Lucent Technologies
Bell Labs Innovations

DACS IV-2000 (512) Digital Access and Cross-Connect System IV-2000 Release 5.0

Applications, Planning, and Ordering

365-340-904

365-340-904

Notice
Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

Federal Communications Commission Statement
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the Fcc Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Security
In rare instances, unauthorized individuals make connections to the telecommunications network through the use of remote access features. In such event, applicable tariffs require that the customer pay all network charges for traffic. Lucent cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

Trademarks
COMMON LANGUAGE and TIRKS are registered trademarks, and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.
DACSmate is a trademark of Lucent Technologies.
5ESS, DACScan, Lineage, SLC, and Star Server are registered trademarks of Lucent Technologies.
SPARCstation is a trademark of SPARC International, Inc.
MICOM is a registered trademark of Micom Communications Corporation.

Warranty
Lucent Technologies provides a limited warranty to this product. For more information, consult your local Account Executive.

Technical Support
For technical support, contact the Regional Technical Assistance Center at 1-800-225-7822.

Documentation Support
For documentation questions, information, and support, contact the DACS IV-2000 Documentation Coordinator at (908) 949-7265.

Applications, Planning, and Ordering
(365-340-904)

Prepared by the
Technical Publications Center

We Welcome Your Opinion

AT&T welcomes your feedback on this document. Your comments are of great value in helping us improve our documentation.

DACS IV-2000 (512) Release 5.0 Applications, Planning, and Ordering
AT&T 365-340-904 January 1996

1. Please rate the effectiveness of this document in the following areas:

Area	Excellent	Good	Fair	Poor
Ease of finding information				
Clarity				
Completeness				
Accuracy				
Organization				
Appearance				
Examples				
Illustrations				
Overall Satisfaction				

2. Please check the ways you feel we could improve this document:

- ❑ Improve the overview/introduction
- ❑ Improve the index
- ❑ Improve the organization
- ❑ Include more figures
- ❑ Add more examples
- ❑ Make it more concise/brief
- ❑ Add more step-by-step procedures/tutorials
- ❑ Add more troubleshooting information

Please provide details for suggested improvements. _____

_____

3. What did you like most about this document?

_____

_____

4. Feel free to write any comments below or on an attached sheet.

_____

_____

_____

_____

If we can contact you concerning your comments, please complete the following.

Name:_____ Telephone Number: (___)_____

Company/Organization:_____ Date: _____

Address:_____

When you have completed this form, please fold, tape, and return to address on back or Fax to: 908-949-6784.

Do Not Cut — Fold Here And Tape

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 5 NEW PROVIDENCE N.J.

POSTAGE WILL BE PAID BY ADDRESSEE

DACS IV-2000 Documentation Coordinator
AT&T Bell Laboratories Room 2G-513A
101 Crawfords Corner Road
Holmdel, NJ 07733-9965

Contents

Contents

Contents

Contents

Figures

Figures

Tables

1 Introduction

4 Ordering Information

A Technical Specifications

Tables

B ROADS Standard Product Configurations

About This Guide

Purpose

The *DACS IV-2000 (512) 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). It assists in the planning and integration of a DACS IV-2000 system into the network.

NOTE:
The previous release of the DACS IV-2000 (512) was Release 3.0. There is no Release 4.0 for the (512) platform.

New features described in this guide include capacity expansion (CE); optical remoting (OR); DS3 clear-channel cross-connection (DS3cc); DS3 path identification for the AT&T transport self-identification plan; 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; DS3 test access; identification of VT1.5 or DS1 tributaries within STS-1 signals; and downloadable synchronizer firmware upgrade.

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

Audience

This guide is intended primarily for network planners and engineers. It can be used by anyone desiring specific information about the applications, ordering, and technical specifications of the DACS IV-2000 (512).

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 (512).
- **Chapter 3 - Applications** describes how the DACS IV-2000 (512) 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 (512).
- **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 (512) 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.
- **Bold** type is used for references to chapters within this document.
- `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 (512) Release 5.0 Reference Manual*, AT&T 365-340-900

  This manual provides in-depth, encyclopedic information about the DACS IV-2000 (512) for craft, engineers, and system administrators.

- *DACS IV-2000 (512) Release 5.0 Operations and Maintenance*, AT&T 365-340-901

  This manual provides detailed procedures for daily operations, trouble-clearing procedures, and routine maintenance of the DACS IV-2000 (512).

- *DACS IV-2000 (512) Release 5.0 Commands and Messages*, AT&T 365-340-902

  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 (512) Release 5.0 Quick Reference Job Aids*, AT&T 365-340-903

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

- *DACS IV-2000 (512) Release 5.0 Software Release Description,* AT&T 365-340-905

  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 customer documentation is available on CD-ROM. Consult your AT&T account executive for details.

Ordering Documents

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.

