the DACS IV-2000 terminates the section and line overhead, cross-connects the entire STS-1 SPE (including the path overhead) through the frame, and adds the section and line overhead on the outgoing STS1 interface.

If the STS-1 is terminated and demultiplexed into 28 VT1.5s, either the VT1.5 is clear-channel SPE cross-connected, or it is terminated and further demultiplexed to the DS1 rate. Regardless of how the VT1.5 is processed, the DACS IV-2000 provides VT1.5 path performance monitoring data to the user.

- If the VT1.5 is clear-channel SPE cross-connected, the DACS IV-2000 cross-connects the entire VT1.5 SPE (including path overhead) through the frame.
- If the VT1.5 is terminated, it is demultiplexed down to the DS1 level and cross-connected to the appropriate terminating network element in the office.

Performance monitoring is available for the DS1 signal by bridging to a PMGR circuit pack.

SONET Test Access

The DACS IV-2000 provides a variety of test access modes for STS-1 and VT1.5. This SONET release supports monitoring and splitting of the equipment and the facility for both the A and B directions. Loopbacks, bridging, and rolling capabilities currently used in many asynchronous DACS IV-2000 applications are provided for STS-1 and VT1.5.

Network Applications

Creating a network that includes the DACS IV-2000 and other networking equipment can result in significant savings. The DACS IV-2000 offers the following network applications:

- Ring interworking
- Centralized network control, provisioning, and maintenance
- VT1.5/DS1 hubbing
- DS1 add/drop
- Route restoration.

Ring Interworking

The DACS IV-2000 provides a cost-effective interconnection point between SONET rings. Models have shown that a SONET ring network costs more if implemented without the DACS IV-2000s at the ring intersection nodes. Significant savings (25 percent in network studies) can be realized by using the DACS IV-2000s to manage bandwidth between SONET rings. (The level of savings depends on the size and complexity of the network.)

The customer interface to the access rings is generally at the DS1 signal level (which for SONET transport is carried in a VT1.5 envelope). Each DS1 signal is usually destined for a different interoffice facility (to a far-end office).

Without a DACS IV-2000, the central office cross-connection between the access and interoffice rings would have to be at the STS-1 signal level to maintain SONET path connectivity. One EC-1 would be required for each far-end destination; as a result, each EC-1 would carry a low number of VT1.5s carrying services. With a DACS IV-2000 performing ring interworking, an STS-1 signal can carry VT1.5s destined for several different far-end offices (different interoffice facilities). The DACS IV-2000 grooms and routes these VT1.5s to the appropriate interoffice EC-1 facility. This provides greater utilization of the EC-1 facilities.

The DACS IV-2000 also allows the SONET rings to interface with asynchronous network terminating elements (the SONET/Asynchronous Gateway feature). Access rings and interoffice rings are shown in Figure 3-14.

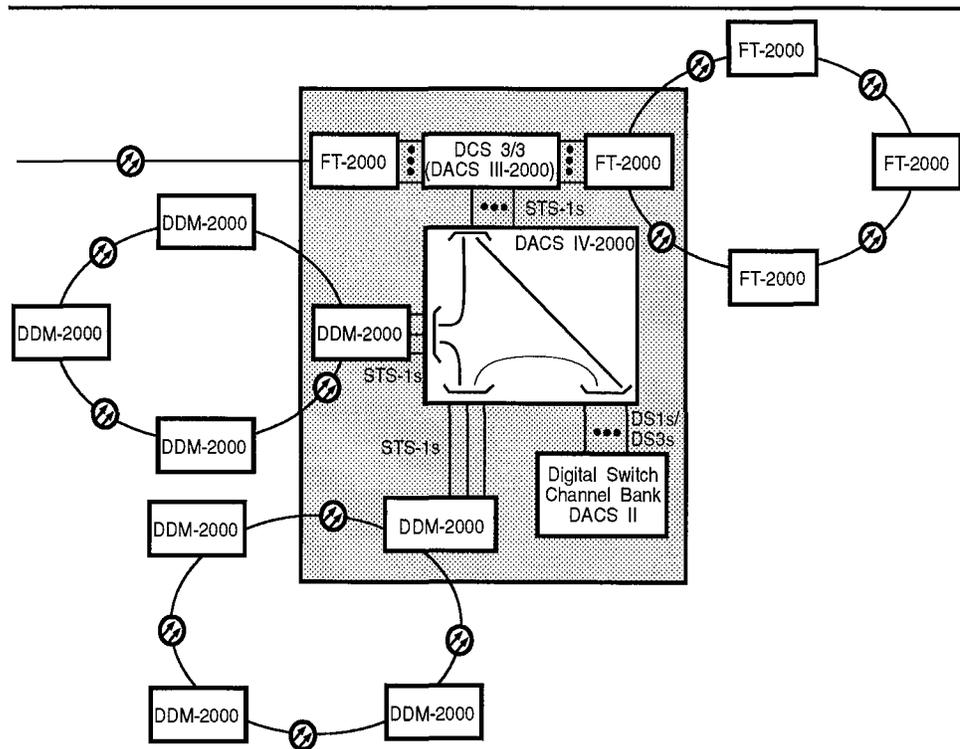


Figure 3-14. DACS IV-2000 Ring Interworking

Centralized Network Control

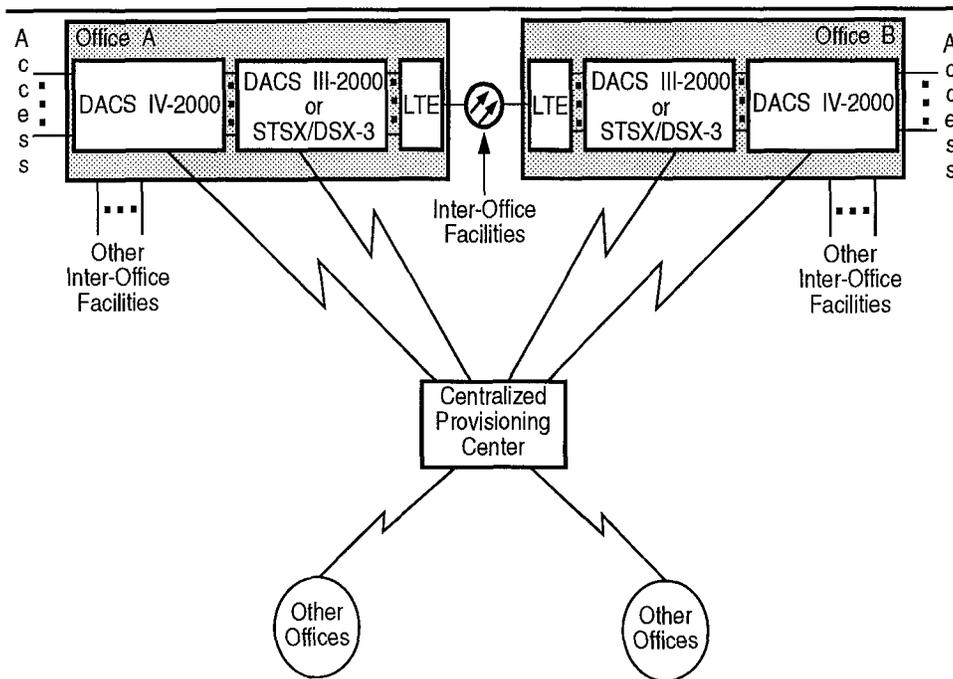
Deployment of the DACS IV-2000 in a network allows centralized control of the network and thus provides greater flexibility, customer responsiveness, and new revenue-generating opportunities, while reducing operating costs. Faster service and facility provisioning time can be provided as well as quick trouble identification and resolution. New service opportunities, such as facility restoration, are made possible by these system features.

Some of the centralized control opportunities using the DACS IV-2000 features and capabilities are network provisioning and network maintenance; they are described below.

Centralized Network Provisioning

The central control allows fast DS1 service and DS1 facility provisioning to provide quick customer response and faster revenue flow.

Figure 3-15 illustrates a centralized provisioning center with an administrative link to the DACS IV-2000 deployed in the network.



Note:

LTE = Lightwave Terminal

Figure 3-15. DACS IV-2000 Centralized Provisioning

Centralized Network Maintenance

The DACS IV-2000 equipment and facility maintenance features and the associated alarm reporting messages can be routed to one or more centralized work centers. (See Figure 3-16.)

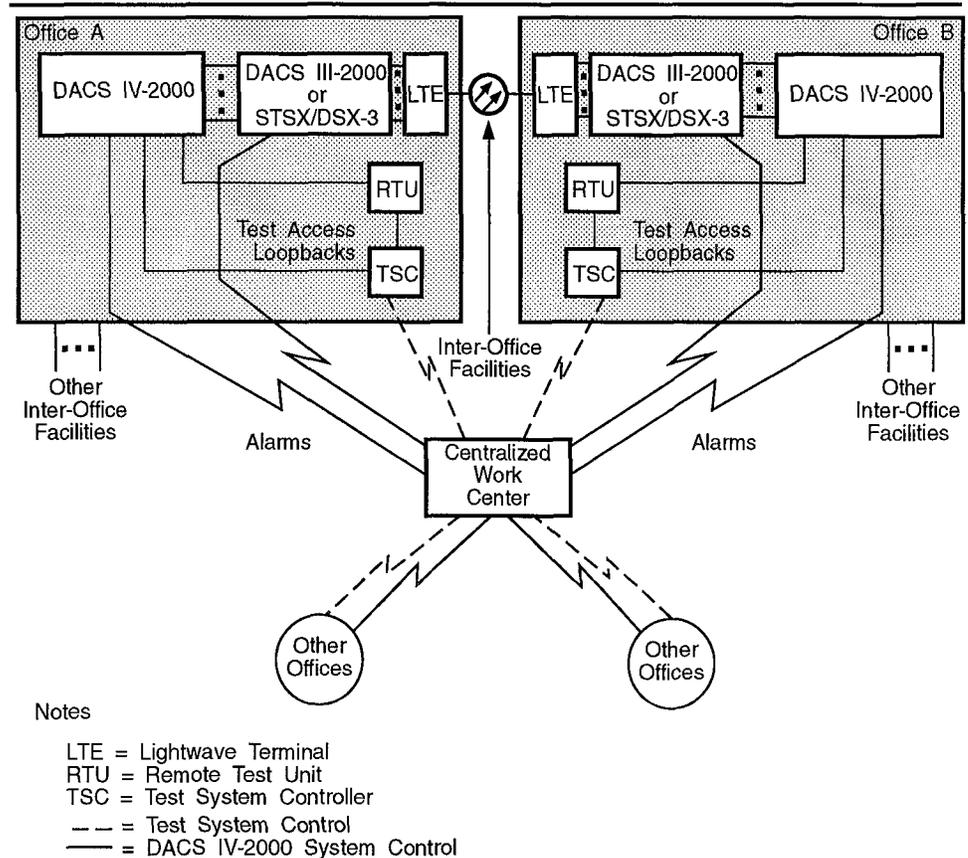


Figure 3-16. DACS IV-2000 Centralized Maintenance

When a centralized DS1 test system is also deployed, testing of any DS1 cross-connected in the DACS IV-2000 can be done from this centralized work center. Trouble isolation is facilitated by the test access, loopback, and alarm features of the DACS IV-2000.

VT1.5/DS1 Hubbing

Hubbing is a well-established network architecture that provides significant savings over a point-to-point network. The DACS IV-2000 can be used to groom VT1.5/DS1 facilities from several end offices, allowing efficient use of the facilities from these offices, as well as between hub offices.

As illustrated in Figure 3-17, when the demand between pairs of offices becomes large enough to justify economically a direct link, a direct link can be constructed, thus relieving part of the load on the hub equipment. The direct link can be either a dedicated EC-1/DS3 facility through-connected in the office or, if the demand is large enough, a dedicated fiber route.

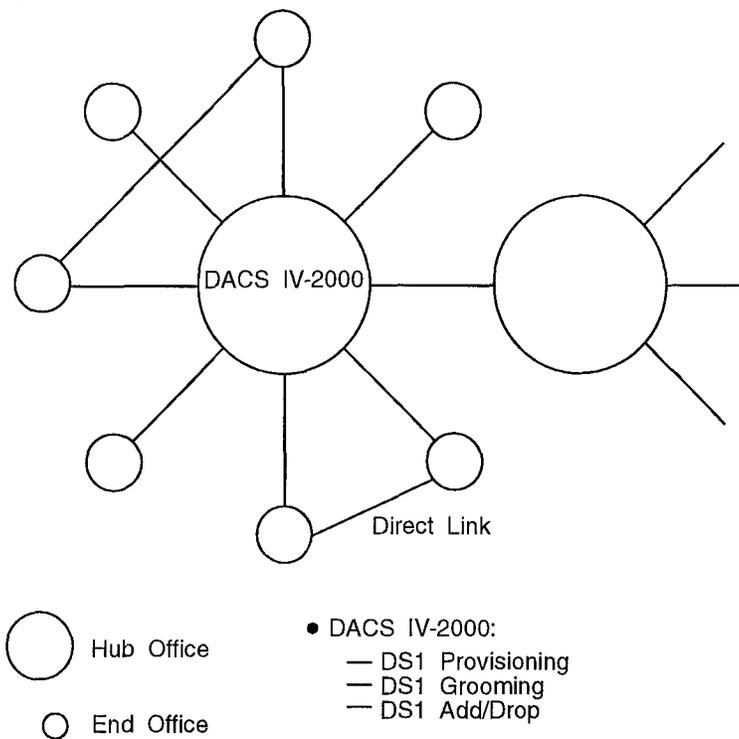


Figure 3-17. DACS IV-2000 Hub Network Application

DS1 Add/Drop

In addition to through VT1.5/DS1s on EC-1/DS3 facilities, DS1s in the EC-1/DS3 facilities may need to be dropped or added at hub office or add/drop locations.

- In a manual environment, add/drop is accomplished using back-to-back multiplexers with a DSX cross-connect frame to access the appropriate DS1s. (See Figure 3-18.)
- With the DACS IV-2000, you do not need back-to-back multiplexers to perform add/drop functions. (See Figure 3-19.)

Figure 3-19 also shows the through-connected VT1.5s/DS1s on the EC-1/DS3 facilities and the DS1-to-DS1 cross-connections within the office.

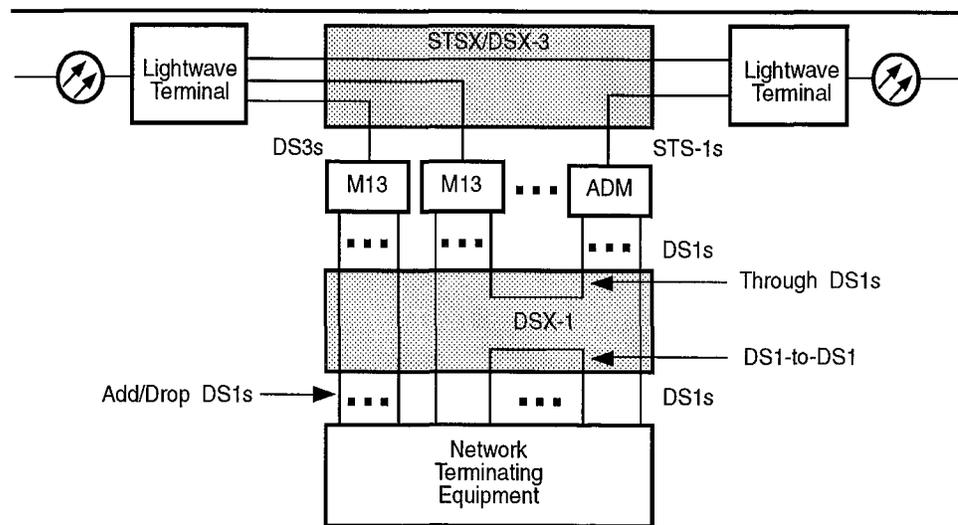


Figure 3-18. DS1 Add/Drop with Multiplexers

Use of the DACS IV-2000 for add/drop functions can result in significant savings in equipment and operating costs, floor space, and DS1 cabling and DSX-1 congestion. In addition, VT1.5s can be dropped from an interoffice facility and interfaced to network terminating equipment at the STS-1 signal level.

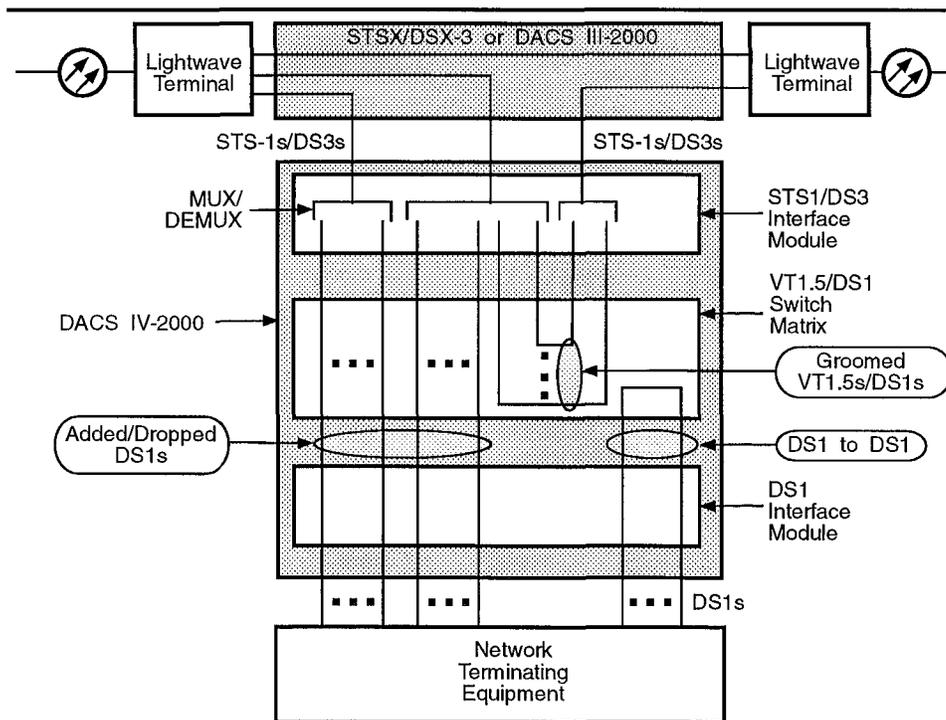


Figure 3-19. DS1 Add/Drop with the DACS IV-2000

Route Restoration

The DACS IV-2000 allows remote and software-controlled route restoration capability for DS1s and VT1.5s, as individual DS1s and DS1 tributaries within DS3s, as tributaries in EC-1s, and for DS1 facilities. The use of the DACS IV-2000 for restoration of STS-1/DS3s (as 28 VT1.5/DS1s) depends on traffic density and grooming requirements. The DACS IV-2000 is generally a more economical restoration tool if it has already been deployed to satisfy VT1.5/DS1 grooming and add/drop needs, and if the number of EC-1/DS3 facilities to be protected is small.

Figure 3-20 shows how the systems in three separate offices communicate with the DACS IV-2000 centralized network administration center to restore transmission following a facility failure. The figure also shows a cut fiber between offices 1 and 2 affecting the normal service path between the two offices. New cross-connections are made electronically to reroute each STS-1/DS3 (as 28 VT1.5/DS1s) affected by the failure onto an unaffected route (dashed lines). Restoration facilities must be available before this can be accomplished.

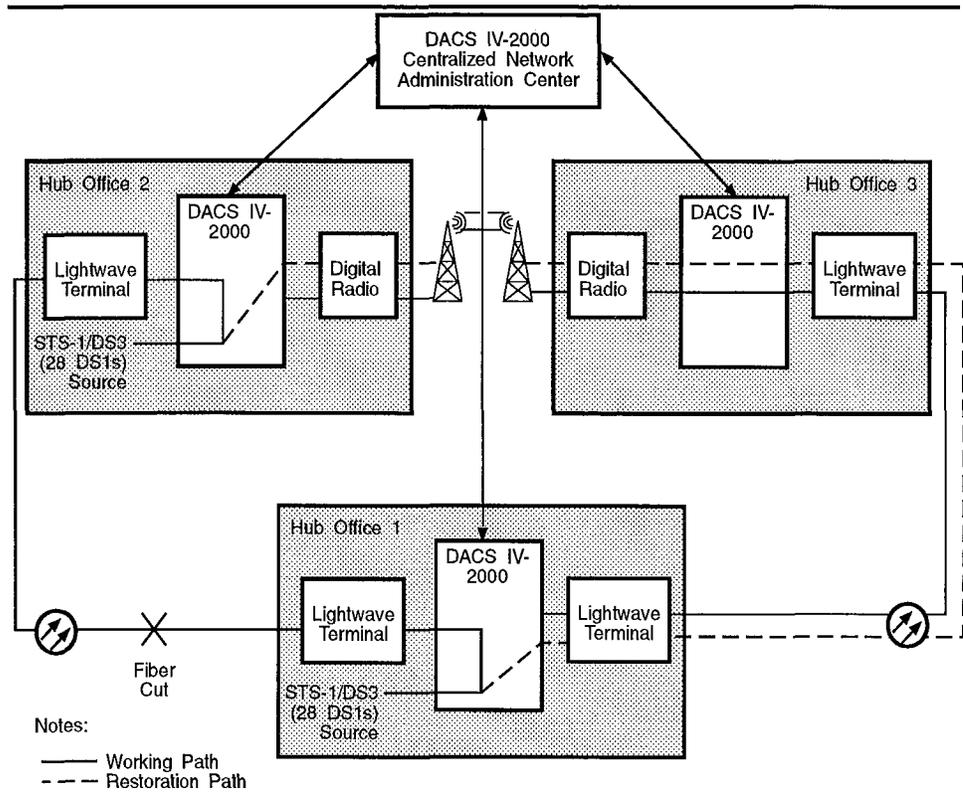


Figure 3-20. Route Restoration with the DACS IV-2000

With the DACS IV-2000, the necessary cross-connections can be made swiftly and accurately under central control. The ability to make the cross-connection electronically from a remote location eliminates the problem of coordinating several technicians at different locations to restore service.

DACS Products Total Network Applications

Figure 3-21 shows a total network application of DACS products and the DACScan-2000 controller. The DACS II provides integrated network access and DS0 hubbing. The DACS IV-2000 provides DS1/VT1.5 hubbing, DS1/VT1.5 route restoration, DS1/VT1.5 add/drop, and access grooming capabilities. All DACS products provide the economic advantages and flexibility of centralized and automated operations, administration, maintenance, and provisioning.

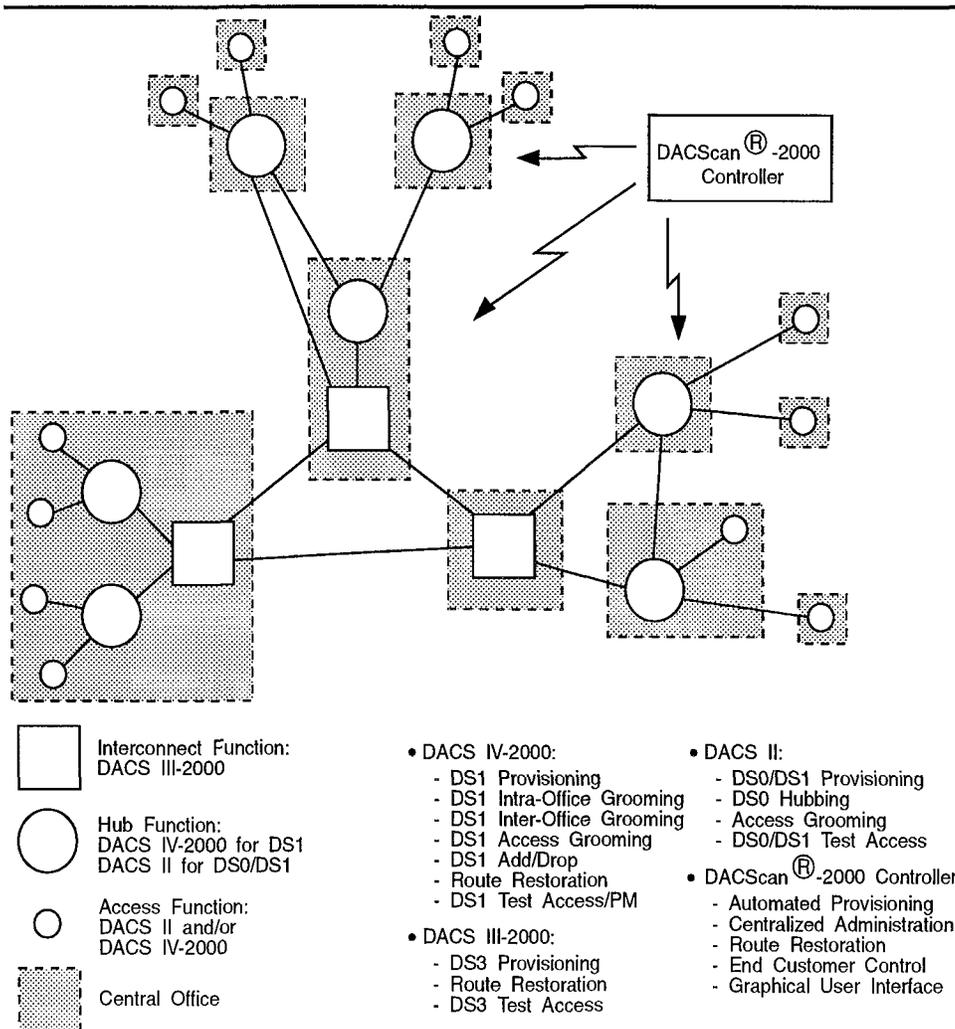


Figure 3-21. DACS Products Total Network Application

Digital Switch Cutover

When an analog-to-digital switch cutover is planned, the DACS IV-2000 can be used to simplify the trunk and, if access is over fiber, the line side cut over from the analog switch to the digital switch. Using a DACS IV-2000 eliminates manual patching and rewiring at the DSX-1 frame, provides continuing operations savings, and positions the office for future enhancements. Figure 3-22 (A) illustrates this application for the trunk side that applies for all switch cutovers.