- To order by mail:

  AT&T
  Customer Information Center
  Attention: Order Entry Section
  2855 N. Franklin Road
  P. O. Box 19901
  Indianapolis, IN 46219

- To order by telephone (Monday through Friday):

  United States:1-800-432-6600 (7:30 a.m. to 6:30 p.m. EST)
  Canada: 1-800-255-1242
  Worldwide: 1-317-352-8557

- To order by fax:

  1-317-352-8484

For RBOC/BOC customers, orders should be processed through the company documentation coordinator.

For commercial customers, a check, money order, purchase order number, or charge card number is required with all orders. Make checks payable to AT&T. (Consult your AT&T account executive for prices.)

AT&T entities should use Form IND 1-80.80 FA, available through the Customer Information Center.

Introduction

1

Contents

Contents

Introduction

1

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 (512) 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 (256) Digital Cross-Connect System.** The DACS IV-2000 (256) is a software-based, high-capacity, digital cross-connect system that merges cross-connect and multiplexer functions. It provides interfaces at the STS-1/DS3/DS1 signal rates and cross-connects at the STS-1/VT1.5/ DS3/DS1 signal levels.
- **DACS IV-2000 (512) Digital Cross-Connect System.** The DACS IV-2000 (512) is a software-based, high-capacity, digital cross-connect system that merges cross-connect and multiplexer functions. It provides interfaces at the STS-1/DS3/DS1 signal rates, cross-connects at the STS-1/VT1.5/DS3/ DS1 signal levels, and has twice the capacity of the (256) system.
- **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. The expanded capacity of the DACS IV-2000 (512) accommodates digital network growth and extends these benefits to larger offices. The benefits are described in the following sections.

SONET Networking

Release 5.0 provides the following SONET capabilities:

- End-to-end SONET connectivity between SONET network elements
- Grooming of VT1.5s within STS-1 signals
- Cross-connection of STS-1 signals
- Support for a wide range of performance monitoring for SONET signals
- Connection of asynchronous/SONET gateway connections.

Cost Effectiveness

The DACS IV-2000 merges the functions of SONET add/drop and M13 multiplexers with manual DSX-1 cross-connect systems and performance monitoring, 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. This release supports a wide range of performance monitoring for SONET signals, and allows for the connection of asynchronous facilities 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 medium or large traffic cross-section applications. The DACS IV-2000 replaces existing multiplexing and manual cross-connection equipment, thereby providing office modernization.

The DACS IV-2000 reduces equipment costs for DS1 grooming and add/drop 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 (and VT1.5s within STS-1 facilities) to central office locations allows for 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 system design permits a wide range of network applications. With 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.

The DACS IV-2000 (512) Release 5.0, with its added capacity expansion and optical remoting features, increases flexibility by enabling the customer to absorb DACS IV-2000 (256) systems into DACS IV-2000 (512) systems.

NOTE:
Release 5.0 bays contain seismic framing and are known as enhanced bays. Nonenhanced bays will continue to be supported (with restrictions) but can no longer be ordered.

NOTE:
The DS3 Interface Bay (J98787M-1) has been rated Discontinued Availability (DA).

Operating Efficiency

The DACS IV-2000 allows centralized control of the DS1, VT1.5, DS3, and STS1 provisioning, maintenance, and administration functions. This centralized control opens up new service opportunities, permits faster response time for facility and service order provisioning, and permits faster resolution of trouble reports.

The DACS IV-2000 (512) Release 5.0 capacity expansion feature simplifies facility provisioning and reduces the number of facilities required to connect between DACS IV-2000 systems.

Revenue Generation

A new opportunity made possible with the DACS IV-2000 is network restoration. The DACS IV-2000 can be used to restore DS1s, or DS3s as groups of 28 DS1s. The route restoration capability of the DACS IV-2000 satisfies customers' concerns regarding service interruptions that affect critical voice and data traffic. This secures the existing base of revenue and adds enhanced service protection for customers who seek such network assurance.

Faster provisioning results in earlier revenue flow, and faster trouble resolution reduces the amount of lost revenue.

Office Modernization

AT&T provides a complete office modernization service that allows the advantages of the DACS IV-2000 described above 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. 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 STS-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 provides a full set of features to support asynchronous and SONET networking for a wide variety of applications. SONET interfaces and the Synchronizer Module enable the DACS IV-2000 to make the following cross-connections:

- STS-1 signals between SONET interfaces
- Virtual tributaries (VT1.5s) within STS-1 signals between SONET interfaces
- DS1 signals between DS1, DS3, or SONET interfaces
- DS3 signals between DS3 or SONET interfaces.

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 operation of asynchronous and synchronous network elements as a single transparent network.

A wide range of termination mixes is supported by the system architecture. The number of ports allocated to DS1, DS3, and STS-1 terminations depends on the particular application. The extreme cases are when all of the ports are allocated for STS-1s (480 STS-1s), for DS3s (496 DS3s), or for DS1s (13,888 DS1s).

The equipment architecture reduces startup configuration costs, increases modular growth capability, and allows for reduced floor space. These benefits allow the DACS IV-2000 (512) to be economically deployed in any moderate- to large-size office. The DACS IV-2000 (256), which is half the size of the DACS IV-2000 (512), is an economical solution for small offices.

System Architecture

Figure 1-1 shows the DACS IV-2000 (512) system architecture for collocated interface bays, and Figure 1-2 shows the DACS IV-2000 (512) system architecture for optically remoted/capacity expanded interface bays. The architecture consists of DS1, DS3, and STS-1 signal interfaces, a nonblocking switch matrix that supports both DS1 and SONET virtual tributary (VT) rate signals, as well as a software-based controller. The high-capacity controller (HCC) provides the system intelligence to enable centralized automated control, primary and secondary memory backup, and local and remote operations interfaces.

Controller Architecture

The DACS IV-2000 system control architecture (Figure 1-3) is a distributed multiprocessor design that supports concurrent execution and performs real-time operations. The architecture consists of the following three systems:

- High-Capacity Controller System
  - — Duplicated Control Complexes (CPU/MTC/SCI/SSC/UI/OUI circuit packs)
  - — Enhanced Communications Interface (ECI)

- Unit Controller System
  - — Unit Controllers
  - — Interface Circuit Packs
  - — DS3 Performance Monitoring (DS3PM) over a TABS interface (optional)