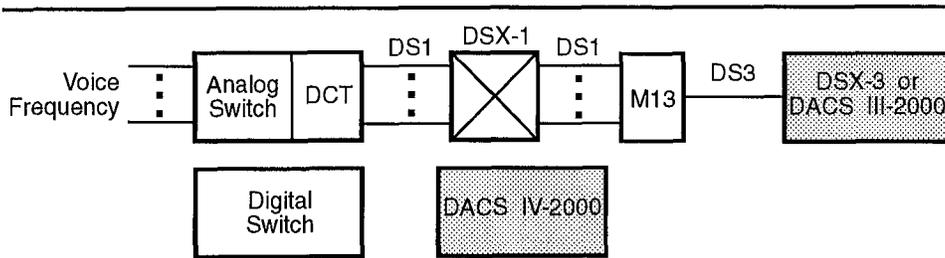
All DS3s that carry circuits on the analog switch are initially in-service rolled over to the DACS IV-2000 and through-connected as shown on Figure 3-22 (B). This places the DACS IV-2000 in series with the original signal path. At the same time, DS1 cabling is installed between the DACS IV-2000 and the new digital switch.

Simultaneously with the voice frequency (VF) side cut from the analog to the digital switch, commands are issued to roll the associated DS1s in the DACS IV-2000 to the new digital switch. Figure 3-22 (C) illustrates the final arrangement. The rolling of the associated DS1s is done over an administrative link by issuing commands at the DACS IV-2000, which eliminates the need to patch and rewire at the DSX-1 frame.

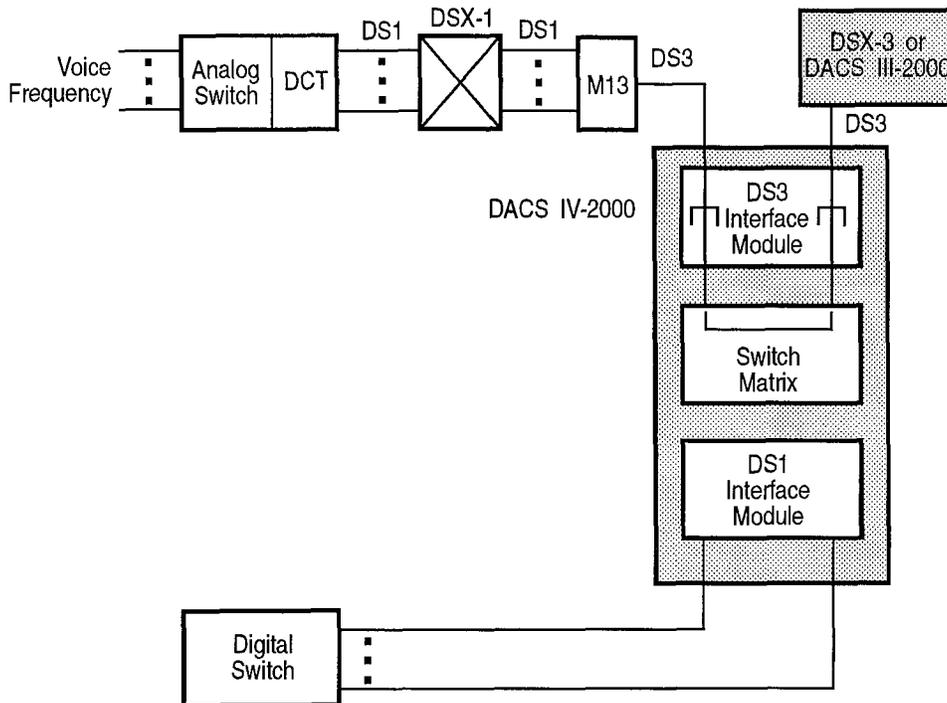
Where access is provided over fiber, both the line side and the trunk side can be simultaneously cut over using the DACS IV-2000. Figure 3-23 shows this procedure.

In addition to through-connecting the trunk side, the access side is through-connected in the DACS IV-2000, as shown in Figure 3-23 (B). This allows simplified board-to-board (office-to-office) testing of the new switch prior to the cutover and results in significant savings. The DACS IV-2000 is used to roll both the access and trunk sides. Also shown in Figure 3-23 (B): the analog switch has been replaced by a digital switch; the access and interoffice DSX-1s and M13 multiplexers have been replaced by the DACS IV-2000; and the Main Distributing Frame and SLC Central Office Terminals have been replaced by a DACS II.

After the switch cutover is complete, the DACS IV-2000 can be used for other grooming and add/drop applications.



A. Initial Configuration

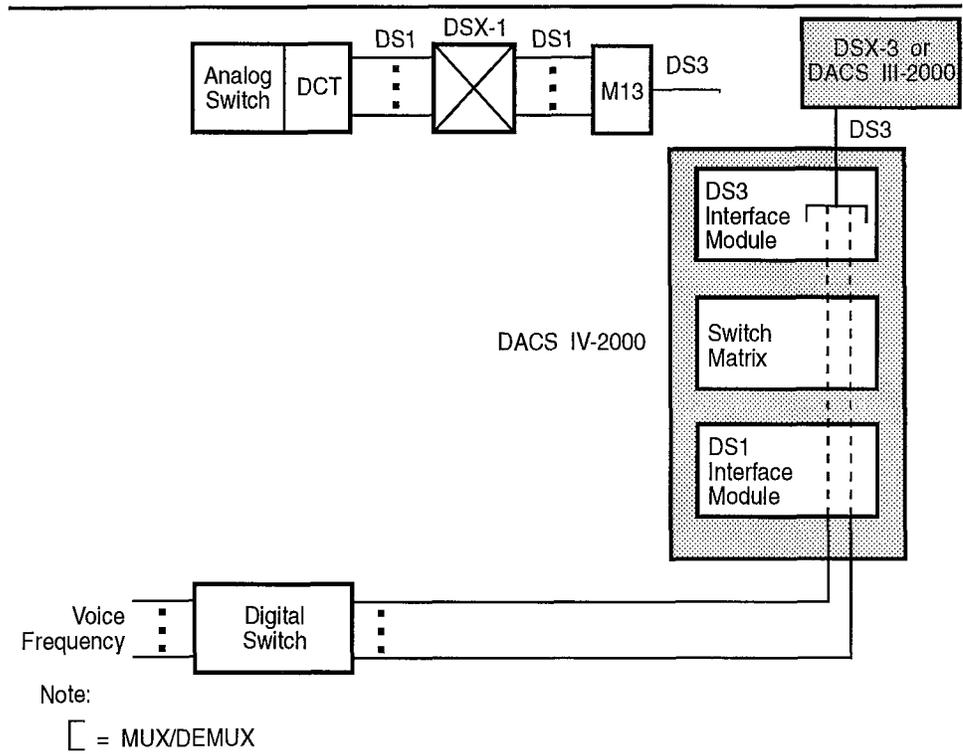


Note:

[] = MUX/DEMUX

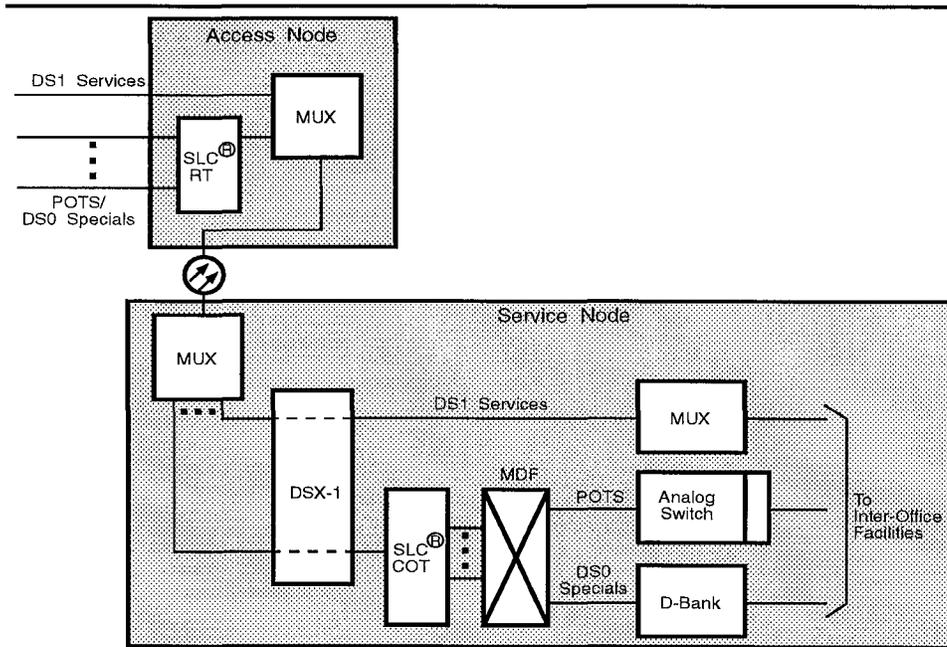
B. DS3s Through-Connected in the DACS IV-2000 System

Figure 3-22. Digital Switch Trunk Side Cutover Assistance (Sheet 1 of 2)

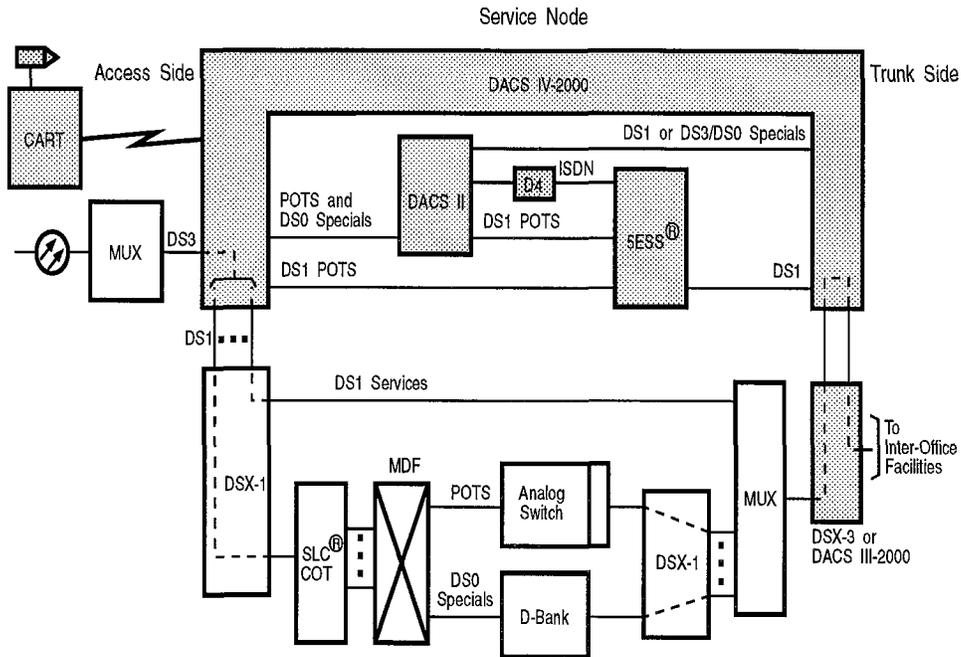


C. After Cutover

Figure 3-22. Digital Switch Trunk Side Cutover Assistance (Sheet 2 of 2)

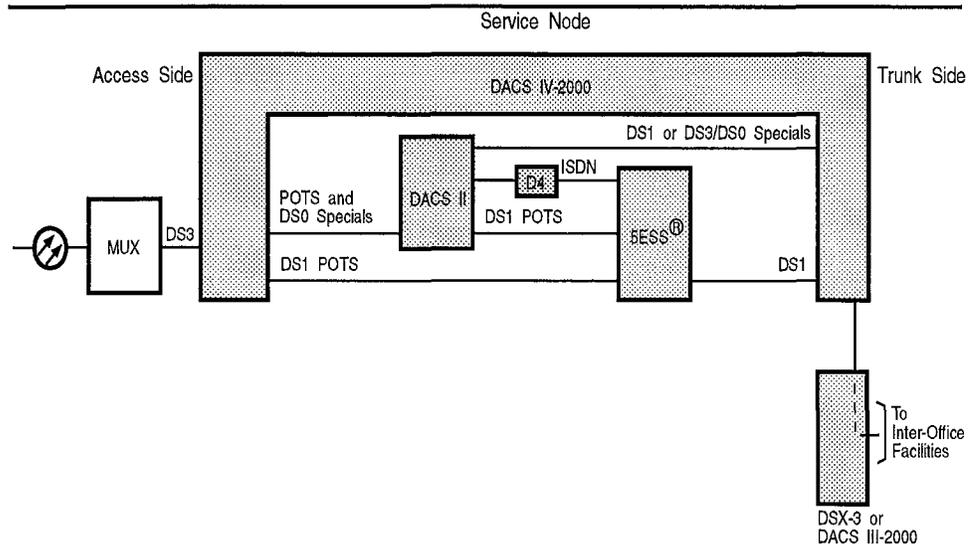


A. Initial Configuration



B. DS3s Through-Connected in the DACS IV-2000 System

Figure 3-23. Digital Switch Fiber Access Cutover Assistance (Sheet 1 of 2)



C. After Cutover

Figure 3-23. Digital Switch Fiber Access Cutover Assistance (Sheet 2 of 2)

Ordering Information

4

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Ordering Information

4

This chapter contains ordering lists for the DACS IV-2000 (256) Release 5.0 hardware and software.

Figure 4-1 shows the possible bay arrangements for the DACS IV-2000 (256). It illustrates how the four types of interface bays can be configured to accommodate any changing DS1, DS3, and EC-1 facility under the cabling constraint that no more than 124/120 equivalent DS3/STS-1 lines be connected on either side of the Switch Bay. The Switch Bay (bay position 5) must be filled first; bays can then be added to the left, then to the right. A maximum of two STS1/DS3/DS1 Interface Bays, DS3 Interface Bays, or STS1/DS3 Interface Bays, or four DS1 Interface Bays can be located on either side of the Switch Bay.

Table 4-1 provides a cross-reference between equipment names and equipment codes for the DACS IV-2000 (256) Release 5.0 circuit packs.

⇒ NOTE:

The information in this chapter is provided as a guide and is subject to change. It is not intended to replace standard engineering documentation, e.g., schematic drawings and equipment drawings. More detailed, and the most current, J-specification ordering information is available from your AT&T account executive.

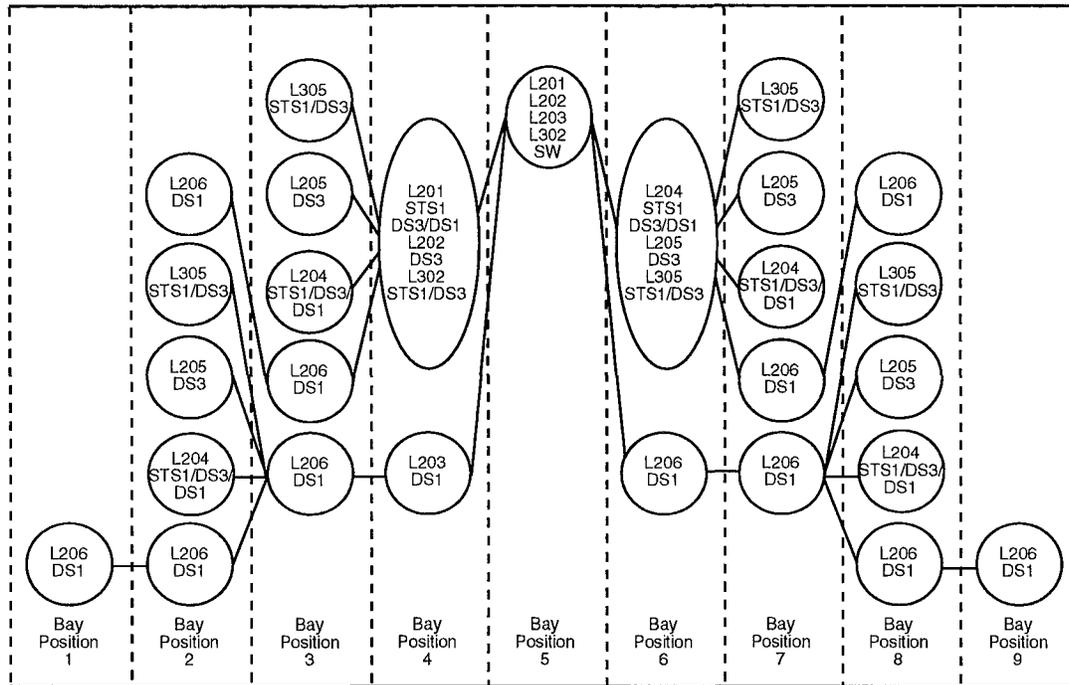


Figure 4-1. Possible Bay Arrangements for the DACS IV-2000 (256)

Table 4-1. Circuit Pack Equipment

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required
AWR-type filler assembly	846103760	SW Mod	As required*
AWS-type filler assembly	846960664	SYNC Mod	2
BXA1 (bus extender A 1)	AKM64	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3 CC INTFC-16 Mod ENH DS3 INTFC-16 Mod STS1 INTFC-16 Mod	As required [†]
CLKDR1 (clock distributor 1)	AKM56	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3 CC INTFC-16 Mod ENH DS3 INTFC-16 Mod STS1 INTFC-16 Mod	2 per module 4 per module
CLKGN2 (clock generator 2)	AKM90	SW Mod	2 ^{††}
CLKGN3 (clock generator 3)	AWR11	SW Mod	2 ^{††}
CPU2 (central processing unit 2)	AWP6	RC Mod	2
DPLL2 (digital phase lock loop 2)	AWP15	SYNC Mod	2
DS1IF1 (DS1 interface 1)	AKM46/AKM46B	DS1 INTFC Mod DS1 INTFC-P Mod	2-16 per module** 2-14 per module
DS1IP1 (DS1 interface protection 1)	AKM47	DS1 INTFC-P Mod	2 per module
DS1RY1 (DS1 relay 1)	AKM48	DS1 INTFC Mod DS1 INTFC-P Mod	4 per module

Table continued on next page; notes are listed at end of table.

Table 4-1. Circuit Pack Equipment (Continued)

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required
DS1TX2 (DS1 timing extractor 2)	AWS9	SYNC Mod	2
ECI3 (enhanced communications interface 3)	AWP8	RC Mod	2
Fan assembly	ED-9C130-30,G1	SW Bay	1 per bay
Fan assembly	ED-9C130-30,G2	STS1/DS3 Bay	1 per bay
FBA (fuse board A)	ED-2C962-30,G1	SW PWR Mod	1
FBB (fuse board B)	ED-2C960-30,G1	SW PWR Mod	4
FBC (fuse board C)	ED-2C963-30,G1	SW PWR Mod	1
FBD (fuse board D)	ED-2C961-30,G1	SW PWR Mod	4
FBF (fuse board F)	ED-9C051-30,G2	RC PWR Mod	1
FBG (fuse board G)	ED-9C052-30,G2	RC PWR Mod	1
FBH (fuse board H)	ED-9C053-30,G3	RC PWR Mod	1
FBI (fuse board I)	ED-9C055-30,G1	RC PWR Mod	1
MTC3 (maintenance interface 3)	AWR10	RC Mod	2 ^{††}
MUX2 (multiplexer 2)	AKM68B	DS3 INTFC-16 Mod DS3 INTFC-32 Mod	1-15 per module [‡] 1-31 per module [‡]
MUXP2 (multiplexer protection 2)	AKM70	DS3 INTFC-16 Mod DS3 INTFC-32 Mod	1 per module [‡] 1 per module [‡]
MUX3 (multiplexer 3)	AKM91	DS3 INTFC-16 Mod DS3 CC INTFC-16 Mod ENH DS3 INTFC-16 Mod	1-15 per module 1-15 per module ^{‡‡} 1-15 per module
MUXP3 (multiplexer protection 3)	AKM92	DS3 INTFC-16 Mod DS3 CC INTFC-16 Mod ENH DS3 INTFC-16 Mod	1 per module ^{‡‡}

Table continued on next page; notes are listed at end of table.

Table 4-1. Circuit Pack Equipment (Continued)

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required
MUXPS1 (multiplexer protection switch 1)	AKM53	DS3 INTFC-16 Mod DS3 INTFC-32 Mod STS1 INTFC-16 Mod	1 per module
PMGR1 (performance monitor test signal generator receiver 1) [optional]	AKM66	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod	1-8§ 1-7§ 1-14§ 1-16§
PRI5 (primary off-line storage 5)	ERB5	RC Mod	2
PWRA (power A; standard power configuration)	552A2	SW PWR Mod	4
PWRA (power A; duplex power configuration)	566A	SW PWR Mod	4
PWRE3 (power E3)	556C	AUX PWR Mod DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3 CC INTFC-16 Mod ENH DS3 INTFC-16 Mod STS1 INTFC-16 Mod	2 per module
PWRF (power F)	427AB	RC PWR Mod	2
PWRG (power G)	428AA	RC PWR Mod	2
SCI3 (switch communications interface 3)	AWR2C	RC Mod	2
SEC5 (secondary off-line storage 5)	ERB6	RC Mod	1
SMUX1 (SONET multiplexer 1)	AKM84	STS1 INTFC-16 Mod	1-15 per module‡

Table continued on next page; notes are listed at end of table.

Table 4-1. Circuit Pack Equipment (Continued)

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required
SMUXP1 (SONET multiplexer protection 1)	AKM85	STS1 INTFC-16 Mod	1 per module [†]
SSC5 (secondary storage controller 5)	AWP14	RC Mod	2
STPNL (status panel)	ED-9C049-30,G2	RC Mod	1
SWCS2 (switch center stage 2)	AWS1B	SW Mod	32
SWIF2 (switch interface 2)	AKM50	DS1 INTFC Mod DS1 INTFC-P Mod	1-8 per module
SWIO1 (switch input/output 1)	AWR6	SW Mod	2-32**
TBS32 (stratum 3 time base oscillator 2)	AWS8	SYNC Mod	2
UC2 (unit controller 2)	AKM59B	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3 CC INTFC-16 Mod ENH DS3INTFC-16 Mod STS1 INTFC-16 Mod	1 per module
UI2 (unit interface 2)	AWR12	RC Mod	1

Notes:

- * The AWR-type filler assemblies are installed in the switch module in place of AWR6 (SWIO1) circuit packs when the switch module is not equipped with the full complement of 32 AWR6 circuit packs.
- † The AKM64 circuit packs are used in these modules when they are not filled to capacity with AKM46B, AKM50, AKM68B, or AKM84 circuit packs.
- ‡ One protection and at least one service circuit pack must be installed.
- ** Must be installed in adjacent pairs.
- †† Must use two identical MTC3 circuit packs (slots labeled MTC); two identical CLKGN3 circuit packs (CLKGN2 for non-SONET applications running without the synchronizer).
- ‡‡ MUX2 and MUX3 circuit packs may not be mixed in a clear-channel module; only MUX3 may be used.
- ¶ Required if one or more MUX3 circuit packs are used in a module.
- § PMGR is an optional circuit pack that can be used to replace only SWIF or MUX circuit packs. (It cannot be used as a replacement for an SMUX circuit pack.)