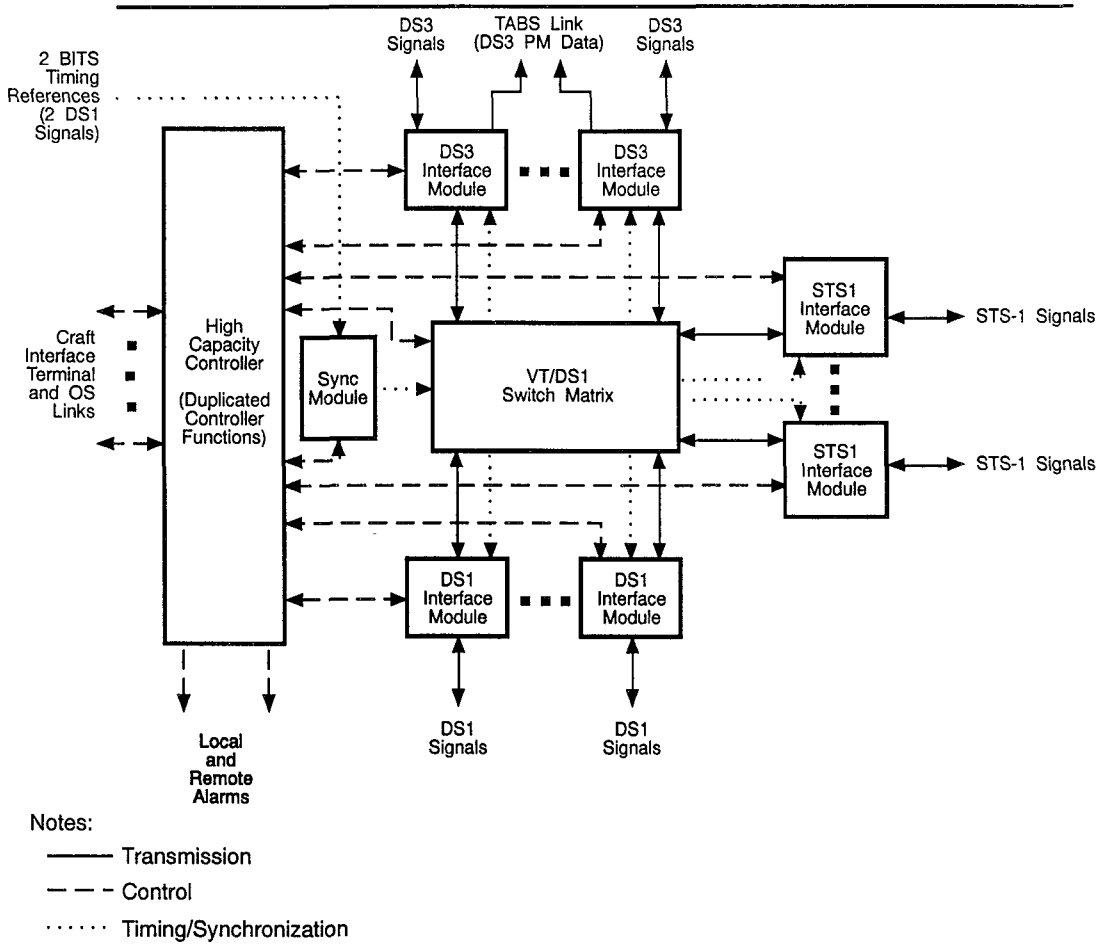


Figure 1-1. **DACS IV-2000 System Architecture — Collocated Interface Bays**

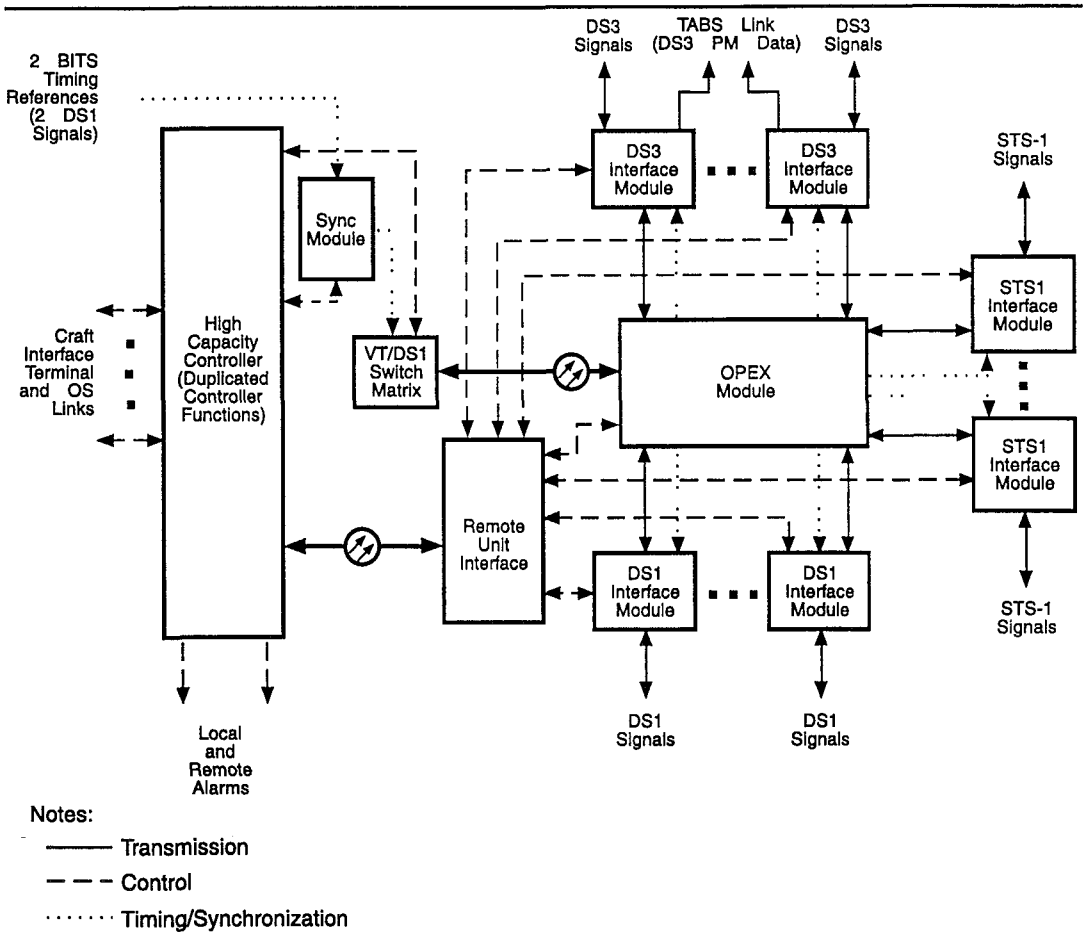


Figure 1-2. DACS IV-2000 System Architecture — Remote Complex Interface Bays

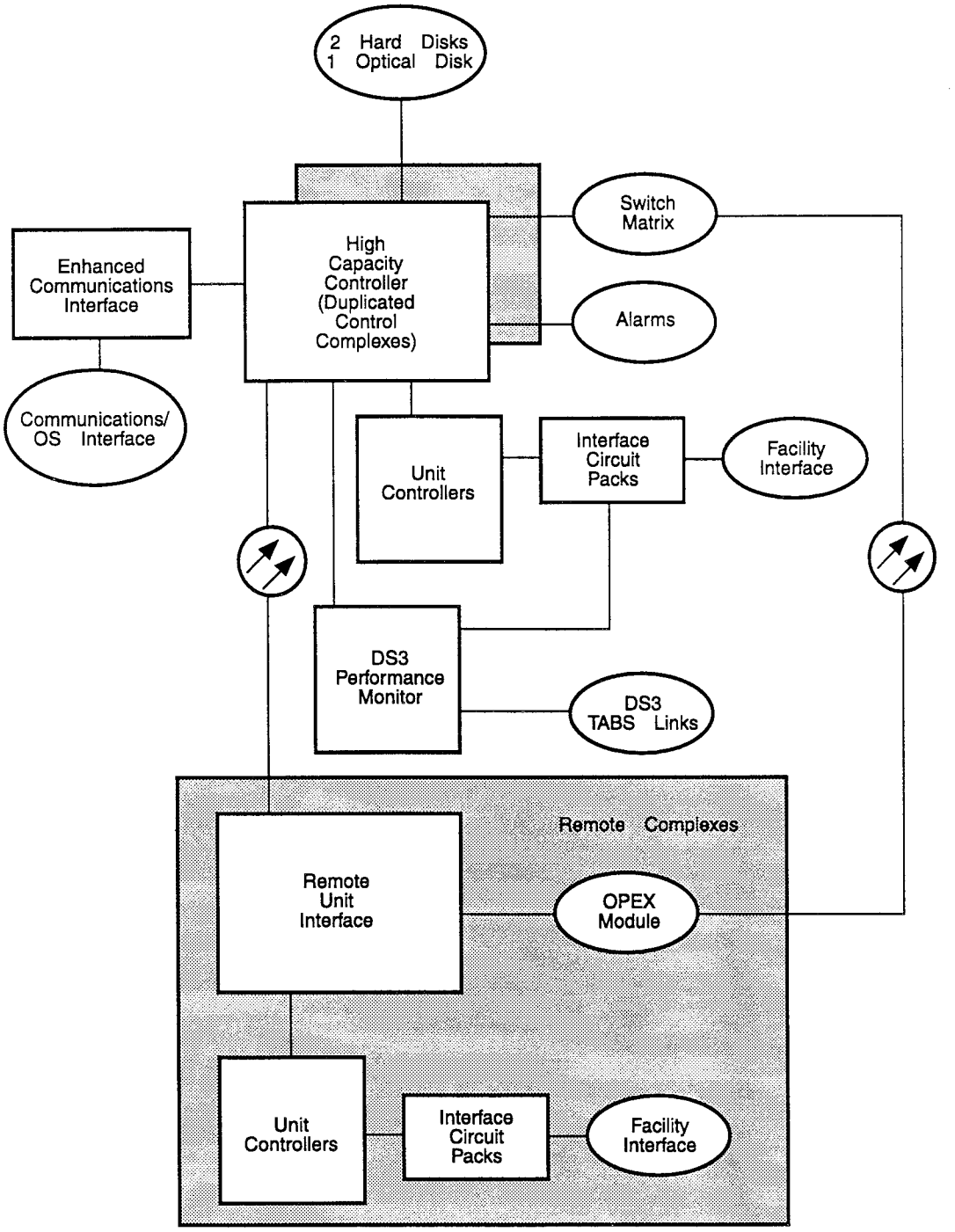


Figure 1-3. System Control Architecture

- Remote Unit Interface System - Remote Complexes Only
  - — Remote Unit Interface (UIA/UIB/SCI/CLKGN circuit packs)
  - — Optical Extension to/from the HCC and Switch Matrix
  - — Remote Communications Interface (RCI) to the ECI.

High-Capacity Controller System

As the central component of the high-capacity controller system, the duplicated control complex:

- Runs application software to perform all system administration functions including cross-connection, provisioning, test access, and synchronization for the SONET interfaces
- Serves as the central point of coordination for all system maintenance functions such as diagnostics, fault recovery, and alarms
- Performs 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) and TABS (Telemetry Asynchronous Block Serial)
- Provides the physical and electrical interfaces supporting synchronous (X.25) and asynchronous (Snider, telemetry) protocols.

The two ECI circuit packs are equipped to provide redundancy or to provide additional communication links.

Unit Controller System

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

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

The optional DS3PM circuit pack supports the TABS interface to the DS3 performance data.

NOTE:
The DS3PM circuit pack is not required unless you are using TABS interface language.

NOTE:
The DS3PM circuit pack is supported in collocated interface bays but not in optically connected interface bays.

Remote Unit Interface System

The Remote Unit Interface (RUI) system provides the following functions:

- The Optical Unit Interfaces (OUIs), which replace the UI circuit packs in the HCC Module, provide LAN distribution functions for the (512) Switch Complex and provide optical interface (for control) to the Remote Complexes.
- The UIA and UIB circuit packs provide LAN hubbing functions from the OUI circuit packs to the Remote Unit Interface.
- The RCI circuit pack provides RS232-to-RS422 conversion for CILINKs to the Remote Complex.
- The Optical Extension (OPEX) circuit packs optically connect the Remote Complex interface modules to the Switch Complex Optical SWIO (OSWIO) circuit packs (OSWIO circuit packs replace the SWIO circuit packs).

Hardware

NOTE:
All shipping hardware for the DACS IV-2000 must be returned to the factory. The shipping hardware includes: one lift support; two rear panel hinge assemblies; four shipping covers; two jack assemblies; three support angles; four handle bar assemblies; two junction panel assemblies; and eight caster assemblies (wheels).

NOTE:
Each unused circuit pack position in a partially equipped interface module, Optical Extension (OPEX) Module, or Switch Input/Output (SWIO) Module (equipped with SWIOs or Optical Switch Input/Outputs [OSWIOs]) must be equipped with a bus extender circuit pack for proper circuit operation (BXA for interface modules, AWR-type filler assemblies for SWIO Modules, and AUX PWR for OPEX Modules). Unequipped modules do not require these bus extenders, but do require a cover for air flow. See Chapter 4, **Ordering Information**, for details.