Hardware (J98786A-1) Lists

This section supplies list numbers and other component information grouped for your ordering convenience. Quantities necessary for a given configuration are also listed.

The J-drawing number associated with all the lists is J98786A-1. It should be used for complete ordering information.

This section provides ordering information for:

- Startup systems
- Growth bays
- Startup modules
- Interface circuit packs
- BNC interconnect panels
- EMC enclosures
- Release 5.0 retrofits
- TTY connector adapters (ED-2C646-30)
- Fuses
- Miscellaneous equipment.

The AT&T sparing recommendations are given below.

Sparing

The AT&T circuit pack recommendation is 10 percent per circuit pack code, with a minimum of one spare per code. However, operating company sparing policies should prevail.

The fuse sparing recommendation is 5 percent per fuse value, with a minimum of five spares per value.

Replacement LEDs

Replacement LEDs for the ED-9C130-30,G1 or ED-9C130,G2 fan assembly can be ordered from McLean Engineering, Inc., Princeton Junction, New Jersey.

Startup Systems

Lists 201, 67, 80, 364, 260, 262, and AB

Framework, assembly, wiring, equipment, and circuit packs for the initial two bays, which comprise one Switch Bay with redundant controller (including enhanced Secondary Storage Subsystem) and synchronizer, and one STS1/DS3/DS1 Interface Bay with interfacing for the first 28 DS1 and first DS3 or STS-1 service signals and with switching for the first 420 DS1, 15 DS3, or 15 STS-1 service signals. If a DS3 Interface-16 Module is to be used as an Enhanced DS3 Interface-16 Module or as a DS3 CC Interface-16 Module, List 260 and/or List 262 is required.

If the lower DS3 Interface-16 Module is to be used as an STS1 Interface-16 Module, List 344 is also required. (List 344 is provided later in this section under "Interface Circuit Packs.")

Maximum: One List 201 per frame

(1) ED-2C975-30,G1, G4, G7, GA, GB	Initial Bay Framework (including two temporary cable end guard assemblies)
(2) AKM46B	DS1IF1 (DS1 interface 1)
(2) AKM47	DS1IP1 (DS1 interface protection 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(2) AKM50	SWIF2 (switch interface 2)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(4) AKM56	CLKDR1 (clock distributor 1)
(2) AKM59B	UC2 (unit controller 2)
(2) AKM64	BXA1 (bus extender 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(4) AWR6	SWIO1 (switch input/output 1)
(32) AWS1B	SWCS2 (switch center stage 2)
(4) 552A2	PWRA (power A)
(6) 556C	PWRE3 (power E3)
(4) ED-2C960-30,G1	FBB (fuse board B)
(4) ED-2C961-30,G1	FBD (fuse board D)
(1) ED-2C962-30,G1	FBA (fuse board A)
(1) ED-2C963-30,G1	FBC (fuse board C)
(8) 70G	0.5A Fuse
(8) KS-19780,L2	10A Fuse

List 67

Equipment, power, and circuit packs required in addition to List 201, 202, or 203 to provide a redundant controller/auxiliary power/synchronizer shelf assembly with enhanced secondary storage. (Do not order with List 63.)

(1) ED-2C975-30,G18	Initial Bay Framework
(2) AWP6	CPU2 (central processing unit 2)
(2) AWP8	ECI3 (enhanced communications interface 3)
(2) AWP14	SSC5 (secondary storage controller 5)
(2) AWR2C	SCI3 (switch communications interface 3)
(2) AWR10	MTC3 (maintenance interface 3)
(1) AWR12	UI2 (unit interface 2)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(2) 428AA	PWRG (power G)
(1) ED-9C049-30,G2	STPNL (status panel)
(1) ED-9C051-30,G2	FBF (fuse board F)
(1) ED-9C052-30,G2	FBG (fuse board G)
(1) ED-9C053-30,G3	FBH (fuse board H)
(1) ED-9C055-30,G1	FBI (fuse board I)

List 80

Wiring and equipment required in addition to List 201 to provide for redundant power operation (duplex power option).

(4) 566A	PWRA (power A)
----------	----------------

List 364

Circuit packs required in addition to List 63, 67, or 302, or in addition to List 361, for field modification to provide enhanced synchronization.

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack

NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the I/O interface modules is CC847201001.

List 260

Circuit packs required in addition to List 201 or 204 to provide interfacing and protection for the first DS3 service signal in an unequipped DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 260 per module.

- | | |
|-----------|----------------------------------|
| (1) AKM91 | MUX3 (multiplexer 3) |
| (1) AKM92 | MUXP3 (multiplexer protection 3) |

⇒ NOTE:
List 260 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 262

Circuit packs required in addition to List 201, 204, 302, or 305, or for field modification to provide interfacing for an additional DS3 service signal in a DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 241.)

Maximum: Fourteen List 262 per module.

(1) AKM91 MUX3 (multiplexer 3)



NOTE:

List 262 requires Release 5.0 or later.



NOTE:

In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.



NOTE:

When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List AB

Rearrangement of internal DACS IV-2000 local cabling to support the duplex power configuration. (Future shipments will automatically contain this arrangement.)

Startup Systems (Continued)

Lists 202, 67, 80, and 364

Framework, assembly, wiring, equipment, and circuit packs for the initial two bays, which comprise one Switch Bay with redundant controller (including enhanced Secondary Storage Subsystem) and synchronizer, and one DS3 Interface Bay with interfacing for the first DS3 service signal and with switching for the first 15 DS3 service signals.

List 202

Maximum: One List 202 per frame

(1) ED-2C975-30, G2, G4, G7, GB	Initial Bay Framework (including two temporary cable end guard assemblies)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(4) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(2) AWR6	SWIO1 (switch input/output 1)
(32) AWS1B	SWCS2 (switch center stage 2)
(4) 552A2	PWRA (power A)
(4) 556C	PWRE3 (power E3)
(4) ED-2C960-30, G1	FBB (fuse board B)
(4) ED-2C961-30, G1	FBD (fuse board D)
(1) ED-2C962-30, G1	FBA (fuse board A)
(1) ED-2C963-30, G1	FBC (fuse board C)
(4) 70G	0.5A Fuse
(4) KS-19780, L2	10A Fuse

List 67

Equipment, power, and circuit packs required in addition to List 201, 202, or 203 to provide a redundant controller/auxiliary power/synchronizer shelf assembly with enhanced secondary storage. (Do not order with List 63.)

(1) ED-2C975-30,G18	Initial Bay Framework
(2) AWP6	CPU2 (central processing unit 2)
(2) AWP8	ECI3 (enhanced communications interface 3)
(2) AWP14	SSC5 (secondary storage controller 5)
(2) AWR2C	SCI3 (switch communications interface 3)
(2) AWR10	MTC3 (maintenance interface 3)
(1) AWR12	UI2 (unit interface 2)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(2) 428AA	PWRG (power G)
(1) ED-9C049-30,G2	STPNL (status panel)
(1) ED-9C051-30,G2	FBF (fuse board F)
(1) ED-9C052-30,G2	FBG (fuse board G)
(1) ED-9C053-30,G3	FBH (fuse board H)
(1) ED-9C055-30,G1	FBI (fuse board I)

List 80

Wiring and equipment required in addition to List 202 to provide for redundant power operation (duplex power option).

(4) 566A	PWRA (power A)
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List 364

Circuit packs required in addition to List 63, 67, or 302, or in addition to List 361, for field modification to provide enhanced synchronization.

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack



NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the I/O interface modules is CC847201001.

Startup Systems (Continued)

Lists 203, 67, 80, 364, and AC

Framework, assembly, wiring, equipment, and circuit packs for the initial two bays, which comprise one Switch Bay with redundant controller (including enhanced Secondary Storage Subsystem) and synchronizer, and one DS1 Interface Bay with interfacing for the first 28 DS1 service signals and with switching for the first 420 DS1 service signals.

List 203

Maximum: One List 203 per frame

(1) ED-2C975-30,G5, G7, GB	Initial Bay Framework (including two temporary cable end guard assemblies)
(2) AKM46B	DS1IF1 (DS1 interface 1)
(2) AKM47	DS1IP1 (DS1 interface protection 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(2) AKM50	SWIF2 (switch interface 2)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(4) AKM64	BXA1 (bus extender 1)
(4) AWR6	SWIO1 (switch input/output 1)
(32) AWS1B	SWCS2 (switch center stage 2)
(4) 552A2	PWRA (power A)
(4) 556C	PWRE3 (power E3)
(4) ED-2C960-30,G1	FBB (fuse board B)
(4) ED-2C961-30,G1	FBD (fuse board D)
(1) ED-2C962-30,G1	FBA (fuse board A)
(1) ED-2C963-30,G1	FBC (fuse board C)
(8) 70G	0.5A Fuse
(8) KS-19780,L2	10A Fuse

List 67

Equipment, power, and circuit packs required in addition to List 201, 202, or 203 to provide a redundant controller/auxiliary power/synchronizer shelf assembly with enhanced secondary storage. (Do not order with List 63.)

(1) ED-2C975-30,G18	Initial Bay Framework
(2) AWP6	CPU2 (central processing unit 2)
(2) AWP8	ECI3 (enhanced communications interface 3)
(2) AWP14	SSC5 (secondary storage controller 5)
(2) AWR2C	SCI3 (switch communications interface 3)
(2) AWR10	MTC3 (maintenance interface 3)
(1) AWR12	UI2 (unit interface 2)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(2) 428AA	PWRG (power G)
(1) ED-9C049-30,G2	STPNL (status panel)
(1) ED-9C051-30,G2	FBF (fuse board F)
(1) ED-9C052-30,G2	FBG (fuse board G)
(1) ED-9C053-30,G3	FBH (fuse board H)
(1) ED-9C055-30,G1	FBI (fuse board I)

List 80

Wiring and equipment required in addition to List 203 to provide for redundant power operation (duplex power option).

(4) 566A	PWRA (power A)
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List 364

Circuit packs required in addition to List 63, 67, or 302, or in addition to List 361, for field modification to provide enhanced synchronization.

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack

⇒ NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the I/O interface modules is CC847201001.

List AC

Rearrangement of internal DACS IV-2000 local cabling to support the duplex power configuration. (Future shipments will automatically contain this arrangement.)

Startup Systems (Continued)

Lists 302, 68, 80, 364, 261, 262, AD, and AJ

Framework, assembly, wiring, equipment, and circuit packs for the initial two bays; comprises the Switch Bay with redundant controller (including enhanced Secondary Storage Subsystem) and synchronizer, and one STS1/DS3 Interface Bay with switching for the first 15 STS-1 or DS3 service signals. If an STS1 Interface-16 Module is to be used as an Enhanced DS3 Interface-16 Module or as a DS3 CC Interface-16 Module, List 261 and/or 262 is required.

If the lower DS3 Interface-16 Module is to be used as an STS1 Interface-16 Module, List 344 is required. (See Interface Circuit Packs later in this section.)

List 302

Maximum: One List 302 per frame

- | | |
|---------------------|--|
| (1) ED-2C975-30,G14 | Initial Bay Framework (including two temporary cable end guard assemblies and built-in redundant controller) |
| (2) AWP6 | CPU2 (central processing unit 2) |
| (2) AWP7 | SSC2 (secondary storage controller 2) |
| (2) AWP8 | ECI3 (enhanced communications interface 3) |
| (2) AWR2C | SCI3 (switch communications interface 3) |
| (2) AWR6 | SWIO1 (switch input/output 1) |
| (2) AWR10 | MTC3 (maintenance interface 3) |
| (1) AWR12 | UI2 (unit interface 2) |
| (32) AWS1B | SWCS1 (switch center stage 1) |
| (2) 427AB | PWRP (power F) |
| (2) 428AA | PWRG (power G) |
| (4) 552A2 | PWRA (power A) |
| (2) 556C | PWRE3 (power E3) |
| (1) ED-9C046-30,G1 | PRI2 (primary off-line storage 2) |
| (1) ED-9C049-30,G2 | STPNL (status panel) |
| (1) ED-9C050-30,G1 | SEC2 (secondary off-line storage 2) |
| (1) ED-9C051-30,G1 | FBF (fuse board F) |
| (1) ED-9C052-30,G1 | FBG (fuse board G) |
| (1) ED-9C053-30,G2 | FBH (fuse board H) |
| (1) ED-9C055-30,G1 | FBI (fuse board I) |
| (4) ED-2C960-30,G1 | FBB (fuse board B) |
| (4) ED-2C961-30,G1 | FBD (fuse board D) |
| (1) ED-2C962-30,G1 | FBA (fuse board A) |
| (1) ED-2C963-30,G1 | FBC (fuse board C) |
| (10) 70G | 0.5A Fuse |
| (10) KS-19780,L2 | 10A Fuse |

List 68

Power and circuit packs required in addition to List 302 to provide enhanced secondary storage (factory upgrade).

(2) AWP14	SSC5 (secondary storage controller 5)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(3) WP90247,L313	5A Fuse



NOTE:

Labels and fuses are provided for the following upgrades:

ED-9C051-30, G1 to G2
ED-9C052-30, G1 to G2
ED-9C053-30, G2 to G3

List 80

Wiring and equipment required in addition to List 302 to provide for redundant power operation (duplex power option).

(4) 566A	PWRA (power A)
----------	----------------

List 364

Circuit packs required in addition to List 63, 67, or 302, or in addition to List 361, for field modification to provide enhanced synchronization.

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack

List 261

Circuit packs required in addition to List 302 or 305 to provide interfacing and protection for the first DS3 service signal in an unequipped STS1/DS3 Interface (16 STS1/DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 243.)

Maximum: One List 261 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(2) 556C	PWRE3 (power E3)

⇒ NOTE:
List 261 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 262

Circuit packs required in addition to List 201, 204, 302, or 305, or for field modification to provide interfacing for an additional DS3 service signal in a DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 241.)

Maximum: Fourteen List 262 per module.

(1) AKM91 MUX3 (multiplexer 3)



NOTE:

List 262 requires Release 5.0 or later.



NOTE:

In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.



NOTE:

When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List AD

Rearrangement of internal DACS IV-2000 local cabling to support the duplex power configuration. (Future shipments will automatically contain this arrangement.)

List AJ

Equipment always required in addition to List 302.

(1) ED-2C975-30,GP Initial Bay Framework



NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the I/O interface modules is CC847201001.

Growth Bays

List 204

Framework, assembly, wiring, equipment, and circuit packs for a growth bay to support Release 5.0 features; comprises an STS1/DS3/DS1 Interface Bay with interfacing for 28 DS1 service signals and one DS3 service signal and with switching for an additional 420 DS1 and 15 DS3 service signals.

If the lower DS3 Interface-16 Module is to be used as an STS1 Interface-16 Module, List 344 is also required. (List 344 is provided later in this section under "Interface Circuit Packs.")

If a DS3 Interface-16 Module is to be used as an Enhanced DS3 Interface-16 Module or as a DS3 CC Interface-16 Module, List 259, 260, and/or 262 is also required.

Maximum: Three List 204 per frame

(1) ED-2C934-30, G1,GA,GB	STS1/DS3/DS1 Interface Bay Framework
(2) AKM46B	DS1IF1 (DS1 interface 1)
(2) AKM47	DS1IP1 (DS1 interface protection 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(2) AKM50	SWIF2 (switch interface 2)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(4) AKM56	CLKDR1 (clock distributor 1)
(2) AKM59B	UC2 (unit controller 2)
(2) AKM64	BXA1 (bus extender 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(4) AWR6	SWIO1 (switch input/output 1)
(4) 556C	PWRE3 (power E3)
(8) 70G	0.5A Fuse
(8) KS-19780,L2	10A Fuse

List 205

Framework, assembly, wiring, equipment, and circuit packs for a growth bay to support Release 5.0 features; comprises a DS3 Interface Bay with interfacing for one DS3 service signal and with switching for an additional 15 DS3 service signals in the switch shelf assembly.

Maximum: Three List 205 per frame

(1) ED-2C968-30, G1,GA	DS3 Interface Bay Framework
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(4) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(2) AWR6	SWIO1 (switch input/output 1)
(2) 556C	PWRE3 (power E3)
(4) 70G	0.5A Fuse
(4) KS-19780,L2	10A Fuse

List 206

Framework, assembly, wiring, equipment, and circuit packs for a growth bay to support Release 5.0 features; comprises a DS1 Interface Bay with interfacing for 28 DS1 service signals and with switching for an additional 420 DS1 service signals.

Maximum: Seven List 206 per frame

(1) ED-2C870-30, G1	DS1 Interface Bay Framework
(2) AKM46B	DS1IF1 (DS1 interface 1)
(2) AKM47	DS1IP1 (DS1 interface protection 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(2) AKM50	SWIF2 (switch interface 2)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(4) AKM64	BXA1 (bus extender 1)
(2) AWR6	SWIO1 (switch input/output 1)
(2) 556C	PWRE3 (power E3)
(8) 70G	0.5A Fuse
(8) KS-19780,L2	10A Fuse

List 305

Framework, assembly, wiring, and equipment for a growth bay; comprises one STS1/DS3 Interface Bay to accommodate interfacing for an additional 60 STS-1 or 60 DS3 service signals and four protection lines and with circuit packs for switch interfacing for an additional 15 STS-1 or 15 DS3 service signals in the switch shelf assembly.

When List 305 is equipped with List 341, the main switch must be equipped with a redundant controller and Synchronizer Module.

If an STS1 Interface-16 Module is to be used as an Enhanced DS3 Interface-16 Module or as a DS3 CC Interface-16 Module, List 259, 261, and/or 262 is also required.

Maximum: Three List 305 per frame

(1) ED-9C090-30, G1	STS-1/DS3 Interface Bay Framework
(2) AWR6	SWIO1 (switch input/output 1)
(10) 70G	0.5A Fuse
(10) KS-19780,L2	10A Fuse

NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the I/O interface modules is CC847201001.

List 259

Circuit packs required for field modification of List 201, 204, 302, or 305 to provide interfacing for the first DS3 service signal in a 16 DS3 or 16 STS1/DS3 module only, for Release 5.0 and above. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 259 per List 201 or 204
Three List 259 per List 302 or 305

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)

NOTE:

List 259 requires Release 5.0 or later.

NOTE:

In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

NOTE:

When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 260

Circuit packs required in addition to List 201 or 204 to provide interfacing and protection for the first DS3 service signal in an unequipped DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 260 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)

⇒ NOTE:
List 260 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 261

Circuit packs required in addition to List 302 or 305 to provide interfacing and protection for the first DS3 service signal in an unequipped STS1/DS3 Interface (16 STS1/DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 243.)

Maximum: One List 261 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(2) 556C	PWRE3 (power E3)

⇒ NOTE:
List 261 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 262

Circuit packs required in addition to List 201, 204, 302, or 305, or for field modification to provide interfacing for an additional DS3 service signal in a DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 241.)

Maximum: Fourteen List 262 per module.

(1) AKM91 MUX3 (multiplexer 3)

⇒ NOTE:
List 262 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

Startup Modules

List 230

Circuit packs required in addition to List 1, 3, 4, or 6 (if List 1 or 3 is equipped with List 251) or in addition to List 201, 203, 204, or 206 to provide interfacing for the first 28 DS1 signals with Release 5.0 support in an unequipped DS1 Interface Module.

Maximum: One List 230 per List 1, 4, 201, or 204
Three List 230 per List 3, 6, 203, or 206

(2) AKM46B	DS1IF1 (DS1 interface 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(1) AKM50	SWIF2 (switch interface 2)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(2) 556C	PWRE3 (power E3)

List 240

Circuit packs required in addition to List 1, 2, 4, or 5 (if List 1 or 2 is equipped with List 251) or in addition to List 201, 202, 204, or 205 to provide interfacing for the first DS3 signal with Release 5.0 support in an unequipped DS3 Interface-32 Module

Maximum: One List 240 per List 1, 2, 4, 5, 201, 202, 204, or 205

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(4) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(2) 556C	PWRE3 (power E3)

List 243

Circuit packs required in addition to List 302 or 305 to provide interfacing for the first DS3 service signals in an unequipped STS1/DS3 Interface-16 Module. (Do not order with List 261.)

Maximum: Four List 243 per List 302 or 305

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(2) 556C	PWRE3 (power E3)

List 343

Circuit packs required in addition to List 302 or 305 to provide interfacing for the first STS-1 service signals in an unequipped STS1/DS3 Interface-16 Module.

Maximum: Four List 343 per List 302 or 305

- | | |
|------------|--|
| (1) AKM53 | MUXPS1 (multiplexer protection switch 1) |
| (2) AKM56 | CLKDR1 (clock distributor 1) |
| (1) AKM59B | UC2 (unit controller 2) |
| (1) AKM84 | SMUX1 (SONET multiplexer 1) |
| (1) AKM85 | SMUXP1 (SONET multiplexer protection 1) |
| (2) 556C | PWRE3 (power E3) |

Interface Circuit Packs

List 231

Circuit packs required in addition to List 1, 3, 4, or 6 (if List 1 or 3 is equipped with List 251) or in addition to List 201, 203, 204, or 206 to provide interfacing for an additional 28 DS1 signals with Release 5.0 support in a DS1 Interface Module or DS1 Interface Protection Module.

Maximum: Thirteen List 231 per List 1, 4, 201, or 204
Twenty-seven List 231 per List 3, 6, 203, or 206

(2) AKM46B	DS1IF1 (DS1 interface 1)
(1) AKM50	SWIF2 (switch interface 2)

List 241

Circuit packs required in addition to List 1, 2, 4, or 5 (if List 1 or 2 is equipped with List 251) or in addition to List 201, 202, 204, 205, 302, or 305 or for field modification of List 41 to provide interfacing for an additional DS3 service signal with Release 5.0 features in a DS3 Interface-16 Module or DS3 Interface-32 Module. (Do not order with List 262.)

Maximum: Forty-four List 241 per List 1, 4, 201, or 204
Sixty List 241 per List 2, 5, 202, 205, 302, or 305

(1) AKM68B	MUX2 (multiplexer 2)
------------	----------------------

List 260

Circuit packs required in addition to List 201 or 204 to provide interfacing and protection for the first DS3 service signal in an unequipped DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 260 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)



NOTE:

List 260 requires Release 5.0 or later.



NOTE:

In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.



NOTE:

When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 341

Circuit packs required in addition to List 343 or 344 or to field upgrade (with List 342 and 345 or 346) a DS3 service signal and provide interfacing or increase capacity for one STS-1 service signal in an STS1/DS3 Interface-16 Module.

Maximum: Fourteen List 341 per List 343 or 344
Fifteen List 341 per List 342 and 345 or 346

(1) AKM84	SMUX1 (SONET multiplexer 1)
-----------	-----------------------------

List 344

Circuit packs required in addition to List 201 or 204 to provide interfacing for the first STS-1 service signals when the lower DS3 Interface-16 Module is to be used as an STS1/DS3 Interface Module.

(1) AKM84	SMUX1 (SONET multiplexer 1)
(1) AKM85	SMUXP1 (SONET multiplexer protection 1)

BNC Interconnect Panels

List 70

Equipment required in addition to List 201 to provide a DS3 interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C975-30,G12 Initial Bay Framework

List 71

Equipment required in addition to List 202 to provide a DS3 interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C975-30,G13 Initial Bay Framework

List 72

Equipment required for field conversion of a non-EMC-shielded interconnect panel to EMC.

List 73

Equipment required in addition to List 204 to provide a DS3 interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C934-30,G5 STS1/DS3/DS1 Interface Bay Framework

List 74

Equipment required in addition to List 205 to provide a DS3 interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C968-30,G5 DS3 Interface Bay Framework

List 75

Equipment required to field retrofit an existing DS1/DS3 Interface Bay with BNC interconnect panel, in a non-EMC-shielded arrangement.

(1) ED-2C934-30,G6 STS1/DS3/DS1 Interface Bay Framework

List 76

Equipment required to field retrofit an existing DS3 Interface Bay with BNC interconnect panel, in a non-EMC-shielded arrangement.

(1) ED-2C968-30,G6 DS3 Interface Bay Framework

List 371

Equipment required in addition to List 302 to provide a BNC interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C975-30,G15 Initial Bay Framework

List 374

Equipment required in addition to List 305 to provide a BNC interconnect panel for a non-EMC-shielded arrangement.

(1) ED-2C090-30,G2 STS1/DS3 Interface Bay Framework

⇒ NOTE:

A label kit is available to designate shelf numbers. The comcode for the label kit for the BNC panel is CC847334463.

EMC Enclosures

List 152

Equipment required in addition to List 202 to provide factory-installed EMC shielding (BNC panel included) for one DS3 initial bay arrangement.

- | | |
|--------------------|-----------------------|
| (1) ED-2C975-30,G9 | Initial Bay Framework |
| (1) ED-9C115-31,G1 | EMC Shielded Assembly |

List 154

Equipment required in addition to List 204 to provide factory-installed EMC shielding (BNC panel included) for one DS1/DS3 growth bay.

- | | |
|--------------------|---------------------------------|
| (1) ED-2C934-30,G3 | DS3/DS1 Interface Bay Framework |
| (1) ED-9C115-31,G2 | EMC Shielded Assembly |

List 155

Equipment required in addition to List 205 to provide factory-installed EMC shielding (BNC panel included) for one DS3 growth bay.

- | | |
|--------------------|-----------------------------|
| (1) ED-2C968-30,G3 | DS3 Interface Bay Framework |
| (1) ED-9C115-31,G2 | EMC Shielded Assembly |

List 156

Equipment required in addition to List 206 to provide factory-installed EMC shielding for one DS1 growth bay.

- | | |
|--------------------|--------------------------------------|
| (1) ED-2C870-30,G2 | DS1 Interface Bay Framework Assembly |
| (1) ED-9C115-31,G2 | EMC Shielded Assembly |

List 157

Equipment required in addition to List 201 to provide factory-installed EMC shielding (BNC panel and dual power capability included) for one DS1/DS3 initial bay arrangement.

- | | |
|---------------------|-----------------------|
| (1) ED-2C975-30,G21 | Initial Bay Framework |
| (1) ED-9C115-31,G1 | EMC Shielded Assembly |

List 158

Equipment required in addition to List 203 to provide factory-installed EMC shielding (BNC panel and dual power capability included) for one DS1 initial bay arrangement.

- | | |
|---------------------|-----------------------|
| (1) ED-2C975-30,G22 | Initial Bay Framework |
| (1) ED-9C115-31,G1 | EMC Shielded Assembly |

List 353

Equipment required in addition to List 302 to provide factory-installed EMC shielding (BNC panel and dual power capability included) for STS1/DS3 initial bay arrangement.

- | | |
|---------------------|-----------------------|
| (1) ED-2C975-30,G23 | Initial Bay Framework |
| (1) ED-9C115-31,G1 | EMC Shielded Assembly |

List 355

Equipment required in addition to List 305 to provide factory-installed EMC shielding (BNC panel included) for STS1/DS3 growth bay.

- | | |
|--------------------|-----------------------|
| (1) ED-9C090-30,G4 | Switch Bay Framework |
| (1) ED-9C115-31,G2 | EMC Shielded Assembly |

Release 5.0 Retrofits

List 66

Power and circuit packs required for field modification to provide a redundant controller with link expansion and enhanced secondary storage.

(1) ED-2C975-30,G18	Initial Bay Framework
(2) AWP6	CPU2 (central processing unit 2)
(2) AWP8	ECI3 (enhanced communications interface 3)
(2) AWP14	SSC5 (secondary storage controller 5)
(2) AWR2C	SCI3 (switch communications interface 3)
(2) AWR10	MTC3 (maintenance interface 3)
(1) AWR12	UI2 (unit interface 2)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(2) 428AA	PWRG (power G)
(1) ED-9C049-30,G2	STPNL (status panel)
(1) ED-9C051-30,G2	FBF (fuse board F)
(1) ED-9C052-30,G2	FBG (fuse board G)
(1) ED-9C053-30,G3	FBH (fuse board H)
(1) ED-9C055-30,G1	FBI (fuse board I)

List 69

Power and circuit packs required in addition to List 302 to provide enhanced secondary storage (field modification).

(2) AWP14	SSC5 (secondary storage controller 5)
(2) ERB5	PRI5 (primary off-line storage 5)
(1) ERB6	SEC5 (secondary off-line storage 5)
(2) 427AB	PWRF (power F)
(3) WP90247,L313	5A Fuse
(1) 847398781	Fuse Label
(1) 847398799	Fuse Label
(1) 847398807	Fuse Label

NOTE:

Labels and fuses are provided for the following upgrades:

ED-9C051-30, G1 to G2
ED-9C052-30, G1 to G2
ED-9C053-30, G2 to G3

List 364

Circuit packs required in addition to List 63 or 67 to provide enhanced synchronization.

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack

List 365

Circuit packs required in addition to List 63, 67, or 302 for field upgrade to the new synchronizer (no previously provided synchronization feature).

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWR11	CLKGN3 (clock generator 3)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)
(2) 846960664	Blank Filler Circuit Pack

List 366

Circuit packs required in addition to List 63, 67, or 302, or in addition to List 361, for field modification to provide enhanced synchronization (previously provided synchronization exists).

(2) AWP15	DPLL2 (digital phase lock loop 2)
(2) AWS8	TBS32 (stratum 3 time base oscillator 2)
(2) AWS9	DS1TX2 (DS1 timing extractor 2)

List 259

Circuit packs required for field modification of List 201, 204, 302, or 305 to provide interfacing for the first DS3 service signal in a 16 DS3 or 16 STS1/DS3 module only, for Release 5.0 and above. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 259 per List 201 or 204
Three List 259 per List 302 or 305

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)

⇒ NOTE:
List 259 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 260

Circuit packs required in addition to List 201 or 204 to provide interfacing and protection for the first DS3 service signal in an unequipped DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals.

Maximum: One List 260 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)

⇒ NOTE:
List 260 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 261

Circuit packs required in addition to List 302 or 305 to provide interfacing and protection for the first DS3 service signal in an unequipped STS1/DS3 Interface (16 STS1/DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 243.)

Maximum: One List 261 per module.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM56	CLKDR1 (clock distributor 1)
(1) AKM59B	UC2 (unit controller 2)
(2) 556C	PWRE3 (power E3)

⇒ NOTE:
List 261 requires Release 5.0 or later.

⇒ NOTE:
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ NOTE:
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 262

Circuit packs required in addition to List 201, 204, 302, or 305, or for field modification to provide interfacing for an additional DS3 service signal in a DS3 Interface (16 DS3) Module only for Release 5.0 and above features. List provides broadband capability, DS3 clear-channel, full-time performance monitoring, and support of unframed DS3 signals. (Do not order with List 241.)

Maximum: Fourteen List 262 per module.

(1) AKM91 MUX3 (multiplexer 3)

⇒ **NOTE:**
List 262 requires Release 5.0 or later.

⇒ **NOTE:**
In an enhanced DS3-16 Module, AKM68B (MUX2) and AKM91 (MUX3) circuit packs may be equipped in the same module only if the shelf is equipped with the AKM92 (MUXP3) circuit pack.

⇒ **NOTE:**
When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 259, 260, 261, or 262 may be equipped.

List 110

Equipment required for one field-installed LAN interface retrofit kit.

(1) ED-9C129-30,G1 LAN Interface Assembly
(1) 104371514 Retainer

List 115

Equipment required for one fan firmware upgrade kit containing new EPROM firmware and labels.

List 116

Equipment required for one factory-installed LAN interface kit.

(1) ED-9C129-30,G3 LAN Interface Assembly
(1) 104371514 Retainer

⇒ **NOTE:**
List 110 or 116 required for upgrade from Release 4.0.

**TTY Connector Adapters
(ED-2C646-30)**

Group 1

Assembly, wiring, and equipment for one DACS TTY connector adapter to convert from a 37-pin connector (EIA-449 standard) to a 25-pin connector (EIA-232 standard) when connecting to a modem (less than 50 feet).

Group 2

Assembly, wiring, and equipment for one DACS TTY connector adapter to convert from a 37-pin connector (EIA-449 standard) to a 25-pin connector (EIA-232 standard) when connecting to a terminal.

Group 3

Assembly and equipment for one DACS TTY connector adapter to provide for a direct connector of two pair of signal leads (EIA-423 and EIA-449 standards).

Group 7

Assembly, wiring, and equipment for one DACS TTY connector adapter to convert from a 37-pin connector (EIA-449 standard) to a 25-pin connector (EIA-232 standard) when connecting to a DTE such as an X.25 PAD.

Group A

Equipment for DACS TTY connector adapters. Always required in addition to Group 1 through Group 11.

(2) 843987603 Screw

Fuses

The fuses used in the DACS IV-2000 (256) Release 5.0 are listed in Table 4-2.

Table 4-2. Fuses

Type	Location	Amperage	Comcode	Quantity
KS-19780,L8	ED-2C940-30 Fuse Panel	12 (load)	400848602	See Note 1
KS-19780,L2	ED-2C940-30 Fuse Panel	10 (load)	997964697	See Note 1
70D	ED-2C940-30 Fuse Panel	5 (indicator)	100203355	See Note 1
70B	ED-2C940-30 Fuse Panel	2 (indicator)	100203330	See Note 1
70G	ED-2C940-30 Fuse Panel	0.5 (indicator)	100203389	See Note 1
WP91768,L115	ED-9C114-30 Fuse Panel	12	407749847	6
WP91768,L114	ED-9C114-30 Fuse Panel	10	405750431	See Note 1
WP91768,L107	ED-9C114-30 Fuse Panel	2	406747527	1
77D	Switch Power Module	10	406547067	See Note 2
78J	Switch Power Module	7.5	406547307	See Note 3
WP90247,L314	Redundant Con- troller Power Module	7.5	406520833	4 on ED-9C055 (fuse board I)
WP90247,L313	Redundant Con- troller Power Module	5	406520825	See Note 4
WP90247,L309	Redundant Con- troller Power Module	2	406520791	See Note 5

Table continued on next page See footnotes at end of table.

Table 4-2. Fuses (Continued)

Type	Location	Amperage	Comcode	Quantity
WP90247,L306	Redundant Controller Power Module	1	406520783	See Note 6
WP90247,L303	Redundant Controller Power Module	0.5	406520767	2 on ED-9C055 (fuse board I)

Notes:

1. Quantities depend on system configuration installed (see SD-96673-01).
2. 14 on ED-2C960 (fuse board B); 12 on ED-2C962 (fuse board A).
3. 14 on ED-2C961 (fuse board D), 12 on ED-2C963 (fuse board C).
4. 6 on ED-9C051 (fuse board F), 6 on ED-9C052 (fuse board G); 7 on ED-9C053 (fuse board H).
5. 1 on ED-9C052 (fuse board G); 2 on ED-9C055 (fuse board I).
6. 2 on ED-9C051 (fuse board F); 2 on ED-9C052 (fuse board G).

Miscellaneous Equipment

List 20

Circuit packs required to provide switching for an additional 16 DS3 service signals or 448 DS1 service signals in the switch shelf assembly.

Maximum: Two List 20 per List 1, 4, 201, or 204
Three List 20 per List 2, 5, 202, 205, 302, or 305
One List 20 per List 3, 6, 203, or 206

(2) AWR6 SWIO1 (switch input/output 1)

List 21

Circuit packs required when List 20 is not provided to maintain a forced-air air-cooling channel in the switch shelf assembly.

Maximum: Fourteen List 21 per List 1 or 201
Fifteen List 21 per List 2, 3, 203, or 302

(2) 846103760 Blank Filler Circuit Pack

List 50

Circuit pack required to provide bus continuity in a DS1 Interface Module, DS1 Interface Protection Module, DS3 Interface-16 Module, or DS3 Interface-32 Module.

(1) AKM64 BXA1 (bus extender 1)

List 103

Equipment required in addition to List 201, 202, 203, 204, 205, or 206 to provide front cover protection for one Input/Output Bay Interface Module.

Maximum: Two List 103 per Lists 202 or 205
Four List 103 per List 201, 203, 204, or 206

(1) 846874162 Left Mounting Bracket
(1) 846874170 Right Mounting Bracket

List 106

Equipment required in addition to List 201, 202, 203, 204, 205, or 206 to retrofit front cover protection for one Input/Output Bay Interface Module.

Maximum: Two List 106 per Lists 202 and 205
Four List 106 per List 201, 203, 204, or 206

(1) 846874162 Left Mounting Bracket
(1) 846874170 Right Mounting Bracket

List 109

Equipment and wiring required in addition to List 201, 202, 203, or 302 to provide a factory-installed LAN interface.

(1) ED-2C975-30,G19 Initial Bay Framework

List 115

Equipment required for one fan firmware upgrade kit containing new EPROM firmware and labels.

List 245

Circuit pack required for field modification of List 1, 2, or 3 (if List 1, 2, or 3 is equipped with List 251) or List 4, 5, or 6 to provide the following Release 2 features: DS1 performance monitoring and DS1 test signal generation and reception.

(1) AKM66 PMGR1 (performance monitor test signal generator receiver 1; optional)

List C

Equipment required to provide a blank cover for the DS3 performance monitoring circuit pack position on the DS3 Interface-16 Module or DS3 Interface-32 Module.

Maximum: One List C per List 1, 2, 4, 5, 40, 201, 202, 204, 205, or 240
Four List C per List 302 or 305

(1) 846138337 Blank Cover

List AF

Equipment required to provide a front cover for an unequipped DS3 Interface-32 Module or STS1/DS3 Module.

Maximum: One List AF per List 1, 2, 4, 5, 201, 202, 204, or 205
Four List F per List 302 or 305

(1) 847038791 DS3 Interface Module Front Cover

Software (J98807SD-6) Lists

This section supplies list numbers for ordering the DACS IV-2000 (256) Release 5.0 software.

List	Description
1	Assembly and equipment required to provide Release 5.0 for initial orders and retrofits from Release 4.0. List 1 includes one optical disk and the software release description (SRD).
2	Assembly and equipment required to provide generic software for CN applications. List 2 includes one optical disk and the SRD.
3	Assembly and equipment required to provide one blank optical disk for creating backup copies of the DACS IV-2000 Release 5.0 software and/or its databases.
4	Assembly and equipment required to provide one spare optical disk of DACS IV-2000 Release 5.0 software.
A	Documentation kit always required in addition to List 1.
B	System startup disk always required in addition to List M1R for initial orders of DACS IV-2000 Release 5.0 software.
M1R	Application software right-to-use fee always required in addition to List 1 on initial orders of DACS IV-2000 Release 5.0 software.
M1S	Application software right-to-use fee always required in addition to List 1 for retrofits from DACS IV-2000 Release 4.0 to Release 5.0.
P1R	Operating software right-to-use fee always required in addition to List 1 on initial orders of DACS IV-2000 Release 5.0 software.
P1S	Application software right-to-use fee always required in addition to List 1 for retrofits from DACS IV-2000 Release 4.0 to Release 5.0.

Initial Software Ordering

For DACS IV-2000 (256) Release 5.0 software, order the following:

1	J98807SD-6	List 1
1	J98807SD-6	List B
1	J98807SD-6	List M1R
1	J98807SD-6	List P1R
1	J98807SD-6	List A

Upgrading from Previous Releases

When a retrofit from Release 4.0 to Release 5.0 software is required, the following software must be ordered:

1	J98807SD-6	List 1
1	J98807SD-6	List M1S
1	J98807SD-6	List P1S
1	J98807SD-6	List A

Customers currently running software releases prior to Release 4.0 must upgrade to Release 4.0 before upgrading to Release 5.0.

Documentation Kit

The Documentation Kit (List A) comprises the following documents:

- AT&T 365-340-800 - *DACS IV-2000 (256) Release 5.0 Reference Manual*
- AT&T 365-340-801 - *DACS IV-2000 (256) Release 5.0 Operations and Maintenance*
- AT&T 365-340-802 - *DACS IV-2000 (256) Release 5.0 Commands and Messages*
- AT&T 365-340-803 - *DACS IV-2000 (256) Release 5.0 Quick Reference Job Aids*

ROADS Ordering Information

This section contains ordering information for the new DACS IV-2000 (256) Rapid Order and Delivery System (ROADS) standard product configurations. These configurations are listed in Table 4-3.

Table 4-3. (256) ROADS Standard Product Configurations

Configuration Name	Application Code
DACS IV-2000 (256) New System	KH
(256) Growth I/O or OPEX Bays	K6
(256) Hardware/Software Upgrades	K7

DACS IV-2000 (256) New System

Application Code: KH

This product configuration includes a (256) switch bay, one initial I/O bay (DS1/DS3/STS-1 or STS-1/DS3), DACS IV-2000 hardware and software, circuit packs, and a choice of synchronization, covers and enclosures. Also included are fixed length coaxial cables, power pigtail cables, floor attachments, bay extenders for non-7ft environments, a DSX panel (if required), enhanced secondary storage, the standard BDFB items, common site material, and any hardware and cabling to support these items.

The following options, which can be ordered as part of this configuration, are grouped with their applicable initial I/O bay types.

Switch and Combination Bay (DS1/DS3/STS-1)

- BNC Panel
- Optical Remote Configuration
- Additional DS1 Service (28 DS1 signals)
- Additional DS3 Service (MUX2)
- DS3 (Release 5.x) Service (MUX3)
- Additional DS3 (Release 5.x) Service (MUX3)
- STS-1 Service

- Additional STS-1 Service
- Performance Monitoring (MUX2 only)
- Synchronization
- Enhanced Synchronization
- Dual Power
- High Performance Fan Assembly

Switch and STS-1/DS3 Bay

- BNC Panel
- Optical Remote Configuration
- Additional DS3 Service (MUX2)
- DS3 (Release 5.x) Service (MUX3)
- Additional DS3 (Release 5.x) Service (MUX3)
- STS-1 Service
- Additional STS-1 Service
- Performance Monitoring (MUX2 only)
- Dual Power
- Synchronization
- Enhanced Synchronization
- High Performance Fan Assembly

(256) Growth I/O or OPEX Bays

Application Code: K6

This product configuration includes up to six I/O bays, DACS IV-2000 hardware and software, circuit packs, and a choice of synchronization, covers, and enclosures. Also included are fixed length coaxial cables, power pigtail cables, floor attachments, bay extenders for non-7ft. environments, a DSX panel, standard BDFB items, common site material, and hardware and cabling to support these items.

The following orderable items are categorized by hardware configuration type (collocated or optically remoted) and signal capacity.

(256) DS1/DS3/STS-1 Growth I/O Bay

This selection contains equipment and plug-ins for one DS1/DS3/STS-1 I/O Bay. This selection has a maximum interface capacity of 420 DS1 signals and 46 DS3 signals.

The following options may be ordered as part of this configuration:

- BNC Panel
- Optical Remote Configuration
- Additional DS1 Service (28 DS1 signals)
- Additional DS3 Service (MUX2)
- DS3 (Release 5.x) Service (MUX3)
- Additional DS3 (Release 5.x) Service (MUX3)
- STS-1 Service
- Additional STS-1 Service
- Performance Monitoring (MUX2 only)

(256) DS1 Growth I/O Bay

This selection contains equipment and plug-ins for one DS1 I/O bay. This selection has a maximum interface capacity of 868 DS1 signals.

The following options may be ordered as part of this configuration:

- Optical Remote Configuration
- Additional DS1 Service (28 DS1 signals)

(256) STS-1/DS3 Growth I/O Bay

This selection contains equipment and plug-ins for one STS-1/DS3 growth bay. This selection has a maximum interface capacity of sixty STS-1 or DS3 signals and four protection lines.

The following options may be ordered as part of this configuration:

- BNC Panel
- Optical Remote Configuration
- Additional DS3 Service (MUX2)
- DS3 (Release 5.x) Service (MUX3)
- Additional DS3 (Release 5.x) Service (MUX3)
- STS-1 Service
- Additional STS-1 Service
- Performance Monitoring (MUX2 only)

(256) Hardware/Software Upgrades

Application Code: K7

This product configuration includes DACS IV-2000 hardware and software, circuit packs, and a choice of synchronization.

The following sections list the hardware and software upgrades that are available with this configuration. Optional orderable items are provided.

(256) Hardware Upgrades

The following two types of enhanced secondary storage are available with this configuration:

Enhanced Secondary Storage w/ Enhanced Synchronizer
[Field Upgrade from DACS IV-2000 (256) Release 3.xRC to 4.xRC]

- Enhanced Synchronizer Circuit Packs
- LAN Interface
- Synchronizer Backplane

Enhanced Secondary Storage w/ Enhanced Synchronizer
[Field Upgrade from DACS IV-2000 (256) Release 3.x to 5.x]

- Enhanced Synchronizer Circuit Packs
- LAN Interface
- MUX3 and MUXP3 Circuit Packs
- Synchronizer Backplane

(256) Software Upgrades

The following software options may be ordered as part of this configuration:

- Field Upgrade (R3.xRC to 5.xRC)
- Field Upgrade (R3.xRC to 4.xRC)
- Field Upgrade (R4.xRC to 5.xRC)

Product Support

5

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Product support includes engineering and installation services, technical support, documentation, and training.

Engineering and Installation Services

The Lucent Technologies Customer Support and Operations (CS&O) organization is committed to providing customers with quality product support services. Whether you need assistance in engineering, installation, normal system maintenance, or disaster recovery, the support staff provides the technical support you need to get your job done. Each segment of the CS&O organization regards the customer as its highest priority and understands your obligation to maintain quality service for your customer.

Within the CS&O organization, the Engineering and Installation Services group is a highly skilled force of support personnel. These specialists use state-of-the-art technology, equipment, and procedures to provide customers with highly competent, rapid response services. These services include analyzing your equipment request, preparing a detailed specification for manufacturing and installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

The Engineering and Installation Services group provides the customer with an individually tailored, quality-tested job that meets our published high standards and the customer's operational requirements. The group ensures that the customer's order is integrated into a complete working system tailored to office conditions and preferences. It includes provisions for cabling, lighting, power equipment, and ancillary connections to local and/or remote alarm systems. The group also responds to any customer changes that occur during installation.

All equipment engineered and installed by Lucent Technologies is thoroughly tested and integrated into a reliable system at cutover. Once approved by Lucent Technologies' Quality Assurance Test group (the industry's toughest), the system is turned over to the customer.

The group also provides any specialized engineering and installation services required for unusual or highly individualized applications. These specialized services may include engineering consultations and database preparation. Your local Account Executive can provide more information about these services.

Technical Support

Assistance in maintaining your installed system is available through the Regional Technical Assistance Center (RTAC) and Customer Technical Support and Information (CTSI). As shown in Figure 5-1, your single point of contact is the RTAC. RTAC personnel troubleshoot field problems 24 hours a day over the phone and, if necessary, on site. For technical assistance, simply call **1-800-225-RTAC (7822)**. One call guarantees support. You can also call this number to provide comments on OLS or to suggest enhancements.

RTAC organizations are supported by a centralized CTSI for transmission products. CTSI maintains a close relationship with Lucent Technologies' development community to expedite resolutions effectively. This association provides continuous accessibility through every phase of a product's life cycle and assures prompt resolution to all inquiries.

CTSI has also established a technical support medium: the COACH customer support tools. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. COACH tools reside on a dedicated time-share computer accessible over toll free lines and available 24 hours a day, seven days a week. For information about how to access COACH, contact your local account executive.

Once connected to COACH, the user specifies which product to access and COACH grants the appropriate combination of tools and commands. Each one of these tools and commands is reached through a centralized, menu-driven computer program. Every screen provides help in making appropriate menu selections. COACH users achieve proficiency quickly because of the consistency of menu selections among products.