The DACS IV-2000 (512) Release 5.0 comprises the Switch Complex and one to sixteen interface bays. (Each bay contains a number of modules, and each module consists of an equipment shelf and its associated circuit packs.)

If the optical remoting feature is used, the system also includes one or two Remote Complexes in place of collocated interface bays; they are described

below. Both Remote Complexes can be in-service (256) frames capacity-expanded to the same (512) frame. (Only one Remote Complex can be capacity-expanded at a time.) The controller functions are extended to the Remote Complex via the fiber-optic cables from the HCC Module to the RUI Module.

Collocated (512) System

The Switch Complex consists of two Switch Bays and a Main Controller Bay. In a collocated system, two Fuse and Alarm Bays must also be ordered. Unequipped circuit pack slots are not permitted. To provide proper air flow, functionally unused slots must either contain a circuit pack or be covered with filler assemblies.

All system bays are 26 inches wide, 84 inches high, and 12 inches deep, except the Fuse and Alarm Bays, which are 13 inches wide. (The optional EMC enclosure is 13 inches deep.) All enhanced bays use the seismic bay framework. System capacity can be expanded by adding circuit packs and/or interface bays.

This initial configuration is 130 inches wide. The Switch Bays and Fuse and Alarm Bays are delivered with interbay cabling for the capacity required by the customer. Consequently, both Fuse and Alarm Bays are used to store and protect the power cables until they are needed. All bays are bolted to the floor during installation. The interface bay required for the initial configuration is shipped separately.

When a growth Interface bay is provided, the growth bay is installed adjacent to the existing interface bay, and connections are made to its Switch Bay. Recommended growth is to the left of the Switch Complex (Switch and Main Controller Bays) until all the cables are used, then to the right of the Switch Complex. When your system is configured for more than four interface bays on one side of the Switch Complex, an additional Fuse and Alarm Bay is required on that side. All bay positions must be filled; empty bay positions (gaps) are not permitted in the system lineup. If less than full switch capacity is ordered, additional cable storage bays are required.

Remote Complex

A Remote Complex is equivalent to a DACS IV-2000 (256) frame (containing at least one Interface Bay and a Switch Bay) whose Switch Module is replaced with an OPEX Module and whose Redundant Controller Module is replaced with an RUI Module. The OPEX and RUI Modules are connected with optical fiber to the SWIO Module (containing OSWIO circuit packs in place of SWIO circuit packs) and the HCC Module (containing OUI circuit packs in place of the UI circuit packs), respectively, in the Switch Complex of a (512) system with at least 256 DS3 equivalents available. By using such a configuration, the OAM&P of the two systems is combined, effectively increasing the capacity of the (256) system. The Remote Complex can be field-upgraded or ordered from the factory.

A DACS IV-2000 (512) Release 5.0 configured for one Remote Complex requires a complete set of optical fiber cable assemblies, even though the system may not be fully equipped. If the system contains two Remote Complexes, two complete sets of fiber cable assemblies are required, even though the system may not be fully equipped. As a minimum, 68 fibers (34 pairs) are installed and made available for the transmission fiber links (OSWIO-to-OPEX) to each Remote Complex. Of these, two pairs are designated as spares.

Optical Remoting

By using optical fibers and the associated OPEX and OSWIO circuit packs, the interface bays of a (512) system can be located up to 1000 cable feet away from the Switch Bay. Optical remoting facilitates capacity expansion, but can also be used without the capacity expansion feature.

New Modules for Release 5.0

The following modules have been added or modified to support the Release 5.0 features:

- Enhanced DS3 Interface-16 Module
- DS3 Clear-Channel Interface-16 Module
- SWIO Module
- OPEX Module
- OPEX Power Module
- RUI Module
- RUI Power Module.

The Enhanced DS3 Interface-16 Module can contain:

- All MUX3 circuit packs
- A mix of MUX2 and MUX3 circuit packs.

In either case, this module is protected by the MUXP3 circuit pack.

The Enhanced DS3 Interface-16 Module does not support scanned performance monitoring.

The DS3 Clear-Channel Interface-16 Module contains up to 15 MUX3 circuit packs and one MUXP3 circuit pack; it cannot contain MUX1, MUX2, or PMGR circuit packs. The DS3 Clear-Channel Interface-16 Module does not support scanned performance monitoring but *does* support full-time performance monitoring.

The SWIO Module, located in the (512) Switch Complex, is based on the pre-Release 5.0 SWIO Module. It can contain SWIO circuit packs as it did prior to Release 5.0, which electrically connect the (512) Switch Module to the interface bays, or it can contain OSWIO circuit packs, which optically connect the (512) SWIO to the remotely located interface bays via the OPEX Module.