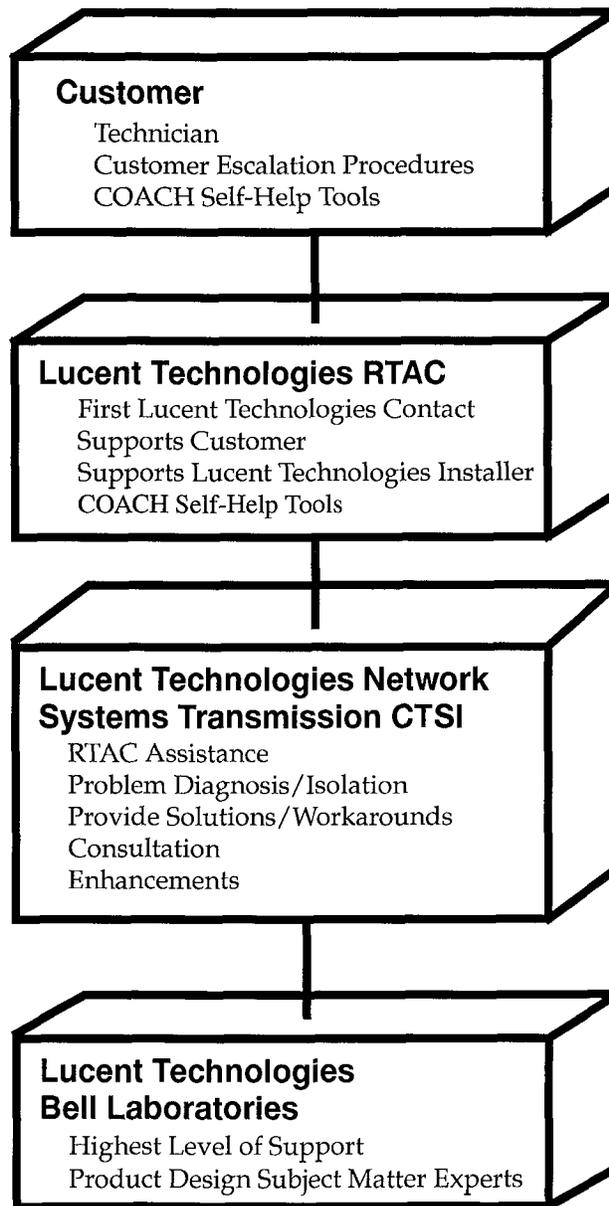


Figure 5-1. Product Support

These COACH tools are available to the user:

Diagnostic dictionary	The diagnostic dictionary contains histories of previously encountered problems and the descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem. Your support staff is allowed to enter problems and solutions into the customer input area of the diagnostic dictionary. CTSI personnel evaluate the data daily and, when appropriate, the data is moved to the general area.
News and bulletins	Immediately after a user logs into the COACH tools, the news and bulletins tool displays bulletins containing urgent information relating to all the user's products. All users are automatically notified about urgent matters such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.
Compatibility data	Occasionally, hardware/software configuration problems arise when new software generics are issued. The compatibility data tools permit users to view the correct hardware configuration associated with a specific software generic. The user simply enters the appropriate software generic number and COACH responds with page-formatted lists of circuit packs compatible with the selected software generic.
Ordering guides	With the COACH ordering guide tool, users can obtain an electronic copy of the latest version of the ordering guide for selected products served by COACH tools. This eliminates the time-consuming delays experienced in distributing printed documentation.
COACH user's guide	COACH supplies an on-line version of its user's guide. The COACH user's guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

CTSI strives to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, CTSI provides you with the best possible customer support.

Documentation Support

The Lucent Technologies Customer Training and Information Products (CTIP) organization provides a customer comment form in the front of this guide. Please use the form to report errors or make suggestions about the document. If the form is missing, please send or fax your comments to:

Lucent Technologies
Customer Training & Information Products
Building 21, Room 3A-06
1600 Osgood Street
North Andover, MA 01845

Fax: (508) 960-6835

Training

No product offering is complete without a formal training package. Contact your account executive to enroll in training classes or to arrange suitcase sessions.

The following courses are provided:

TR3544 — DACS IV-2000 (512) Operation and Maintenance

Course Description: Intended for operation and maintenance people and their supervisors, this 4-day course provides a comprehensive introduction to the DACS IV-2000 (512).

Prerequisites: Experience with digital carrier or course number TR0510, Transmission Principles.

The following courses are also offered for the DACS IV-2000 (256).

DG3201 — DACS IV-2000 Overview

Course Description: Intended for people responsible for the planning and implementation of the DACS IV-2000, this 2-day course provides an introduction to the DACS IV-2000 (256).

Prerequisites: Understanding of digital equipment principles and networks.

TR3542 — DACS IV-2000 Operation and Maintenance

Course Description: Intended for operation and maintenance people and their supervisors, this 4-day course provides a comprehensive introduction to the DACS IV-2000 (256).

Prerequisites: Experience with digital carrier or course number TR0510, Transmission Principles.

DG3230 — DACS IV-2000 (256) Operations Maintenance and Administration

Course Description: Intended for DACS IV-2000 (256) technical support people, this 5-day course provides in-depth knowledge of the DACS IV-2000 functions, capabilities, and features.

Prerequisites: Background in the operation and maintenance of digital transmission equipment and an understanding of digital transmission theory and schematic drawings.

To obtain more information or to register for these courses, call:

1-888-LUCENT-8 (select option 2)

Fax: 1-407-767-2677

Or write to:

Lucent Technologies
Customer Training and Information Products
307 North Lake Blvd.
Altamonte Springs, FL
32701

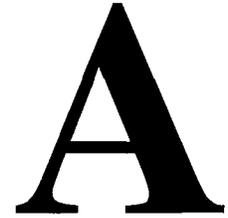
Warranty Support

Lucent Technologies provides a limited 5-year hardware warranty for this product. For more information, contact your local Lucent Technologies account executive.

Account Executive Support

Your local account executive serves as a single point of contact if you encounter difficulties in any area of product support.

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Technical Specifications

A

This appendix describes the technical specifications that must be considered when engineering the DACS IV-2000 (256) Release 5.0 into a network. It provides technical specifications for the following areas:

- Interface
- Commands and messages
- System performance
- Power
- Physical
- Environmental
- Availability and reliability.

Interface Specifications

This section describes the transmission interface and the alarm and control interface specifications for the DACS IV-2000.

Transmission Interface

The transmission interface characteristics of the DACS IV-2000 include the port capacity, signal characteristics, signal impairments, and cable characteristics. Each of these areas is described in this section, and the particular specifications and requirements associated with each area are listed.

Port Capacity

Port capacity defines the number of DS1, DS3, and/or STS1 ports that can be terminated on the DACS IV-2000 and is a function of the number and types of interface bays. The maximum configurations include:

- 6944 DS1 ports for a 9-bay arrangement consisting of all DS1 ports (248 equivalent DS3s)
- 248 DS3 ports for a 5-bay arrangement consisting of all DS3 ports
- 240 STS1 ports for a 5-bay arrangement consisting of all STS1 ports.

Bay arrangements include:

- 9-bay arrangement: one Switch Bay and eight DS1 Interface Bays
- 5-bay arrangement: one Switch Bay and four DS3 Interface-32 Bays
- 5-bay arrangement: one Switch Bay and four STS1 Interface-16 Bays.

The port capacities of the DACS IV-2000 are summarized in Table A-1.

Table A-1. Port Capacity

Item	Value
Maximum System Capacity	Up to 248 equivalent DS3 or 240 STS1 input and output interface ports
Maximum DS1 Port Capacity	Up to 6944 input and output DS1 interface ports
Maximum DS3 Port Capacity	Up to 248 input and output DS3 interface ports
Maximum STS1 Port Capacity	Up to 240 input and output STS1 interface ports

Signal Characteristics

The transmission interfaces to the DACS IV-2000 are DSX-3, DSX-1, and STSX-1 compatible facilities or network elements.

DS3 Signal

The DACS IV-2000 accepts incoming DS3 signals at the specified line rate of 44.736 Mbits/s with the specified B3ZS line code. Acceptable signal formats are asynchronous M13 or C-bit parity. (See Table A-2.)

Table A-2. DS3 Signal Characteristics

Item	Value
Frame Format	Asynchronous M13/C-bit parity
DS3 Line Rate	44.736 Mbits/s \pm 20 ppm
Line Code	B3ZS
Test Load Impedance	75 Ω \pm 5% resistive, unbalanced

DS1 Signal

The DACS IV-2000 accepts incoming DS1 signals at the specified line rate of 1.544 Mbits/s with the specified AMI or B8ZS line code. (See Table A-3.) The DACS IV-2000 is fully transparent to the DS1 bit stream; that is, all overhead and payload bytes are passed through unchanged.

Table A-3. DS1 Signal Characteristics

Item	Value
DS1 Line Rate	1.544 Mbits/s \pm 130 ppm
Line Code	AMI or B8ZS
Test Load Impedance	100 Ω \pm 5% resistive, balanced

STS-1 Signal

The DACS IV-2000 accepts incoming STS-1 signals at the specified line rate of 51.84 Mbits/s with the specified B3ZS line code. (See Table A-4.)

Table A-4. STS-1 Signal Characteristics

Item	Value
STS-1 Signal Format	Conforms to GR-253
STS-1 Line Rate	51.84 Mbits/s \pm 4.6 ppm
Line Code	B3ZS
Duty Cycle (measured at output cable terminals)	Nominal 50%, RZ pulse with 1.03V (\pm 10%) peak output amplitude
Frame Synchronous Scrambling	Conforms to GR-253
Wideband Power Level	-2.7 dBm to 4.7 dBm (measured at 450 ft)

Signal Impairments

The requirements related to signal impairments in electronic digital signal cross-connect equipment are specified in Bellcore TA-TSY-000241, *Electronic Digital Signal Cross-Connect (EDSX) System Generic Requirements and Objectives* (Issue 4, July 1989). The requirements applicable to the DACS IV-2000 are summarized in the following paragraphs.

DS3 Signal

The jitter accommodation (tolerance) requirement for a DS3 signal input is specified in terms of the amount of sinusoidal jitter (peak-to-peak) that must be accommodated versus the frequency of that jitter. The DACS IV-2000 meets the jitter accommodation requirements for a DS3 signal given in Bellcore TR-NWT-000499, *Transport Systems Generic Requirements (TSGR): Common Requirements* (Issue 5, December 1993). The DACS IV-2000 does not generate more than 0.01 unit interval (UI; timeslots) of rms jitter with a high-pass measurement filter with 12-kHz cutoff frequency. Jitter generation at the DS3 outputs of the DACS IV-2000 is negligible.

In the absence of input jitter, DS3 signals that are cross-connect clear-channel or line-looped-back at the MUX3 circuit pack will have an output jitter of less than 0.4 UI as specified in Bellcore GR-253, *SONET Transport Systems: Common Generic Criteria for Operations Communications Routing and LAN Support* (Issue 1, December 1994).

The peak signal-to-rms noise (S/N) power ratio for an *all ones* pattern measured over the bandwidth of the digital signal in the DACS IV-2000 is greater than 46 dB on any digital output line signal.

The return loss at a half bit rate (normal cross-connection) measured at the input of a cross-connection in the DACS IV-2000 is greater than 18 dB. The cross-connection must be properly terminated when making this measurement.

The DACS IV-2000 provides better than 46-dB (measured at 22.368 MHz) isolation between any two DS3 output ports.

The DS1-to-DS3 nominal transmission delay (normal cross-connection) through the DACS IV-2000 is 21 μ s for AMI-coded DS1 inputs and 25.5 μ s for B8ZS-coded DS1 inputs. The DS3-to-DS3 nominal transmission delay (normal cross-connection) through the DACS IV-2000 is 19 μ s. The transition from transmitting a cross-connected signal to transmitting a DS3 idle signal causes no more than a 3-ms hit and a change of frame alignment.

The DACS IV-2000 provides an operational bit error rate (BER) of less than 10^{-10} per cross-connect path across the system regardless of the number of other cross-connections established. The DS3 signal impairment specifications are listed in Table A-5.

Table A-5. DS3 Signal Impairment Specifications

Item	Value
Jitter Accommodation	Conform to TR-TSY-000009 (Figure 7) and TR-NWT-000499 (Figure 7-2)
Jitter Generation (rms)	< 0.01 UI
S/N Power Ratio	> 46 dB for all ones signal pattern
Return Loss at 22.368 MHz (normal cross-connection)	> 18 dB
Crosstalk	> 46-dB isolation between any two DS3 output ports
Transmission Signal Delay DS1 to DS3 (normal cross-connection)	21.0 μ s (AMI), 25.5 μ s (B8ZS)
Transmission Signal Delay DS3 to DS3	19 μ s
Bit Error Rate (BER/cross-connect path)	< 1×10^{-10}
DS3 Clear-Channel or Gateway (including broadcast)	125 μ s maximum

DS1 Signal

The jitter accommodation (tolerance) requirement for a DS1 signal input is specified in terms of the amount of sinusoidal jitter (peak-to-peak) that must be accommodated versus the frequency of that jitter. DS1 signals cross-connected from a MUX3 circuit pack to a DS1 interface circuit pack meet the jitter transfer function for Category I equipment shown in Figure 7-3 of TR-NWT-000499. The DACS IV-2000 meets the jitter accommodation requirements for a DS1 signal given in Figure 7 of Bellcore TR-TSY-000009, *Asynchronous Digital Multiplexer Requirements and Objectives* (Issue 1, May 1986) and Figure 7-2 of Bellcore TR-NWT-000499, *Transport Systems Generic Requirements (TSGR): Common Requirements* (Issue 5, December 1993).

The DACS IV-2000 does not generate more than 0.3 UI of rms jitter or more than 1 UI of peak-to-peak jitter over a 10-Hz to 40-kHz jitter spectrum in the absence of input jitter.

The peak S/N power ratio for an *all ones* pattern measured over the bandwidth of the digital signal in the DACS IV-2000 is greater than 46 dB on any digital output line signal.

The return loss at a half bit rate (normal cross-connection) measured at the input of a cross-connection in the DACS IV-2000 is greater than 18 dB. The cross-connection must be properly terminated when making this measurement. The DACS IV-2000 provides better than 46-dB (measured at 772 kHz) isolation between any two DS1 output ports.

The DS1-to-DS1 nominal transmission delay (normal cross-connection) through the DACS IV-2000 is 23.5 μ s for AMI-coded DS1 inputs/outputs and 33 μ s for B8ZS-coded DS1 inputs/outputs. The nominal DS1 line loopback transmission delay is 3 μ s.

The DS1 signal impairment specifications are summarized in Table A-6.

Table A-6. DS1 Signal Impairment Specifications

Item	Value
Jitter Accommodation	Conform to TR-TSY-000009 (Figure 7) and TR-NWT-000499 (Figure 7-2)
Jitter Generation (rms)	< 0.3 UI
Jitter Generation (peak-to-peak)	< 1.0 UI
S/N Power Ratio	> 46 dB for all ones signal pattern
Return Loss at 772 kHz (normal cross-connection)	>18 dB
Crosstalk	> 46-dB isolation between any two DS1 output ports
Transmission Signal Delay DS1 to DS1 (normal cross-connection)	23.5 μ s (AMI), 33 μ s (B8ZS)
Transmission Signal Delay DS1 Line Loopback	3.0 μ s
Bit Error Rate (BER/cross-connect path)	< 1×10^{-10}

STS-1 Signal

The jitter accommodation (tolerance) requirement for an STS-1 signal input is specified in terms of the amount of sinusoidal jitter (peak-to-peak) that must be accommodated versus the frequency of that jitter. The DACS IV-2000 meets the jitter accommodation requirements for an STS-1 signal given in Bellcore GR-253, *SONET Transport Systems: Common Generic Criteria for Operations Communications Routing and LAN Support* (Issue 1, December 1994). The DACS IV-2000 does not generate more than 0.01 UI of rms jitter with a high-pass measurement filter with 12-kHz cutoff frequency.

The STS-1 signal impairment specifications are summarized in Table A-7.

Table A-7. STS-1 Signal Impairment Specifications

Item	Value
Jitter Accommodation	Conform to GR-253
Jitter Transfer (terminating DS1 signals on STS1 interfaces)	Conform to GR-253
Jitter Amplitude (terminating DS1 signals on STS1 interfaces)	< 5 UI peak-to-peak
Jitter Generation (rms)	< 0.01 UI

Cable Characteristics

There are various options available in the types and length of cables and the types of connectors used for interconnection of the DACS IV-2000 either to a DSX-1, DSX-3, STSX-1, or directly to another network element (NE).

DS3 Interface Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor type cable distribution. The DS3 interface cable and connector characteristics are summarized in Table A-8.

Table A-8. DS3 Cable and Connector Characteristics

Item	Value
Maximum Distance to DSX-3 (KS-19224 type cable)	150 ft
Maximum Distance to DSX-3 (734-type cable*)	450 ft
Maximum Distance to DSX-3 (735-type cable)	250 ft
Maximum Distance to DS3 NE (KS-19224 type cable)	300 ft
Maximum Distance to DS3 NE (734-type cable*)	900 ft
Maximum Distance to DS3 NE (735-type cable)	500 ft
DS3 Connector Type (982-type) at the DACS IV-2000	2 x 4
DS3 Connector Type (at DS3 NE)	connectorized

* Identical characteristics to previous 728B-type cable.

DS1 Interface Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor type cable distribution. The DS1 interface cable and connector characteristics are summarized in Table A-9.

Table A-9. DS1 Cable and Connector Characteristics

Item	Value
Maximum Distance to DSX-1 (600-type cable)	655 ft
Maximum Distance to DSX-1 (1249-type cable*)	450 ft
Maximum Distance to DS1 NE (600-type cable)	1310 ft
Maximum Distance to DS1 NE (1249-type cable*)	900 ft
DS1 Connector Type (963T) or Wirewrap at the DACS IV-2000	2 x 14 (in) 1 x 28 (out)
DS1 Connector Type (at DSX-1)	wirewrap

* 1249 is preferred for overhead installation; it is required for underfloor installation.

STS1 Interface Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor type cable distribution. The STS1 interface cable and connector characteristics are summarized in Table A-10.

Table A-10. STS1 Cable and Connector Characteristics

Item	Value
Maximum Distance to STSX-1 (735-type cable or equivalent)	450 ft
Maximum Distance to STS1 NE (734-type cable or equivalent)	900 ft
STS1 Connector Type (982-type) at the DACS IV-2000	2 x 4
STS1 Connector Type (at STSX-1)	connectorized

Alarm and Control Interfaces

The alarm and control interfaces for the DACS IV-2000 consist of office and telemetry alarms, communications, telemetry, and operations systems (OSs). Each of these interfaces is described in this section, and the particular specifications and characteristics associated with each interface are given.

Office and Remote Alarms

The DACS IV-2000 has seven office alarm outputs: Critical Audible, Critical Visual, Major Audible, Major Visual, Minor Audible, Minor Visual, and Main Controller Failure. Contact closures for visual alarms remain latched until the failure is cleared.

The DACS IV-2000 provides a set of relay closures for critical, major, and minor alarms, which can be picked up by a remote telemetry system in the local office and sent to the appropriate OS.

All alarm contacts are rated as follows: maximum current (1.0A), maximum voltage (48V), and maximum volt-amperage (25 VA).

The activation of the alarms is delayed to avoid calling technical personnel to respond to transient errors of short duration. The alarm delay is programmable over a range of 1 to 30 seconds. The alarm delay operates on all audible and visual office alarm outputs, including major and minor visual indicators, autonomous messages, and OS (telemetry) alarm points. The OS status points associated with the delayed alarm points are similarly delayed.

The minimum alarm duration is 20 seconds for all office audible and visual alarm outputs, major and minor visual indicators, and OS (telemetry) alarm points. The minimum duration is not programmable. All alarm points are stretched to a total of at least 20 seconds beyond the programmed delay interval, even if the condition causing the alarm does not persist for the 20-second interval.

If the MUX3 circuit pack is provisioned for DS3 clear-channel cross-connection or DS3 to STS-1 cross-connection, no DS1 alarms are reported for the DS1 tributaries.

The office and telemetry alarm types and requirements for the DACS IV-2000 are summarized in Table A-11.

Table A-11. Office and Telemetry Alarms and Requirements

Item	Value
Office Audible Alarms	Critical, Major, Minor
Office Visual Alarms	Critical, Major, Minor, MC Fail
Remote Telemetry Alarms	Critical, Major, Minor, MC Fail Remote Indicator
Alarm Contact Closure Rating	1.0A, 48V, 25 VA (max)
Alarm Holdoff Delay (non-SONET facilities and equipment)	1 to 30 sec (default 10 sec)
Alarm Clear Delay (non-SONET facilities and equipment)	1 to 20 sec (default 10 sec)
Soak Time — Alarm Onsets (SONET facilities)	1 to 30 sec (default 2 sec)
Soak Time — Alarm Clears (SONET facilities)	1 to 20 sec (default 10 sec)
GTP Poll Time	10 to 60 sec (default 20 sec)

Communications and OS Interfaces

Table A-12 summarizes the characteristics of the links connecting communications and OSs to the DACS IV-2000.

Table A-12. Link Characteristics

Interface	Physical	Baud	Electrical	Functional
CILINK 1-1 and 2-1	EIA-232-D	300, 1200, 2400, 4800, and 9600 Default: 9600	EIA-232-D	Async. Snider
CILINK 1-2 and 2-2	EIA-449	300, 1200, 2400, 4800, and 9600 Default: 2400	EIA-423	Async. Snider
CILINK 1-3 and 2-3	EIA-449	300, 1200, 2400, 4800, and 9600 Default: 9600	EIA-423	Async. Snider
CILINK 1-4 and 2-4	EIA-449	Snider: 300, 1200, 2400, 4800, and 9600 TABS/TBOS: 2400 Default: 9600 (Snider) 2400 (TABS/TBOS)	EIA-485	TABS, TBOS, or async. Snider point-to-point AS&C
CILINK 1-5, 1-6, 2-5, and 2-6	EIA-449	Based on external timing Default: 9600	EIA-423	Sync. X.25 or Async. Terminal Interface with external PAD

Notes:

1. All EIA-423 links are interoperable with EIA-232-D via the use of the suggested adapters. For Snider links DACS IV-2000-to-terminal communication, it is suggested the ED-2C646,G1 adapter be used. For Snider links DACS IV-2000-to-OS via modem communication, it is suggested the ED-2C646,G2 adapter be used.
2. Links 1-2 and 2-2 are electrically compatible with the EIA-232-D (see Note 1) standard up to 4800 baud. Links 1-3 and 2-3 are electrically compatible with the EIA-232-D standard up to 9600 baud. These links may operate with the EIA-232-D above these data rates; however, the 4-percent rise time specification of EIA-232-D is violated.
3. To supply internal timing for the X.25 links, the ED2C646,G7 adapter must be used and the baud rate is fixed at 9600. All baud rates can be used with an external timing source.
4. Links 1-4 and 2-4 have the same characteristics as links 1-2, 1-3, 2-2, and 2-3 when link 1-4 or 2-4 is provisioned as a Snider link.

Protocols

The message interface protocol for links 1-1, 1-2, 1-3, 2-1, 2-2, and 2-3 is Snider, which is defined in Bellcore FR-NWT-00006, *LATA Switching Systems Generic Requirements (LSSGR): 1994 Edition*, and FSD 35-08-0100, *SPCS (Stored Program Control Systems) OS Interface, SCCS (Switching Control Center System), Asynchronous Interface*.

The message interface protocol for links 1-4 and 2-4 (TABS/TBOS) is specified in Compatibility Bulletin 149, *Maintenance Standards for Digital Transmission Systems* (Issue 4).

The message interface protocol for links 1-4 and 2-4 (when provisioned for Snider) is Snider, which is defined in Bellcore TR-NWT-000064, *LATA Switching Systems Generic Requirements (LSSGR): 1994 Edition*, and FSD 35-08-0100, *SPCS (Stored Program Control Systems) OS Interface, SCCS (Switching Control Center System), Asynchronous Interface*.

The synchronous links 1-5, 1-6, 2-5, and 2-6 operate up to 9600 baud. The message interface protocol for the four links is X.25 as verified with Bellcore TR-NWT-001213, *Objectives for the Maintenance User Interface of Switching Systems and Transport Systems* (Issue 1, March 1992) or asynchronous terminal interface with the use of an external PAD.

The network layer for the synchronous links is X.25. The DACS IV-2000 meets the CCITT X.25 1984 specification and has been verified with Bellcore TR-NWT-001213, *Objectives for the Maintenance User Interface of Switching Systems and Transport Systems* (Issue 1, March 1992).

Snider Link Specifications

The specifications for links 1-1, 1-2, 1-3, 2-1, 2-2, and 2-3 are summarized in Table A-13.

Table A-13. Links 1-1, 1-2, 1-3, 2-1, 2-2, and 2-3 Specifications

Item	Value
Communications Interface Terminal (CIT) Ports	Four EIA-449/EIA-423 asynchronous (1-2, 1-3, 2-2, and 2-3) Two EIA-232-D per EIA IEB No.12 (1-1 and 2-1)
Baud	300, 1200, 2400, 4800, or 9600
CIT Type	AT&T 4425 or compatible terminal
CIT Interaction	Command and Menu modes
CIT Interconnections	Connectorized

TABS/TBOS Link Specifications

The DACS IV-2000 has a TABS/TBOS port as an electrical interface to a telemetry-based operations system. The electrical interface specifications are given in Compatibility Bulletin 149, *Maintenance Standards for Digital Transmission Systems* (Issue 4). The interface can be connected to the monitoring equipment on a point-to-point basis. The interface operates at 2400 baud.