The OPEX Module, located in the Remote Complex, is based on the Switch Module in the (256) and replaces the Switch Module for capacity expansion and optical remoting features. The OPEX Module contains circuit packs for optically connecting the Remote Complex Interface Bays to the (512) Switch Complex.

The OPEX PWR Module replaces the Switch Power Module for capacity expansion and optical remoting features.

The RUI Module replaces the RC Module for capacity expansion and optical remoting features and becomes an extension of the HCC Module.

The RUI PWR Module replaces the (256) RC Power Module for capacity expansion and optical remoting features.

The new MUX3 and MUXP3 circuit packs are supported only in the DS3 Interface-16 Module, not in the DS3 Interface-32 Module. All interface module types are supported in the OPEX, RUI, and SWIO Modules. Module types can be mixed within an interface bay; for example, the STS1/DS3/DS1 Interface Bay and the STS1/DS3 Interface Bay.

System Bays and Modules

Table 1-1 identifies the different types of bays and their associated modules. Note that the DS3 Interface Bay has been rated DA. The DS3 Interface-32 Module is still available on the STS1/DS3/DS1 Interface Bay. The existing DS3 Interface Bays will continue to be supported.

NOTE:
In this document, we make the following distinction between *bay* and *module*:

- **Bay** is an 84-inch high frame that contains one or more types of modules.
- **Module** is a set of circuit packs contained in a shelf of a bay.

Table 1-1. System Bays and Modules

Bay	Module	Units Per Bay	See Note
Switch (SW)	Switch Input/Output (SWIO)	2	1
	Switch Center Stage (SWCS)	1	
	Fuse and Alarm (FS & ALM) Panel	1	
	Fan Assembly	1	
Main Controller (MC)	Switch Power (SW PWR)	3	
	High-Capacity Controller (HCC)	1	
	Memory Storage (MEM)	1	
	Synchronizer (SYNC)	1	2
	Fan Assembly	1	
	Status Panel	1	
Optical Extension (OPEX)	Optical Extension (OPEX)	1	
	Optical Extension Power (OPEX PWR)	1	
	Auxiliary Power (AUX PWR)	1	
	Remote Unit Interface (RUI)	1	
	Remote Unit Interface Power (RUI PWR)	1	
	Fuse and Alarm (FS & ALM) Panel	1	
	Fan Assembly	1	

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

Table 1-1. **System Bays and Modules**

Bay	Module	Units Per Bay	See Note
DS1 Interface (DS1 INTFC)	DS1 Interface (INTFC) DS1 Interface-Protection (INTFC-P)	3 1	
Enhanced DS1 Interface (ENH DS1 INTFC)	DS1 Interface (INTFC) DS1 Interface-Protection (DS1 INTFC-P) Fan Assembly	3 1 1	
STS1/DS3/DS1 Interface (STS1/ DS3/DS1 INTFC)	DS1 Interface (INTFC) DS1 Interface-Protection (INTFC-P) DS3 Interface-32 (INTFC-32) DS3 Interface-16 (INTFC-16) Enhanced DS3 Interface-16 (ENH DS3 INTFC-16) DS3 Clear-Channel (DS3CC INTFC-16) STS1 Interface-16 (INTFC-16) BNC Panel Fan Assembly	1 1 0 or 1 0 or 1 0 to 2 0 to 2 0 to 2 1 1	 3,4,5 3,4,6 3,4,5,6 3,4, 5,6 4, 5
Enhanced STS1/ DS3/DS1 Interface (ENH INTFC)	DS1 Interface (INTFC) DS1 Interface-Protection (INTFC-P) DS3 Interface-32 (INTFC-32) DS3 Interface-16 (INTFC-16 Enhanced DS3 Interface-16 (ENH DS3 INTFC-16) DS3 Clear-Channel (DS3CC INTFC-16) STS1 Interface-16 (INTFC-16) BNC Panel Fan Assembly	1 1 0 or 1 0 or 1 0 to 2 0 to 2 0 to 2 1 1	 3,4, 5 3,4, 6 3,4, 5, 6 3,4, 5,6 4, 5, 6
STS1/DS3 Interface (ENH DS3 DS3CC INTFC)	DS3 Interface-16 (INTFC-16) STS1 Interface-16 (INTFC-16) BNC Panel Fan Assembly	0 to 4 0 to 4 1 1	3,6 6

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

Table 1-1. **System Bays and Modules**

Bay	Module	Units Per Bay	See Note
Enhanced STS1/ DS3 Interface (ENH INTFC)	DS3 Interface-16 (INTFC-16)	0 to 4	3,6
	Enhanced DS3 Interface-16 (ENH DS3 INTFC-16)	0 to 4	3,6
	DS3 Clear-Channel (DS3CC INTFC-16)	0 to 4	3,6
	STS1 Interface-16 (INTFC-16)	0 to 4	6
	BNC Panel	1	
	Fan Assembly	1	
Fuse and Alarm (FS & ALM)	Fuse and Alarm Panel	1	