All alarm and status indications available over the communications interface link are also available over the TABS/TBOS telemetry link. (Note that the mapping between communications and telemetry interfaces is not on a one-to-one basis.) The only control functions available over the telemetry links are protection switches and locks, and CLKGN circuit pack switches.

The specifications for links 1-4 and 2-4 are summarized in Table A-14.

Table A-14. Links 1-4 and 2-4 Specifications

Item	Value
Telemetry Interface Port	TABS/TBOS or Snider asynchronous point-to-point
Baud	TABS/TBOS: 2400 Snider: 300, 1200, 2400, 4800, or 9600
Telemetry Interface Protocol	TABS/TBOS or Snider

X.25 Link Specifications

The DACS IV-2000 has two synchronous EIA-449/EIA-423 ports for electrical interfaces to message-based OSs. The electrical interface specifications are given in EIA Standard 449 (November 1977). The synchronous links have the balanced voltage signals of EIA-423. The functions that can be performed over the synchronous links depend on the OS. The links can be converted to an asynchronous terminal interface with the use of an external PAD.

The specifications for links 1-5, 1-6, 2-5, and 2-6 are summarized in Table A-15.

Table A-15. Links 1-5, 1-6, 2-5, and 2-6 Specifications

Item	Value
Physical/Electrical Interface Ports	EIA-449/EIA-423 synchronous or asynchronous
Baud	9600
Message Protocol	X.25 level 2 and 3
Switched Virtual Circuits	Four per link
Cable Length	Up to 50 ft

Command and Message Specifications

The DACS IV-2000 message interface is compatible with two operations systems from Bellcore: the Operations Systems/Intelligent Network Elements (OPS/INE) and Network Monitoring and Analysis (NMA). This message set includes alarm, provisioning, administration, and maintenance (including test access and performance monitoring) commands and messages. This message set, known as Transaction Language 1, Issue 4, is based on the Bellcore special reports, technical advisories, and technical references listed in Table A-16.

Table A-16. Command and Message Specifications

Document Number	Specification
SR-ST5-001665	<i>Network Monitoring and Analysis Generic Network Element Interface Support (Issue 2, December 1992)</i>
SR-ST5-001578	<i>OPS/INE to Network Element Generic TL1/X.25 Interface Support (Issue 3, September 1993)</i>
TA-NWT-000199	<i>Specification of Memory Administration Messages at the OS/NE Interface (Issue 7, January 1993)</i>
TA-NWT-000200	<i>Specification of System Maintenance Messages at the OS/NE Interface (Issue 5, December 1990)</i>
TR-NWT-000811	<i>OTGR: Operations Application Messages - TL1 Message Index (Issue 2, May 1992)</i>
TR-NWT-000818	<i>OTGR Section 6.1: Network Maintenance: Access and Testing - Generic Test Architecture (Issue 1, November 1992)</i>
TR-NWT-000833	<i>OTGR Section 12.3: Operations Application Messages Network Maintenance: Generic Requirements for Network Element and Transport Surveillance Messages (Issue 5, Revision 2, April 1993)</i>
TR-NWT-000835	<i>OTGR Section 12.5: Operations Application Messages - Network Element (NE) Security Parameter Administration Messages (Issue 1, November 1994)</i>

System Performance Specifications

The system capabilities and performance specifications for the DACS IV-2000 include switch types and capacity, cross-connection capabilities, boot time, fault tolerance and protection, and maintenance. Each of these areas is described in this section, and the particular specifications and requirements associated with each area are given.

Switch Type and Capacity

All cross-connect related functions in the DACS IV-2000 are accomplished via a nonblocking, 3-stage space division switch. Nonblocking here implies the ability to access any/all of the free paths through the switch so that a connection from an input port to an output port can always be completed.

The switch type and capacity for the DACS IV-2000 are shown in Table A-17.

Table A-17. Switch Capacity

Item	Value
Switch Type	Nonblocking, 3-stage space division switch
Switch Capacity	7168 input and output switch ports (256 equivalent DS3s)

Cross-Connect Capability

The DACS IV-2000 supports four types of cross-connections:

- One-way
- Two-way
- Bridge (conference)
- Roll.

The execution time for a command depends on the type of command, speed and status of the administrative links, activities in the DACS IV-2000, and the status of the equipment in the system needed to make the connection.

The cross-connection capabilities of the DACS IV-2000 are described below and summarized in Table A-18.

The cross-connect command to the DACS IV-2000 can be one-way or two-way. The cross-connect setup time specification includes the time from which the system receives the command to the time the connection is made; it does not include the output message. The time to set up a one-way or two-way cross-connection is less than 1 second for DS1 and VT1.5 and less than 3 seconds for DS3 and STS-1 clear-channel.

The DACS IV-2000 can bridge any existing connection by cross-connecting the input port to a second output port without affecting service (that is, the existing cross-connect path is not affected). The time to set up a bridge is less than 1 second for DS1 and VT1.5 and less than 3 seconds for STS-1 clear-channel.

A tail-end switch occurs when an existing cross-connect path is disconnected and a new cross-connection made at the tail-end of a facility. The in-service rolling operation requires that a tail-end switch be made in less than 2 ms (less than 3 ms for STS-1 clear-channel). In executing the tail-end switch (command), the DACS IV-2000 does not cause more than a 2-ms interruption in the transmission signal (error-free transmission is established within 2 ms), 3 ms for DS3 and STS-1 clear-channel.

A one-way signal split of an existing cross-connect path between an input port and an output port is accomplished by rerouting the input port signal to a test output port and cross-connecting the signal from the test input port to the output port. The DACS IV-2000 does not cause more than a 2-ms interruption in the signal appearing at the output port (error-free transmission is established within 2 ms), 3 ms for STS-1 clear-channel.

The original cross-connect path is established automatically when the split function is disabled. In establishing the original cross-connection, the system does not cause more than a 2-ms interruption in the signal appearing at the output port (error-free transmission is established within 2 ms).

Table A-18. Cross-Connect Capabilities

Cross-Connect Procedures	Value
One-way Cross-Connect Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (DS3; DS3 and STS-1 clear-channel)
Two-way Cross-Connect Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (DS3; DS3 and STS-1 clear-channel)
One-Way and Two-Way Gateway Cross-Connect Setup Time	< 3 sec (DS3)
Bridge Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (STS-1 clear-channel)
Rolling (Signal Interruption Time)	< 2 ms < 3 ms (STS-1 clear-channel) < 3 sec (DS3 clear-channel or gateway)
One-way Signal Split (Signal Interruption Time)	< 2 ms < 3 ms (STS-1 clear-channel)

Boot Time

The system boot time is the elapsed time from the moment a system reset request is made to the moment the system is ready for an input command. The boot time encompasses the downloading of all the system programs and the latest cross-connect maps from the hard disk to the appropriate controllers. If the information on the hard disk has been corrupted, additional time is required to restore the information to the hard disk from a backup optical disk before the DACS IV-2000 can be booted. The memory update procedures conform to Bellcore TA-NWT-000199, *Specification of Memory Administration Messages at the OS/NE Interface* (Issue 7, January 1993).

The boot time specifications for the DACS IV-2000 are summarized in Table A-19.

Table A-19. Boot Time Specifications

Procedure	Value
Cold Boot Time (from hard disk)	< 15 min
Cold Boot Time (from backup optical disk)	< 15 min
Restart Time (MC, ECI)	< 5 min
Memory Administration Procedures	Conform to TA-NWT-000199

Fault Tolerance and Protection

The DACS IV-2000 can isolate a fault to the facility or equipment, and can isolate the fault to the equipment circuit pack level.

The DACS IV-2000 provides two provisionable input facility signal monitor alarm threshold BERs. The high category shows failures at 10^{-3} , and the low category shows failures at 10^{-6} . If the facility connects to a MUX2 circuit pack (DS3) or a SWIF2 circuit pack (DS1), you can choose from the following bit error rate thresholds: 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} , or 10^{-9} errors per second.

If the facility connects to an SMUX circuit pack (STS-1), you can choose from the following section and line bit error rate thresholds: 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} , or 10^{-9} . At the local office, the incoming signal failures are indicated at the threshold you've specified (major, minor, or no alarm).

Any single hard equipment failure (a nontransient failure that can cause interruption in the transmission path) in the DACS IV-2000 is protected, and the protection switching capability restores error-free transmission within 60 ms from the moment such a failure occurs. Following a correct protection switch around a failed circuit pack and after the failed circuit pack is replaced by a new circuit pack, the health of this new circuit pack is checked and service is restored to this new circuit pack from the protection circuit pack automatically. The automatic restoration time is the elapsed time between the replacement of a circuit pack and

the restoration of service to this new circuit pack. The automatic restoration time is less than 10 seconds. The automatic restoration does not cause more than a 60-ms interruption in the transmission path.

The DACS IV-2000 supplies DS1 idle (unframed all ones), STS-1 idle, or VT1.5 idle signals automatically to the output ports (toward facilities/DSX-3) to drive facilities that are not cross-connected through the DACS IV-2000. When an existing cross-connect path is disconnected, a DS1, STS-1, or VT1.5 idle signal is substituted at the output port in approximately 3 ms.

⇒ NOTE:

When STS-1 and VT1.5 signals are idle, the DACS IV-2000 outputs STS and VT path AIS, respectively.

If the incoming DS3 facility has a failure and DS1 AIS is consequently injected downstream, this DS1 AIS is not reported as an incoming DS1 AIS condition.

The fault tolerance and protection specifications for the DACS IV-2000 are summarized in Table A-20.

Table A-20. Fault Tolerance and Protection Specifications

Item	Value
Cross-Connect Path Monitoring	Continuous
Input Signal Alarm, BER Threshold (DS1 and DS3 interfaces)	$> 10^{-3}$ through 10^{-6} (selectable)
Input Signal Alarm, BER Threshold (DS1 and DS3 interfaces) [optional]	10^{-3} through 10^{-9}
Input Signal Alarm, Section BER Threshold (STS1 interfaces)	10^{-3} through 10^{-9}
Input Signal Alarm, Line BER Threshold (STS1 interfaces)	10^{-3} through 10^{-9}
Input Signal Failure Alarm	Major, Minor, or No Alarm (selectable)
Input Signal Failure Visual Indication	ALM (flashes at 1-sec intervals)
DS1 AIS Substitution Time (DS1 and DS3 interfaces)	< 3 ms
DS1 AIS Substitution Time (STS1 interfaces)	< 50 ms
DS3 AIS Substitution Time (DS3 interfaces)	< 3.1 ms
STS-1 Path AIS Substitution Time	< 125 μ s
VT1.5 Path AIS Substitution Time	< 500 μ s
Protection Switching Time	< 60 ms
Automatic Restoration Time	< 10 sec

Frame Indicators and Controls

Eight visual equipment indicators are provided on the DACS IV-2000 status panel:

- CRITICAL signals a critical alarm condition; red
- MAJOR signals a major alarm condition; red
- MINOR signals a minor alarm condition; yellow
- ABNORMAL is reserved for future use.
- ACO (alarm cutoff) signals that the audible alarms have been turned off (ACO switch activated); green
- POWER ON indicates that power is present at the status panel; green
- FAILURE (Main Controller Failure) is a processor major alarm that signals a failure in the Redundant Controller Module; red
- FAR END is reserved for future use.

All circuit packs, except version one synchronizer circuit packs, contain a red LED to aid in problem identification. (In addition, some circuit packs contain a green LED to indicate that they are in service.) The LED is mounted so that it is visible while the circuit pack is in the equipment. The LED is controlled by a main/unit controller so that it can be illuminated even if the circuit pack it is mounted in is defective. In addition to the red LEDs, alarm messages are generated for all circuit pack failures.

For the DS1, DS3, and STS1 interface circuit packs, as well as the DS1TX2 circuit pack, the LED indicators flash continuously at 1-second intervals on circuit packs that have input signal failures, and remain on for failures in the circuit packs themselves. (Circuit pack failure indicators have a minimum duration of 2 seconds, to distinguish them from incoming signal failures.) The power circuit packs activate their respective LEDs when a fault exists. Because the power circuit pack failure LED is powered from the primary power supply, it lights even when there is a loss of logic level power.

Four controls (momentary-action pushbutton or toggle switches) are located on the DACS IV-2000 status panel:

- LED/LAMP TEST tests all LEDs in the DACS IV-2000 (except FAR END LED)
- RESET, when operated simultaneously with the RESET ENABLE switch, initiates the system reset function
- RESET ENABLE inhibits the reset function from being activated accidentally
- ACO silences the office audible alarms.

The alarm selection criteria in the DACS IV-2000 conform to Bellcore TR-TSY-000191, *Alarm Indication Signal Requirements and Objectives* (Issue 1, May 1986).

The alarm indications for maintenance support are summarized in Table A-21.

Table A-21. Visual Indicators

Item	Value or Specification
System Visual Indicators	CRITICAL, MAJOR, MINOR, ABNORMAL, ACO (alarm cutoff), FAILURE
Circuit Pack Failure Visual Indicator	ALM (2-sec minimum duration); red LED lit
Protection Bus Active Visual Indicator	Green LED lit on MUXPS or DS1RY1
Primary Disk Active Visual Indicator (when disk is spinning)	Green LED lit
Power Feed Status Visual Indicator	Green LED lit
System Controls	LED/LAMP TEST, RESET, RESET ENABLE, and ACO
Power Bus Failure Indicator	BUS ALM
Power Circuit Pack Failure Visual Indicator	ALM; red LED lit
Power Feed Status Visual Indicator	ON
Alarm Selection Criteria	Conform to TR-TSY-000191
CPU (Control Complex) Active Visual Indicator	Green LED lit
Version Two Synchronizer Active Visual Indicator	Green LED lit

Power Specifications

The DACS IV-2000 frame is configured to accept two power supply arrangements, standard (existing frames upgraded to Release 5.0) or duplex (new frame orders). The standard configuration consists of one battery distribution feeder board (BDFB) powered from a single Lineage[®] 2000 (or equivalent) battery plant. The duplex configuration allows the DACS IV-2000 to be powered from one or two Lineage 2000 (or equivalent) battery plants.

Standard Power Configuration

In the standard configuration, the DACS IV-2000 operates with a Lineage 2000 (or equivalent) battery plant (-48 Vdc nominal) in a central office environment.

Seven power feeders and seven returns are terminated at the Switch Bay and provide power for the entire DACS IV-2000. The feeders are designated by the loads they serve: A, B, C, D, E, F, and G. Each load is fused separately.

- Feeders A, B, C, D, and E (connected through the Fuse and Alarm Panel) supply power to the facility interface bays, the SW PWR Module, and the fan assemblies.
- Feeders F and G (connected directly to the RC PWR Module) supply power to the RC PWR Module.

Duplex Power Configuration

The duplex power feature provides compatibility with the "red and blue" central office power distribution being deployed in the AT&T Network, and with other power-distribution arrangements. The duplex power feature uses one or two -48V diverse power plants. (A diverse power plant is one that does not share common components, such as rectifiers, batteries, BDFBs, and cable racks.)

Four power feeders (A, B, C, and D) and four returns are terminated at the Switch Bay and provide power for the entire DACS IV-2000. Power feeders A and B supply power buses A, B, and E and power feeders C and D supply power buses C, D, and F. All power feeders are connected to the Fuse and Alarm Panel.

When the DACS IV-2000 is powered using two battery plants, the following requirements apply:

- Power feeders to the DACS IV-2000 must be placed in two groups to allow connection to two separate BDFBs.
- Two BDFBs are required.
- Feeders A and B are fed from BDFB-A; feeders C and D are fed from BDFB-B.

Loss of one battery plant or loss of one group of feeders does not cause any loss of service (except where there is only one battery plant supplying power).

The power supply requirements are summarized in Table A-22.

Table A-22. Power Supply Requirements

Item	Value
Primary Supply Voltage	-48 Vdc nominal (-42.5 to -60.0 Vdc)
Secondary Supply Voltage	-48 Vdc
Transient Voltage Limit	-60.0 Vdc
Battery Noise (voice frequency)	< 56 dBrc0
Battery Noise (radiation frequency)	100 mV rms in any 3-kHz band over 10 kHz to 20 MHz
Power Bus Interconnection	Connectorized
Number of Power Feeders	Seven (A,B,C,D,E,F, and G) for standard power Four (A,B,C, and D) for duplex power
Fuse Rating at BDFB (feeders A,B,C,D, E, F, and G)	Depends on bay configuration (see floor plan data sheets)
Maximum Current Drain over A, B, C, D, E, F, and G Feeders (under failure condition)	Depends on bay configuration (see floor plan data sheets)
Maximum Current Drain over E Feeder	< 2.0A

Power Dissipation

Enough redundancy is provided in the DACS IV-2000 so a single failure of a bus or power circuit pack does not affect service. Each power circuit pack is fed through a 12A fuse located in the fuse and alarm panel. A power feed status visual indicator and a power circuit pack failure visual indicator are located on each power circuit pack.

The power dissipation of the DACS IV-2000 bays conforms to Bellcore TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993).

Power specification requirements are summarized in Table A-23.

Table A-23. Bay Power Dissipation

Item	Value
Power Circuit Pack Fuse Rating	
PWRA	12A
PWRE	10A
PWRF	7.5A
PWRG	7.5A
Switch Bay Power Dissipation (fully equipped)	1253W
DS1 Interface Bay Power Dissipation (fully equipped)	620W
DS3 Interface Bay Power Dissipation (fully equipped)	597W
STS1/DS3/DS1 Interface Bay Power Dissipation (fully equipped)	770W
STS1/DS3 Interface Bay Power Dissipation (fully equipped)	1105W

Physical Specifications

The floor load from the DACS IV-2000 frames (excluding cable distribution system) averaged across the associated floor area does not exceed 115 lb/ft². Other physical characteristics of the DACS IV-2000 are provided in Table A-24.

Table A-24. Physical Characteristics

Item	Value
DACS IV-2000	Up to nine standard 26 in (W) x 84 in (H) x 12 in (D) bays*
Framework Type	Network Bay
Weight (Switch Bay)	512 lbs
Weight (DS3 Interface Bay)	230 lbs
Weight (DS1 Interface Bay)	440 lbs
Weight (STS1/DS3/DS1 Interface Bay)	450 lbs
Weight (STS1/DS3 Interface Bay)	450 lbs
Floor Load (excluding cable distribution)	Conform to TR-NWT-000063
Maintenance Aisle, Front (minimum width)	30 in
Wiring Aisle, Rear (minimum width)	24 in

* All interface bays are 12 inches deep; the Switch Bay is 13 inches deep.

Environmental Specifications

The environmental considerations for the DACS IV-2000 include the thermal characteristics, handling and transportation requirements, and earthquake, acoustical noise, EMC, and ESD specifications. These environmental specifications conform to Bellcore TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993) and GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 1, November 1994).

Each of these areas is described below and the particular specifications and requirements associated with each area are given.

Ambient Characteristics

The DACS IV-2000 remains operational within the following room ambient temperature and humidity limits.

Room ambient refers to conditions at a location 5 feet above the floor and 15 inches in front of the equipment. The short term refers to a period of not more than 72 consecutive hours and a total of not more than 15 days in one year. At the short-term emergency condition of 120°F, the relative humidity must be below 30 percent.

The DACS IV-2000 remains operational when installed in central offices (COs) located from 200 feet below sea level to 13,000 feet above sea level.

The DACS IV-2000 environmental characteristics are summarized in Table A-25.

Fire Resistance

The DACS IV-2000 meets the fire resistance criteria specified in Section 4.3 of TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993).

Table A-25. Environmental Characteristics

Item	Value or Specification
Normal Operating Temperature Range	+40° to +100°F (4.5° to 38°C)
Minimum Short-Term Temperature	35°F (1.7°C)
Maximum Short-Term Temperature	120°F (49°C)
Maximum Rate of Temperature Change	15°F (8.3°C) per hour
Operating Relative Humidity	20 to 55%
Minimum Short-Term Relative Humidity	20%
Maximum Short-Term Relative Humidity	80% or < 0.024 lb of water/lb of dry air, whichever is less
Operational Altitude	From 200 ft below to 13,000 ft above sea level
Equipment Cooling	Natural convection: DS1, DS3, and STS1/DS3/DS1 Interface Bays Forced convection (fans): Switch and STS1/DS3 Interface Bays
Fire Resistance and Dust	Conform to TR-NWT-000063
Standard Heat Dissipation	Conform to TR-NWT-000063

Handling and Transportation

The DACS IV-2000 meets the shock, vibration, temperature, and relative humidity criteria specified in TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993) for handling and transportation. (See Table A-26.)

Table A-26. Handling and Transportation Specifications

Item	Value or Specification
Vibration and Shock Design Criteria	Conform to TR-NWT-000063
Temperature (Transportation/Storage)	Conform to TR-NWT-000063
Relative Humidity (Transportation/Storage)	Conform to TR-NWT-000063
Storage/Shipment Altitude	Up to 40,000 ft

Earthquake, Acoustical Noise, EMC, and ESD

The design techniques for the DACS IV-2000 minimize emissions for an open frame design. The DACS IV-2000 (256) Release 5.0 complies with the specifications of Part 15, Subpart J, of the Federal Communications Commission (FCC) *Rules for Class A Computing Devices* for electromagnetic emission requirements and with emission and immunity specification of GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 1, November 1994).

The DACS IV-2000 is designed to meet the electrostatic discharge (ESD) requirements specified in GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 1, November 1994).

No equipment damage or service-affecting disruption occurs when the DACS IV-2000 (256) R5.0 system is tested with electrostatic discharges of Severity Level 2 (4 kV) and Severity Level 4 (15 kV) as specified in TR-NWT-000063 and the International Electrotechnology Commission (IEC) Publication 801-2 (Second Edition, 1991). The system will continue to operate normally without the need for any manual intervention during the set.

ESD grounding connections are provided on the front and rear of each bay, and the use of wrist straps is required. Electromagnetic compatibility (EMC) enclosures are required for the DACS IV-2000 to be fully compliant with EMC limits and ESD requirements.

The earthquake, acoustical noise, EMC, and ESD specifications are shown in Table A-27

Table A-27. Earthquake, Acoustical Noise, EMC, and ESD Specifications

Item	Value or Specification
Earthquake and Office Vibration	Conform to TR-NWT-000063
Acoustical Noise Limits under Normal Operating Temperatures	< 65 dBA Conform to TR-NWT-000063
Electromagnetic Compatibility with EMC Enclosures	Conform to GR-1089-CORE Part 15, Subpart J, <i>Class A Computing Devices</i>
Electrostatic Discharge with EMC Enclosures	Conform to GR-1089-CORE

Availability and Reliability Specifications

Availability and reliability can be defined in terms of the following three components, which are described in this section and summarized in Table A-23.

- Mean time between failures
- Mean time between maintenance activities for the equipment
- Quality and reliability of the software.

Mean Time Between Failures

Mean Time Between Failures (MTBF) indicates the frequency of service-affecting failures within the DACS IV-2000. MTBF is greater than 9000 years per DS3, greater than 17,000 years per DS1, and greater than 9000 years (estimated) per EC-1 facility. The outage time is less than 0.012 minute per year per DS3, less than 0.006 minute per year per DS1, and less than 0.012 minute per year (estimated) per EC-1 facility as specified in Bellcore TR-NWT-000233, *Wideband and Broadband Digital Cross-Connect Systems Generic Criteria* (Issue 3, November 1993) and TA-NWT-001339, *Generic Reliability Requirements for Digital Cross-Connect Systems* (Issue 1, November 1993).

Mean Time Between Maintenance Activities

Mean Time Between Maintenance Activities (MTBMA) indicates the frequency of failures within the DACS IV-2000. This is a measurement of how often a maintenance activity occurs and includes both service-affecting and non-service-affecting failures. The MTBMA is greater than 3000 hours for a fully equipped DACS IV-2000 standard bay. The MTBMA specified in Table A-28 is for fully equipped standard bays and depends on bay type.

The MTBMA, MTBF, and outage times are based on 2 hours Mean Time To Repair (MTTR) as specified in Bellcore TR-NWT-000233, *Wideband and Broadband Digital Cross-Connect Systems Generic Criteria* (Issue 3, November 1993) and TA-NWT-001339, *Generic Reliability Requirements for Digital Cross-Connect Systems* (Issue 1, November 1993).

The availability and reliability specifications for the DACS IV-2000 are summarized in Table A-28.

Table A-28. Availability and Reliability Specifications

Item	Value or Specification
MTBF (per DS3)	> 9000 years (est.)
MTBF (per DS1)	> 17,000 years (est.)
MTBF (per EC-1)	> 9000 years (est.)
Outage Time (per DS3)	0.012 min/year; better than TR-NWT-000233 and TA-NWT-001339
Outage Time (per DS1)	0.006 min/year; better than TR-NWT-000233 and TA-NWT-001339
Outage Time (per EC-1)	< 0.012 min/year; better than TR-NWT-000233 and TA-NWT-001339
MTBMA Switch Bay (fully equipped)	4299 hours
MTBMA DS3 Interface Bay (fully equipped)	4144 hours
MTBMA STS1/DS3/DS1 Interface Bay (fully equipped)	3835 hours
MTBMA DS1 Interface Bay (fully equipped)	5323 hours
MTBMA STS1/DS3 Interface Bay (fully equipped)	4144 hours
MTTR	2 hours
Reliability Prediction Procedure	Conform to TR-TSY-000332, Issue 4

Software Quality and Reliability

The software quality criteria conform to Bellcore TR-TSY-000179, *Software Quality Program Generic Requirements (SQPR)* (Issue 2, June 1993).

The software reliability criteria conform to Bellcore TR-TSY-000282, *Software Reliability and Quality Acceptance Criteria (SRQAC)* (Issue 1, December 1986).

The reliability prediction procedures conform to Bellcore TR-NWT-000332, *Reliability Prediction Procedure for Electronic Equipment* (Issue 4, September 1992).

**ROADS Standard Product
Configurations**

B

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ROADS Standard Product Configurations

B

This appendix provides information on the new Rapid Order and Delivery System (ROADS) standard product configurations offered with the DACS IV-2000 SONET product line.

ROADS product configurations permit you to order additional I/O bays, circuit packs, and upgrades, as well as whole new systems for both (256) and (512) platforms.

These new product configurations have been simplified and standardized and are sold from a pre-defined set of orderable items which may be used in various combinations to satisfy customer requirements. ROADS is a new delivery process that supports these configurations by coordinating all necessary product components upon receipt of a customer order. All system components are then shipped out to the customer from one location, thus reducing delivery intervals.

⇒ NOTE:

Orders for products outside of standard applications do not offer ROADS processing and may result in longer delivery intervals.

For the (256) platform, ROADS supports *only* Release 4.x and 5.x software.

The DACS IV-2000 SONET product configurations supported by ROADS are listed in Table B-1 and are described in the pages that follow.

Table B-1. DACS IV-2000 ROADS Standard Product Configurations

Configuration	Application Code
DACS IV-2000 (256) New System	KH
(256) Growth I/O or OPEX Bays	K6
(256) Hardware/Software Upgrades	K7
DACS IV-2000 (512) New System	KJ
(512) I/O Growth/Upgrades	K8
(256 to 512) Capacity Expansion	K9

DACS IV-2000 (256) New System

Application Code: KH

This configuration provides one new DACS IV-2000 (256) system, including an initial switch, background equipment, and either a DS1/DS3/STS-1 or STS-1/DS3 I/O bay. Refer to Chapter 4, "Ordering Information," for standard and optional orderable items.

Features and Functionality

This configuration offers the following features:

- **SONET connectivity**— maintains the SONET path while allowing for grooming and rearrangement of STS-1 signals
- **SONET/Asynchronous gateway**— cross-connects DS1 from a DS1 or DS3 signal type to an STS-1 signal type. Release 5.x provides cross-connection of DS3 signals to a SONET interface (MUX3)
- **Grooming capabilities**— adds or drops signals to or from a terminating facility
- **Broadband cross-connection**— combines functionality of both a wide-band and broadband cross-connect system
- **Full time DS1 monitoring**— full-time path performance monitoring of all 28 DS1 tributaries in the DS3 signal (MUX3)
- **Test access**— monitors, splits, or loops any port for testing the path through the network
- **Clear-channel DS3**— uses the MUX3 circuit pack to send a clear-channel DS3
- **Loopbacks**— loops DS1, DS3, VT1, or STS-1 signals at various points through the system for sectionalizing faults

Acceptable Capacity Range

Table B-2 lists the ranges for each signal type within each initial system.

Table B-2. Acceptable Capacity Range (Application Code KH)

DS1/DS3/STS-1		STS-1/DS3	
DS1	0 to 420	DS3	0 to 60
DS3	0 to 46 (MUX2 only)	OR	
DS3	0 to 30 (MUX 3 only)	STS-1	0 to 60
OR		OR	
DS1	0 to 420	STS-1 & DS3	0 to 60
DS3	0 to 30 (MUX 2 only)		
DS3	0 to 15 (MUX3 only)		
STS-1	0 to 16		

System Dimensions/Floor Plan Requirements

This configuration has a minimum dimension of 7ft. H x 6.5ft. W x 13 in. D. Future growth of the system with the purchase of Application Code K6 could result in a total of eight bays or a system width of 17ft 4in.

Figure B-1 illustrates the DACS IV-2000 (256) New System configuration with a DS1/DS3/STS-1 combination bay. The figure shows how a system can be expanded using Application Code K6.

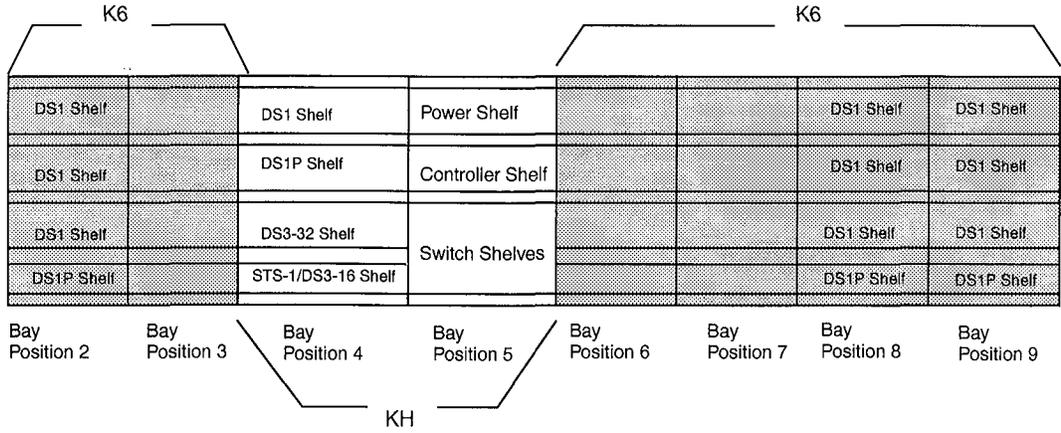


Figure B-1. Sample Application Code KH

Figure B-2 illustrates the (256) New System configuration with an STS-1/DS3 Bay.

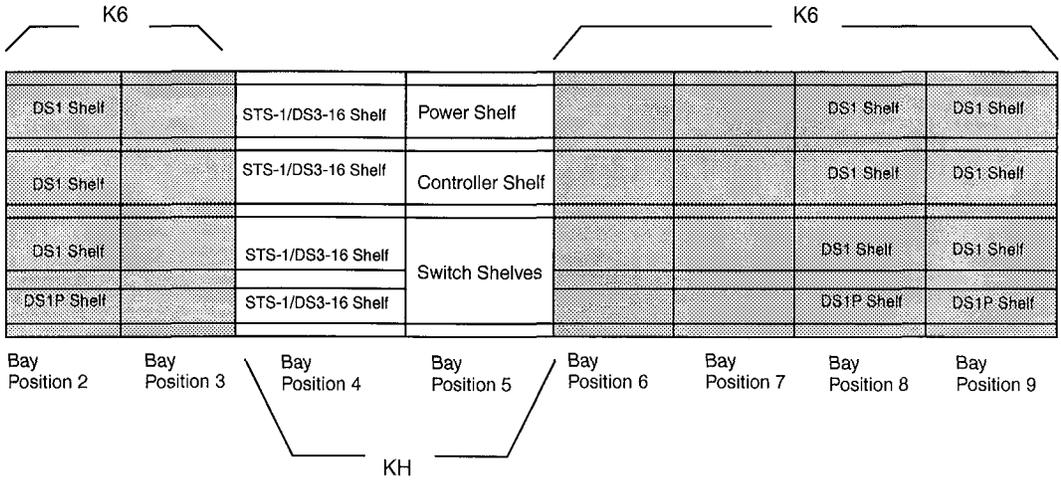


Figure B-2. Sample Application Code KH with an STS-1/DS3 Bay

(256) Growth I/O or OPEX Bays

Application Code: K6

This configuration provides additional I/O bays required for growth of an existing (256) system or an optically remoted system. This configuration supports a purchase of one to six I/O Growth Bays (depending on the desired configuration), DACS IV-2000 hardware and software, and other background equipment. Refer to Chapter 4, "Ordering Information," for standard and optional orderable items.

Features and Functionality

This configuration includes the following items:

- A combination of DS1/DS3/STS-1 I/O bays and their plug-ins
- DS1 I/O bays and plug-ins
- STS-1/DS3 I/O bays and plug-ins

Acceptable Capacity Range

Table B-3 lists the acceptable signal ranges for the growth I/O bay types within the configuration:

Table B-3. Acceptable Capacity Range (Growth I/O Bays)

DS1/DS3/STS-1		DS1	STS-1/DS3		
DS1	0 to 868	0 to 868	DS3	0 to 60	
DS3	0 to 46		STS-1	0 to 60	
OR			0 to 868	DS3 & STS-1	0 to 60
DS1	0 to 868				
DS3	0 to 30				
STS-1	0 to 16				

System Dimensions/Floor Plan Requirements

Each bay for this configuration has a minimum dimension of 7ft. H x 26in. W x 13in. D. It is possible to order up to six bays per this configuration for an existing start-up system. The resulting space requirements for these bays is 7ft. H x 13ft. W x 13in D.

Figure B-3 illustrates the growth bays that can be ordered with this configuration.

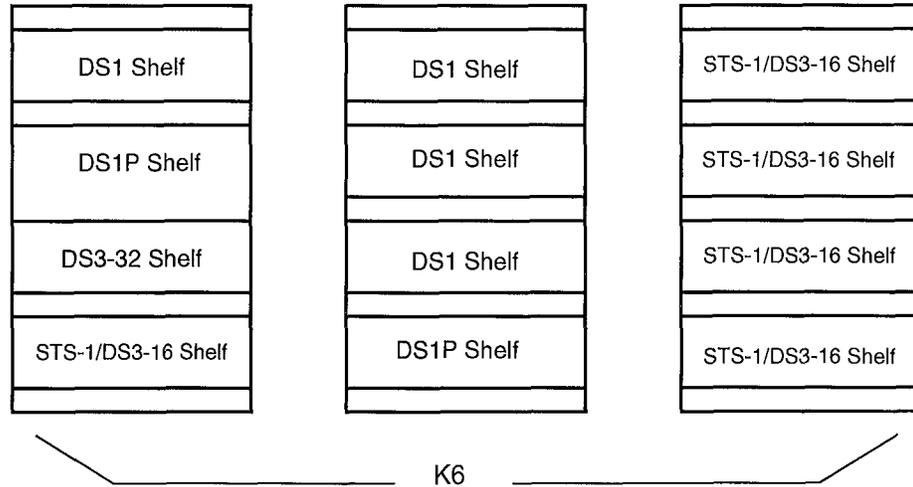


Figure B-3. Application Code K6 Growth Bays

(256) Hardware/Software Upgrades

Application Code: K7

This configuration provides DACS IV-2000 (256) hardware and software upgrades from previous releases to the current release. Background equipment is also included. Refer to Chapter 4, "Ordering Information," for standard and optional orderable items.

⇒ NOTE:

Systems must first be running Release 3.x RC in order to upgrade using this configuration. Starting with Release 3.x RC, hardware and software can be upgraded (optional) individually or as a combined procedure.

Features and Functionality

This configuration has the following features:

- **Enhanced Secondary Storage Subsystem (SSS)**— provides enhanced circuit packs that provide optical disk technology
- **Enhanced synchronizer**— provides improved lock-time performance and LEDs that indicate active or alarm status
- **MUX3 card**— provides DS1 performance monitoring and allows clear-channel DS3 cross-connection and STS-1 to DS3 cross-connection (Release 5.x)

DACS IV-2000 (512) New System

Application Code: KJ

This configuration provides one new DACS IV-2000 (512) system, including an initial switch bay, background equipment, zero to four collocated DS1 I/O bays and/or zero to four STS-1/DS3 I/O bays.

Use this configuration to order one of the following:

- New (512) switch for capacity expansion
- New (512) system with collocated I/O bays
- New (512) switch for optical remoting

Refer to Chapter 4, "Ordering Information," in the *DACS IV-2000 (512) Applications, Planning, and Ordering Guide* for standard and optional orderable items.



NOTE:

To expand capacity from a (256) to (512) system, you must use Application Code K9 described on page B-14.

If more I/O bays are needed, use Application Code K8.

Features and Functionality

This configuration has the following features:

- **Collocated/optically remoted I/O bays**— allows either half or all I/O bays to be located at one site or at two other sites up to 1000 cable feet away from the (512) switch and control bays
- **Full time DS1 performance monitoring**— monitors all tributaries within a DS3 signal (MUX3)
- **DS3 clear-channel cross-connection between DS3 and STS-1 signals (MUX3)**— cross-connects DS3s through the switch matrix as either DS1 or DS3 (MUX3)
- **Gateway cross-connection between DS3 and STS-1 signals (MUX3)**

Acceptable Capacity Range

Table B-4 lists the signal ranges for collocated I/O bays in an initial system:

Table B-4. **Acceptable Capacity Range (Collocated)**

DS1 Bay	STS-1/DS3 Bay	
0 to 868	DS3	0 to 60
	OR	
	STS-1	0 to 60
	OR	
	STS-1 & DS3	0 to 60

System Dimensions/Floor Plan Requirements

The DACS IV-2000 (512) New System configuration has a minimum three bay arrangement with dimensions of 7ft. H x 6.5ft. W x 13 in. D. For this configuration, up to eight I/O bays and two fuse bays can be ordered for each side of the switch (when I/Os are collocated). The resulting space requirements for these bays is 7ft. H x 19.5ft. W x 13 in. D.



NOTE:

The depth of the system increases to 14.5 inches when I/O bays are optically remoted.

Figure B-4 illustrates Application Code KJ with collocated and optically remoted DACS IV-2000 bays.



NOTE:

The optical bay, shown in the lower portion of this figure, is ordered through Application Code KH as a new (256) switch and I/O bay.

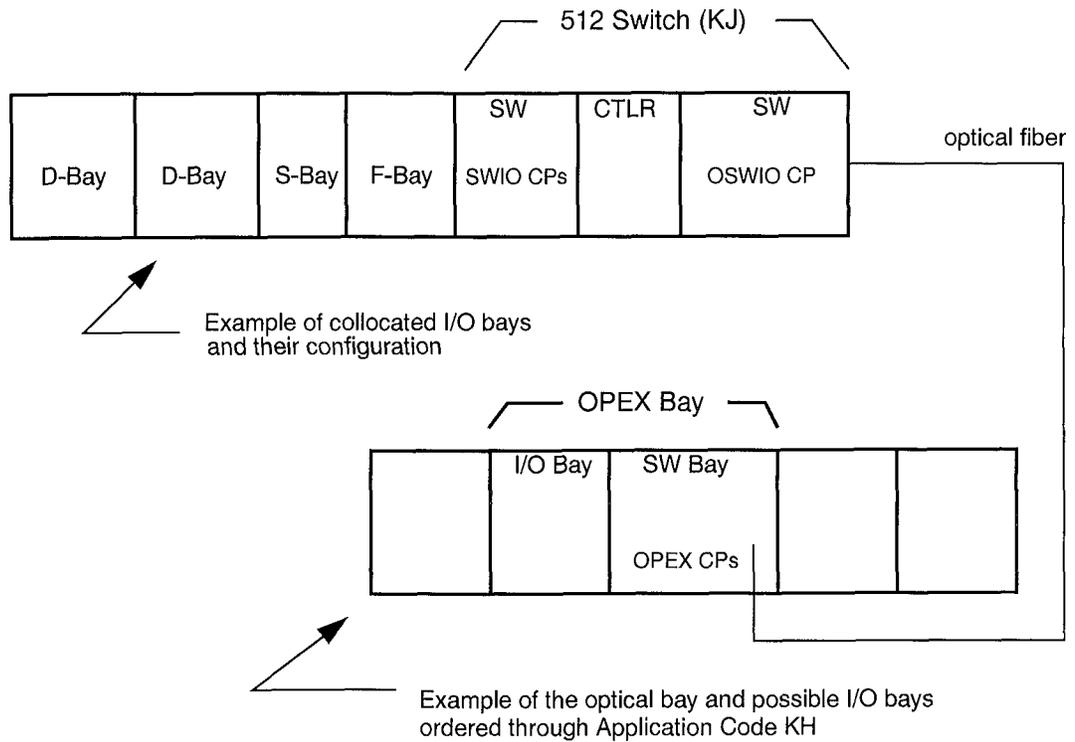


Figure B-4. Sample Application Code KJ with Collocated and Optically Remoted Bays

(512) I/O Growth/Upgrades

Application Code: K8

This configuration supports incremental I/O bay growth collocated with an existing DACS IV-2000 (512) switch. It provides background equipment and permits up to eight (512) I/O bays to be ordered per switch side for a total of sixteen per switch. Refer to Chapter 4, "Ordering Information," of the *DACS IV-2000 (512) Applications, Planning, and Ordering Guide* for standard and optional orderable items.



NOTE:

The I/O bays must be collocated with an existing (512) switch. The number of supported I/O bays is dependent upon the desired configuration.

Acceptable Capacity Range

Table B-5 lists the acceptable signal ranges for each growth I/O bay within the configuration:

Table B-5. Acceptable Capacity Range (Growth I/O Bays)

DS1 Bay	STS-1/DS3 Bay	
0 to 868	DS3	0 to 60
	STS-1	0 to 60
	STS-1 & DS3	0 to 60

System Dimensions/Floor Plan Requirements

Each bay has a minimum dimension of 7ft. H x 26in. W x 13in. D. It is possible to order up to sixteen bays for this configuration for an existing start-up system. The resulting space requirements for these bays would be 7ft. H x 32.5ft. W x 13in. D



NOTE:

Application Code K8 may contain one or more DS1 and STS-1/DS3 I/O bays which are only used when collocated with a (512) switch.

(256 to 512) Capacity Expansion

Application Code: K9

This product configuration supports increased capacity of an existing (256) system, expanding it to a (512) system. It provides the hardware, software, and circuit packs for both the (256) and (512) systems. Refer to Chapter 4, "Ordering Information," in the *DACS IV-2000 (512) Applications, Planning, and Ordering Guide* for standard and optional orderable items.

NOTE:

If not already installed, the (512) switch complex must be ordered through Application Code KJ.

This configuration assumes that the site has been preconditioned with the appropriate DSX and common site material when the (256) and (512) systems were installed.

Features and Functionality

This configuration has the following features:

- **Capacity expansion**— the capacity of a DACS IV-2000 (256) system can be expanded to the (512) platform within the field. The (256) system is optically connected to the (512) switch complex during an in-service procedure performed by the Lucent Technologies CTSI organization.

System Dimensions/Floor Plan Requirements

This configuration will increase the depth of the existing switch frames to approximately 15 inches.

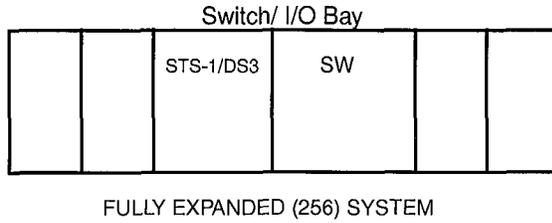
Figure B-6 illustrates an example of capacity expansion.



NOTE:

The (512) switch complex, shown in the bottom right portion of the figure, is ordered separately through Application Code KJ and is connected to the original (256) system using Application Code K9.

Original Configuration:



Capacity Expansion:

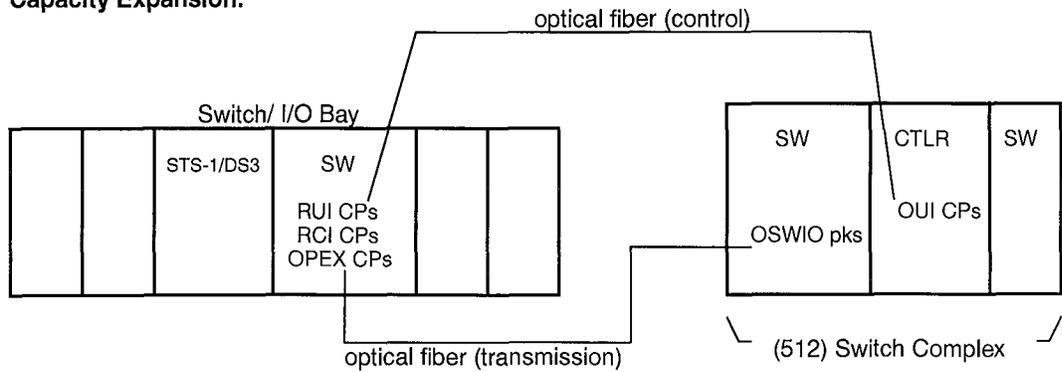


Figure B-6. Sample Application Code K9

Glossary

A

Active

The circuit pack or module is in service, not protected. If it is a traffic-carrying circuit pack or module, it is carrying traffic.

Alarm Delay

Specifies (in seconds) the alarm delay for software-detected alarm conditions. Initial value is 10 seconds.

Alarm Indication Signal (AIS)

A signal transmitted downstream if the incoming signal is defective.

All-Ones Signal

Signal that is defined to contain all ones. AIS is an example of an all-ones signal.

Alphanumeric Characters

Letters and digits.

Alternate Mark Inversion

A DS1 line code in which alternate one bits are positive and negative, but zero substitution is not used.

ASCII Characters

Letters, digits, and symbols used in the American Standard Code for Information Interchange.

Attribute

Alarm indication level: critical, major, minor, or no alarm.

Autolock

When the system autolocks a circuit pack, it switches to protection and forbids return to the working circuit pack even if the trouble clears. This is caused by multiple protection switches on that circuit pack in a short time period.

Autolock Numbers of Switches

This parameter is the number of times that the system restores a circuit pack to service (after intermittent failures) in a given autolock switching interval before the circuit pack is autolocked.

Autolock Release Time

The number of hours between times when the system automatically releases autolock.

Autonomous

An action performed by the system without direction by you.

Auto-provisioning

Put into the provisioned state automatically by the system.

B

B3ZS

Bipolar with 3-zero substitution; a DS3 or STS-1 line code.

B8ZS

Bipolar with 8-zero substitution; a DS1 line code.

Baud Rate

Transmission rate (bits per second) on a link.

BER Metric

Specifies the metric for calculating bit error rate at a DS3 interface port. Options are bipolar variation (BPV) or parity (PTY). The initial value is BPV.

Bipolar Variation

A variation of the alternating +1, -1 pattern in a 3-level code.

Bit Error Rate Threshold

Point at which an alarm is issued for bit errors.

Blue Code

Same as alarm indication signal (AIS).

Boot

To transfer contents of backup memory into the system's working memory.

Broadcast

To take a signal from a single input port and connect it to multiple output ports.

Byte

Usually refers to a group of eight consecutive binary digits, but sometimes used for bit groups of other sizes.

C

C-bit Parity

Parity checks on blocks of data are used to detect bits in error. C-bit parity is a DS3 format specified by ANSI T1.107 that supports near-end and far-end path performance monitoring, contains far-end alarm/control, and three end-to-end overhead communications channels.

Clear (CL)

The state where an alarm condition no longer exists.

Clear-channel

A channel in which all bandwidth is used, with no overhead bits.

Command Mode

One of two modes used to communicate with the DACS IV-2000. This mode involves entering commands directly into the system without any prompts.

Condition

The type of alarm failure, such as internal and loss of signal.

Control Cable ID

Specifies the controller cable identification associated with an interface module or a DS3 performance monitor (DS3PM) circuit pack (J cable).

Control Complex

A set of circuit packs (CPU/MTC/SSC) that provides all control functions for the DACS IV-2000.

Cross-Connect

Hardware used to interconnect line-terminating equipment, multiplexers, and other equipment, allowing access to these facilities and having the ability to change these facilities as required.

Crosstalk

An unwanted signal induced into one transmission line from another transmission line.

Current Value

In the dialog mode, indicates that the current value of a parameter is used by the system unless you direct otherwise.

D

Database

A record of cross-connections, status of circuit packs and facilities, and other data.

Default

A value the system automatically uses for a parameter if the you do not specify a value.

Delimiter

A punctuation mark (colon or comma) used to separate two parameters in an input message.

Demultiplexer

An electronic device used with a multiplexed signal for recovering signals combined within it and restoring the distinct individual channels of these signals.

Diagnose

To test a circuit pack.

DS1GRP

A group of 28 DS1 ports in a SWIF, MUX, or SMUX [VT1.5(DS1) signals] circuit pack.

DS1 Port

Terminates a DS1 signal on a DS1IF (one of fourteen ports), as part of a DS3 signal on a MUX, or as part of an STS-1(VT1.5) signal on an SMUX circuit pack.

DS1 Signal

A logical signal with a data rate of 1.544 Mb/s (ANSI T1.107). A DS1 signal is produced by combining 192 payload bits and one framing bit; for example, 24 DS0 signals (eight bits per DS0) can be combined with one framing bit, thereby transmitting 193 bits per frame.

DS3 Clear Channel Interface-16 Module

A DS3 Interface-16 Module that contains 15 MUX3 circuit packs and one MUSP3 circuit pack (but cannot contain MUX1, MUX2, or PMGR circuit packs). This module supports all the new (256) Release 5.0 features.

DS3 Equivalent

The second item in the address of a port. It refers either to a MUX circuit pack or to an SWIF circuit pack, either of which handles 28 DS1 signals.

DS3 Format

Specifies the line format of a DS3 interface port. The initial value is M13, the common multiplexer format.

DS3 Idle Signal

A signal that can be optionally applied to any DACS IV-2000 output port that is not cross-connected to any input port. This signal lets downstream network elements know that the facility is operating normally even though the DACS IV-2000 is not sending a normal DS3 signal.

DS3 Interface Port

Specifies a DS3 port on a MUX circuit pack. If the value UNIT is given, it indicates all the DS3 interface ports in that DS3 Interface Module.

DS3 Signal

A logical or electrical B3ZS signal with a data rate of 44.736 Mb/s (ANSI T1.107). For the DACS IV-2000, a traffic-carrying DS3 signal is made up of 28 DS1 signals and control bits used for synchronization and other purposes. The DS3 signal consists of a succession of masterframes approximately 106 μ s long. Each masterframe contains seven subframes, each of which consists of eight data blocks. A data block contains one control bit and 84 data bits, with three data bits coming from each of the 28 DS1 signals that make up the DS3 signal.

DSX-1, 2, 3

Digital cross-connect used to interconnect equipment, provide patch capability, and provide test access at the DS1, DS2, or DS3 level.

Duplex Entity

A pair of circuit packs in which one is active and the other is in hot standby (clock generators).

E

Electrical Carrier 1 (EC-1)

The industry standard nomenclature for an electrical STS-1 signal.

Echo

To display an input at a terminal. (A user ID is echoed, but a password is not.)

Electromagnetic Compatibility (EMC)

A measure of equipment tolerance to external electromagnetic fields.

Electromagnetic Interference (EMI)

Interference generated in a circuit by electromagnetic radiation energy coupling.

Electrostatic Discharge (ESD)

Static electrical energy potentially harmful to circuit packs and humans.

Enhanced DS3 Interface-16 Module

A DS3 Interface-16 Module that contains at least one MUX2 circuit pack, at least one MUX3 circuit pack, and one MUXP3 circuit pack (but cannot contain MUX1 or PMGR circuit packs). This module supports all the new (256) Release 5.0 features except clear-channel DS3.

Enter

To provision a circuit pack or interface module by a command, not automatically by the system.

Entity

A specific piece of hardware (such as a circuit pack, memory device, or communications link) that has been assigned a name recognized by the system.

Entity Identifier

The name used by the system to refer to a circuit pack, memory device, or communications link.

Equalizer

A circuit adjustment used to maintain signal strength within desired limits.

Equipped

The circuit pack or interface module is in the system database and physically in the frame, but is not yet provisioned.

F

Facility

A one-way or two-way circuit connected to the DACS IV-2000 that carries a transmission signal (such as a DS1 or STS-1 signal).

Forced

A traffic-carrying circuit pack (either service or protection) has been deliberately locked into a service-providing state by a manual command despite being bad.

Frame

The smallest repetitive block of digital data being transmitted (for example, 193 bits in a DS1 signal), which contains twenty-four 8-bit bytes and a synchronizing frame bit. Also refers to an assembly of equipment units, such as a DACS IV-2000 frame.

G

Grooming

Rearrangement of DS1/VT1.5 signals in DS3/STS-1 signals.

H

Hardware ID

Specifies the hardware identification (type and version) of a circuit pack.

Header

The first line of a message.

Header Date

Specifies the current date as YYMMDD, where YY is the last two digits of the year, MM is the month, and DD is the day of the month.

Header Time

Specifies the current time of day as HHMMSS, where HH is the hour (00 to 23), MM is the minute, and SS is the second.

Hierarchy

An orderly ranking or sequence of elements, such as that of menus presented at a terminal.

Hit

A momentary disruption of service.

Hot Standby

A circuit pack ready for fast, automatic placement into operation to replace an active circuit pack.

I

Idle

An output port is idle if it is not cross-connected to an input port.

Idle Code

A signal that is transmitted downstream automatically from an idle output port; it can also be transmitted downstream by a manual command from a cross-connected output port. The DS1 idle code (the same as DS1 alarm indication signal) consists of all ones.

In-Service

A state in which the circuit pack is performing normal service functions, in either active or standby mode.

Input Status

The input signal status of a DS1, DS3, VT1.5, or STS1 interface port, which can be:

- DRVN (driven) — where a signal is expected at the port, and the port is being monitored for failures
- NDRVN (not driven) — where no valid signal is expected at the port, and the port is not being monitored for failures
- INIT (initialized) — or unset meaning that the port is considered not driven until a valid signal is detected, at which time it becomes driven

- QRSS (quasi-random signal source) — a DS1 port is provisioned as the QRSS for the system.

Initial values are INIT for a DS1 interface port, DRVN for a DS3, VT1.5, and STS1 interface port, and DRVN for DS1 ports of an DS3 interface port.

J

Jitter

Short-term variations in timing properties of a digital signal.

L

Line

A transmission medium, together with the associated equipment, required to provide the means of transporting information between two consecutive network elements; one network element originates the line signal and the other terminates the line signal.

Line Buildout (LBO)

An attenuating (signal-reducing) element used to keep DS3 or STS-1 output signal strength within desired limits. The line buildout setting for MUX or SMUX circuit packs includes:

- IN — the line buildout is in use, reducing the output signal strength
- OUT — the line buildout is not in use
- INIT — initialized (unset)

Line Code Type

Specifies the code type for a DS1 port terminating in a DS1 circuit pack, B8ZS or AMI.

Line Layer

The third layer of the standard SONET signal, used for reliable transport of the path layer payload and its overhead across the physical medium. The added overhead is accessed at points where STS signals are formed or terminated. Both lower layers (the photonic and section layers) exist to provide transport for this layer.

Link ID

The location and type of a user interface link.

Literal Character

A letter, digit, or symbol that is entered in a command. The first hyphen in UNIT-{1-64} is a literal character; the braces and the second hyphen are not literal characters.

Location

An identifier for a specific circuit pack, interface module, interface port, or communications link.

Loopback

A circuit arrangement that causes a received signal to be returned to its source.

Loopback State

Specifies the state of a DS1, VT1.5, or STS1 port loopback:

- LPBKL (line loopback) — loops the signal from an input port to the corresponding output port in the same circuit pack by a connection in the circuit pack
- LPBKT (terminal loopback) — loops the signal from an input port to the corresponding output port in the same circuit pack by a cross-connection in the switch module
- LPBKI (internal loopback) — loops the signal from an output port to the corresponding input port of the same circuit pack.

M

M13

A standard format used for DS3 signals, produced by a DS1-to-DS3 multiplexer.

Maintenance Condition

A circuit pack state in which some normal service functions are suspended, either because of a problem or to perform special functions (copy memory) that cannot be performed while normal service is being provided.

Mapped

Cross-connected.

Memory Class

One of two types of memory in the DACS IV-2000: PROG (software release) or DBASE (database).

Memory Data

Specifies the data (eight hexadecimal digits) associated with a memory type.

Memory Location

Specifies the equipment, DS1 interface port, DS3 MUX port, or STS1 SMUX port location associated with a memory type.

Memory Type

Specifies the memory device, which may be:

- WKG — working (system) random access memory
- PRI — primary backup (disk)
- SEC — secondary backup (optical disk).

Menu/Prompt Mode

One of two modes used to communicate with the DACS IV-2000. When operating in this mode, the system lets you choose commands from menus and then prompts you for information to complete the command.

Multiplexer

An electronic device that allows two or more signals to pass over one communications circuit.

N

N-Rate Cable

A cable that carries an N-rate signal (27.648 Mb/s), which includes 14 DS1 signals, half of an STS-1(cc-SPE) signal, 14 STS-1(VT1.5) signals, or half a DS3 clear-channel signal, and timing information.

Network Element

A DACS IV-2000 frame is an example of a network element.

Notification Code

The notification code for alarm and status conditions, which includes:

- MJ — major alarm
- MN — minor alarm
- NA — indicates no alarm (status only)
- CL — cleared alarm.

NOVAL (no value)

In dialog mode, it indicates that no value is used for this parameter unless you enter one.

O

Out-Of-Service (OOS)

The circuit pack is not providing its normal service function (removed from service or protected) either because of a system problem or because it has been removed from service manually.

Outage

A disruption of service that lasts for more than 1 second.

Output Mode

Specifies what is being transmitted from a DS1, VT1.5, or STS1 output port. The modes are:

- NORM — normal cross-connected data
- TERM (terminated) — idle code
- AIS — alarm indication signal
- QRSS (quasi-random signal source) — an externally generated DS1 test signal, assumed to be quasi-random.

The initial value is NORM.

P

Parity Check

A check that tests whether the number of ones (or zeros) in an array of binary bits is odd or even; used to determine that the received signal is the same as the transmitted signal.

Path

A logical connection between the point at which a standard frame format for the signal at the given rate is assembled, and the point at which the standard frame format for the signal is disassembled.

Path Layer

The highest of the four layers of a standard SONET signal, used to transport services between path-terminating network elements. Examples of such services include DS1s, DS3s (synchronous and asynchronous), and video signals.

Path Overhead (POH)

Informational bytes assigned to, and transported with, the payload until the payload is demultiplexed.

Payload Pointer

The pointer that shows the location of the beginning of the synchronous payload envelope (SPE).

Phase-locked

A synchronizer is phase-locked to an input timing reference when the clock frequency error and the phase-time error remain within a specified range (depending on the stratum level).

Photonic Layer

The lowest of the four layers in a standard SONET signal, used to convert STS signals and OC (optical carrier) signals.

Poll Timing

Specifies (in seconds) how often the system expects a poll request from a remote telemetry on a TABS/TBOS link.

Port

The point of access on an interface circuit pack that connects the DACS IV-2000 to a DS1, DS3, or STS-1 signal.

Primary Line

The second line in an output message.

Protocol

Detailed format and procedures used for transmitting digital data.

Protocol Type

Indicates the protocol supported on an interface link.

Provision

To set parameters to establish the environment required for correct interaction of hardware, software, and peripherals.

Provisioned

The circuit pack is ready to perform its intended function. A provisioned circuit pack can be active (ACT), in-service (IS), standby (STBY), provisioned out-of-service (POS), or out-of-service (OOS).

Pulse Code Modulation (PCM)

The process by which analog signals are sampled, quantized, and coded into a digital bit stream.

Q

Quasi-random Signal Source (QRSS)

Equipment that generates a specific, reproducible but complicated digital test signal that resembles a normal traffic-carrying DS1 signal.

R

Redlined

A circuit that is given special protection against unintentional disconnection.

Released

If an input port, it is not under test access; if an output port, it is not cross-connected to an input port under test access.

Return to Zero

A code form having two information states termed zero and one and having a third state or an at-rest condition to which the signal returns during each period.

Roll

Operation used when the transmission facility between the system and an upstream system is to be replaced.

S

Section

The portion of a transmission facility, including terminating points, between:

- a terminal network element and a line-terminating network element, or
- two line-terminating network elements.

A terminating point is the point, after single regeneration, at which performance monitoring is done.

Section Layer

The second of the four levels in a standard SONET signal, used to transport an STS frame across a physical medium. This layer uses the photonic layer to form the physical transport.

Side Switch

The autonomous action taken when the active control complex (CC) fails. A side switch takes up to 5 minutes to complete and switches the standby CC to the active state.

Snider

Protocol (message format) used on administrative links.

Software ID

Number that provides the software version information for the system. The software ID contains:

- a 1-digit number that indicates the software release
- a 2-digit number that indicates the issue
- a 3-digit number that indicates the point release.

Split

Test access state in which an incoming signal is cross-connected to the receiver of a test set rather than to a previously connected output port, and a signal from the transmitter of the test set is cross-connected to the previously connected output port.

Standby

The circuit pack is in service but is not providing service functions. It is ready to be used to replace a similar circuit pack either by protection or by duplex switching.

State

The state of a circuit pack indicates whether it is defective or normal (ready for normal use).

Stratum 3 Clock

A clock that has a minimum accuracy of ± 4.6 ppm in the absence of input references. In normal operation, a stratum 3 clock accepts a (1 x 1 protected) synchronization input that is traceable to a primary reference source that has a minimum accuracy of $\pm 1 \times 10^{-11}$.

STSX-1

Digital cross-connect used to interconnect equipment, provide patch capability, and provide test access at the STS-1 level.

STS1 Interface Port

Specifies an STS1 port on an SMUX circuit pack.

STS Envelope Capacity

Bandwidth within, and aligned to, the STS frame that carries the STS SPE.

STS Path Overhead

Nine evenly distributed path overhead bytes per 125 μ s, starting at the first byte of the STS SPE. STS path overhead provides for communications between the point of assembly of an STS SPE and its point of disassembly.

STS Payload Capacity

The maximum bandwidth within the STS SPE that is available for payload.

STS-1 Signal

The basic building block signal in the SONET standard. An STS-1 signal has a data rate of 51.84 Mb/s. An STS-1 signal frame consists of 90 columns and 9 rows of 8-bit bytes, for a total of 810 bytes (6480 bits) for a frame length of 125 μ s. The first three columns of an STS-1 signal are the transport overhead, which contains overhead bytes of section (nine bytes) and line (eighteen bytes) layers. The remaining 87 columns of 9 rows of bytes (783 bytes) make up the STS-1 envelope capacity.

STS Synchronous Payload Envelope (STS SPE)

A 125- μ s frame structure composed of STS path overhead and bandwidth for payload.

STS Transport Overhead

The overhead (informational bytes that contain the line and section overhead) added to the STS SPE for transmission.

Subpart

In the Digital Data System, a data bit rate that is 2.4, 4.8, or 9.6 kb/s.

Synchronous

The essential characteristic of time scales or signals such that their corresponding significant instances occur at precisely the same average rate.

Synchronous Network

The synchronization of transmission systems with synchronous payloads to a master (network) clock that can be traced to a reference clock.

Synchronous Payload

Payloads that can be derived from a network transmission signal by removing integral numbers of bits from every frame; that is, no variable bit-stuffing-rate adjustments are required to fit the payload in the transmission signal.

T

Terminated

Output mode in which idle code is transmitted downstream.

Test Mode

Specifies the test access mode.

Tributary

One of the 28 DS1 (1.544 Mb/s) channels in a DS3 (44.736 Mb/s) signal or one of 28 VT1.5 (1.728 Mb/s) channels in an STS-1 (51.84 Mb/s) signal.

U

User Community Authorization Level (UCAL)

Specifies the user authorization level: 5 identifies a super user (system administrator); 1 identifies an ordinary user.

Unit

An interface module; the term is sometimes used instead of entity or subassembly.

Unit Type

Specifies the type of interface module:

- 32DS3 — for DS3 Interface-32 Module
- 16DS3 — for DS3 Interface-16 Module
- 16STS1 — for STS1 Interface-16 Module

- DS1 — for DS1 Interface Module
- DS1P — for DS1 Interface-Protection Module
- 16EDS3 — for Enhanced DS3 Interface-16 Module
- 16DS3CC — for DS3 Clear-Channel (DS3CC) Interface-16 Module.

V

Virtual Tributary (VT)

A structure designed for transporting and switching some STS-1 payloads.

Volatile Memory

Type of memory that is lost if electrical power to it is interrupted.

VT1.5 Port

Terminates a VT1.5 signal that is part of an STS-1 signal on an SMUX circuit pack.

VT1.5 Tributary

A SONET logical signal with a data rate of 1.728 Mb/s. In the 9-row structure of the STS-1 SPE, a VT1.5 occupies three columns. VT-structured STS-1 SPEs are divided into seven VT groups. Each VT group occupies twelve columns of the 9-row structure and, for VT1.5s, contains four VTs per group.

VT Envelope Capacity

Bandwidth within, and aligned to, the VT Superframe that is available for the VT SPE.

VT Group

A 9-row by 12-column structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte-interleaved within the VT-organized SPE.

VT Path Overhead

One path overhead byte per 500- μ s located at the first byte of the VT SPE. VT path overhead provides for communication between the point of assembly of the VT SPE and the point of its disassembly.

VT Payload Capacity

The maximum bandwidth within the VT SPE that is available for payload.

VT Superframe

The VT is organized into a 500- μ s superframe structure overlaid on, and aligned to, a 125- μ s STS-1 SPE. Contained within this structure is the VT payload pointer and the VT SPE.

VT Synchronous Payload Envelope (VT SPE)

A 500- μ s frame structure carried by the VT, composed of VT path overhead and bandwidth for payload. The envelope is contained within the VT envelope capacity and can have any alignment with respect to it.

W

Wideband Digital Cross-Connect System (WDCS)

A digital cross-connect system that interfaces any one or combinations of SONET, DS3, and DS1 signals and has the basic functionality of cross-connecting at the floating SONET Virtual Tributary 1.5 (VT1.5) or the DS1 level. A SONET WDCS is a DCS that cross-connects at the VT1.5 level and provides SONET signal multiplexing and termination. A DCS 3/1 is a DCS that cross-connects at the DS1 level and provides DS3 multiplexing and termination.

Wideband Loopback

The connection of a VT1.5 [VT1.5(cc-SPE) or VT1.5(DS1)] tributary from an incoming EC-1 facility to the outgoing direction of the same facility. This type of loopback differs from a line loopback in that the signal being looped-back is not at the line rate, and it is necessary to modify the VT pointer bits to perform the loopback. The DACS IV-2000 implements the wideband loopback as a terminal loopback (the loopback point is in the cross-connect network).

Acronyms

A

AIS
Alarm Indication Signal status condition

AIS/LOP
Alarm Indication Signal/Loss of Pointer

ALS
Alarm Indication Signal/Loss of Pointer Second

AMI
Alternate Mark Inversion

AS&C
Alarm, Scan, and Control

AUX PWR
Auxiliary Power

B

B8ZS
Bipolar with 8-Zero Substitution

BDCS
Broadband Digital Cross-Connect System

BDFB
Battery Distribution Feeder Board

BEC
Block Error Count

BER
Bit Error Rate

BESP
Path Bursty Errored Seconds

BPV
Bipolar Violations

BRT-2000
Business Remote Terminal-2000

BXA1
Bus Extender A 1

C

CB-149
AT&T Compatibility Bulletin Number 149

cc
Clear-Channel

CIT
Communications Interface Terminal

CLKDR1
Clock Distributor 1

CLKGN3
Clock Generator 3

CO
Central Office

CP-BITS
Copy of Parity Bits

CPU2
Central Processing Unit 2

CRC
Cyclic Redundancy Code

CSS
Controlled Slip Second

CV
Coding Violation

CVL
Line Code Violation

D

DACS
Digital Access and Cross-Connect System

DLI
Data Link Inaccessible

DLN
Data Link Not Responding

DPLL2
Digital Phase Lock Loop 2

DRVN
Driven

DS1IF1
DS1 Interface 1

DS1IP1
DS1 Interface 1 (Protection)

DS1RY1
DS1 Relay 1

DS1TX2
DS1 Timing Extractor 2

DS3 CC INTFC-16
DS3 Clear-Channel Interface-16

DS3 PM
DS3 Performance Monitoring

DSAB
Digital Systems Access Bay

DSX
Digital Signal Cross-Connect

Acronyms

DTAU
Digital Test Access Unit

E

EC-1
Electrical Carrier-1
ECI
Enhanced Communications Interface
ECI3
Enhanced Communications Interface 3
EDSX
Electronic DSX
EEE
ESF Error Event path
EMC
Electromagnetic Compatibility
EMI
Electromagnetic Interference
ENH DS3 INTFC-16
Enhanced DS3 Interface-16
ES
Errored Second
ESA
Errored Second A
ESB
Errored Second B
ESD
Electrostatic Discharge
ESF
Extended Superframe
ESL
Line Errored Second
ESP
Path Errored Second

F

FB
Fuse Board
FC
Failure Count
FEBE
Far-End Block Error
FEPS
Facility and Equipment Planning System

FMA-BITS
F and M Bits Adjusted
FMN-BITS
F and M Bits Nonadjusted
FS & ALM
Fuse and Alarm Panel

G

GTP
General Telemetry Processor

H

HDA
Header Designation Assembly

I

IEC
Interexchange Carrier
International Electrotechnology Commission
INIT
Initialized
INTFC
Interface
INTFC-P
Interface-Protection

L

LATA
Local Access and Transport Area
LOF
Loss-of-Frame
LOS
Loss-of-Signal
LOSS
Loss Of Signal Second
LPBKl
Internal Loopback
LPBKL
Line Loopback

LPBKM
 DS1 Tributary Loopback
 Multiplexed Loopback
LPBKT
 Terminal Loopback
LSSGR
 LATA Switching Systems Generic Requirements

M

MTBF
 Mean Time Between Failures
MTBMA
 Mean Time Between Maintenance Activities
MTC3
 Maintenance Interface 3
MTTR
 Mean Time To Repair
MUX
 Multiplexer
MUXP
 Multiplexer Protection
MUXPS
 Multiplexer Protection Switch

N

NDRVN
 Not Driven
NE
 Network Element
NEBS
 Network Equipment-Building System

O

OCS
 Operations Communications System
OOF
 Out-of-Frame
OOFs
 Path Out-of-Frame Second
OPS/INE
 Operations System/Intelligent Network Element
OS
 Operations System

P

PAD
 Packet Assembler/Disassembler
PCV
 Path Code Violation
PM
 Performance Monitoring
PMGR
 Performance Monitoring Generator and Receiver
PRI-1,-2
 Primary Storage1,-2
PTY
 Parity
PWR
 Power
PWRA
 Power A

R

RC
 Redundant Controller
RC PWR
 Redundant Controller Power
RMS-DS1/SARTS
 Remote Measuring System - DS1/Switched Access
 Remote Testing System
RT
 Remote Terminal

S

S/N
 Signal-to-rms Noise power ratio
SCCS
 Switching Control Center System
SCSI
 Small Computer System Interface
SEC
 Secondary Storage
SEFS
 Severely Errored Frame Second
SES
 Severely Errored Second

Acronyms

SESF
Severely Errored Frame Second

SESL
Line Severely Errored Second

SESP
Path Severely Errored Second

SF
Superframe

SLMF
Signal Label Match Failure

SMUX1
SONET Multiplexer 1

SMUXP1
SONET Multiplexer Protection 1

SONET
Synchronous Optical Network

SPCS
Stored Program Control Systems

SPE
Synchronous Payload Envelope

SSC
Secondary Storage Controller

SSS
Secondary Storage Subsystem

STPNL
Status Panel

SW
Switch

SWCS2
Switch Center Stage

SWIF
Switch Interface

SWIO
Switch Input/Output

SYNC
Synchronizer

T

TABS
Telemetry Asynchronous Block Serial

TBOS
Telemetry Byte-Oriented Serial

TBS32
Stratum 3 Time Base Oscillator 2

TCA
Threshold Crossing Alert

TIRKS
Trunks Integrated Record Keeping System

TL1
Transaction Language 1

TMAS
Transport Maintenance Administration System

TNM
Total Network Management

TPA
Errored Second Type A

TPB
Errored Second Type B

TPC
Errored Second Type C

TSGR
Transport Systems Generic Requirements

U

UAS
Unavailable Second

UC
Unit Controller

UI
Unit Interface

UNF
Unframed

V

VF
Voice Frequency

VT
Virtual Tributary

W

WDCS
Wideband Digital Cross-Connect System

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