Notes:

1. SWIO Modules can contain either SWIO or OSWIO circuit packs: SWIO for collocated interfaces, OSWIO for remote interfaces. You cannot mix circuit pack types within a Switch Bay.
2. The SYNC Module for new systems contains version 2 circuit packs. Existing systems can use either version 1 or version 2 circuit packs.
3. The DS3 Interface-32 Module, the DS3 Interface-16 Module, the DS3 Clear-Channel Interface Module, and the Enhanced DS3 Interface-16 Module can be referred to generically as DS3 Interface Modules.
4. The total number of DS3 and STS1 Interface Modules in an STS1/DS3/DS1 Interface Bay may not exceed two.
5. STS1/DS3/DS1 Interface Bays can be equipped with an STS1 Interface-16 Module in place of the DS3 Interface-32 Module. When used this way, the DACS IV-2000 capacity is decreased by 15 DS3-equivalent signals.
6. The STS1/DS3 Interface-16 shelves can be equipped with a DS3 Interface-16, Enhanced DS3 Interface-16, DS3 Clear-Channel Interface-16, or STS-1 Interface-16 Module. STS1/DS3 Interface Bays can be equipped with any combination of DS3 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. It can later be expanded to a number of possible bay layouts.

The four types of DACS IV-2000 interface bays provide many possible bay layouts for a fully configured system. Note that the DS3 Interface Bay has been rated DA. Figure 1-4 shows fully configured systems and the typical order in which the systems are expanded, and Figure 1-5 shows optically remoted configurations. Table 1-2 lists the capacity of each system. The examples are not intended to limit the options, but rather to represent the range of DS1, DS3, and EC-1 terminations. (EC-1, Electrical Carrier-1, is the industry standard nomenclature for an electrical STS-1 signal.) In Figure 1-4, the designation STS1/DS3/DS1 indicates a standard configuration of one DS3 Interface-32, one STS1/DS3 Interface-16, one DS1 Interface, and one DS1 Interface-Protection Module.

A DACS IV-2000 can be configured to accommodate any changing DS1, DS3, and EC-1 facility needs over time under the cabling constraint that not more than 256 equivalent STS1s/DS3s (including protection) be connected on either side of the Switch Complex. Because of this cabling constraint, the Switch Complex is usually located at or near the center of the bay layout, as shown in Figure 1-4. A maximum of four STS1/DS3/DS1 Interface Bays, or STS1/DS3 Interface Bays, or eight DS1 Interface Bays can be located on either side of the Switch Complex.

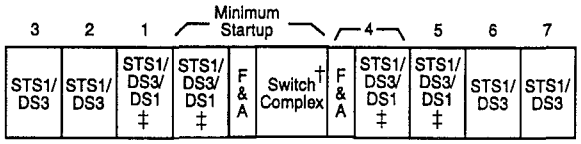
NOTE:
DS1 bays must be installed in pairs, side by side.

When using one Remote Complex, the suggested configuration is to put the collocated interface bays on the right side of the Switch Complex (bay positions 14 through 23) with no bays to the left (bay positions 1 through 10). When using two Remote Complexes, there are no bays to the left or right (bay positions 1 through 10 and 14 through 23) of the Switch Complex.

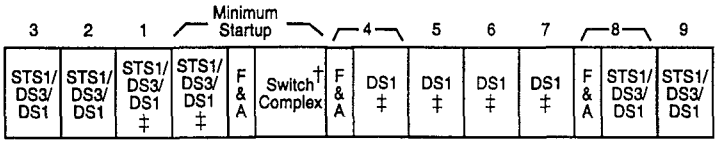
Table 1-2. **Interface Capacity for Sample System Configurations**

Configuration Type	STS1 Interface Capacity	DS3 Interface Capacity	DS1 Interface Capacity
STS1/DS3/DS1	300/0	124/424	1680
STS1/DS3/DS1	90/0	186/276	5992
STS1/DS3/DS1	60/0	124/184	8624
STS1/DS3	480/0	0/480	0
DS1	0	0	13,888

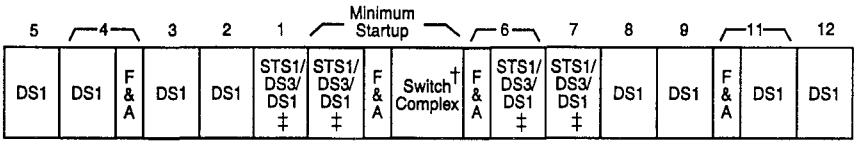
Bay Layout and Growth Order Numbering*



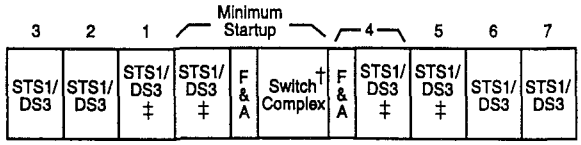
Typical STS1/DS3/DS1 Configuration



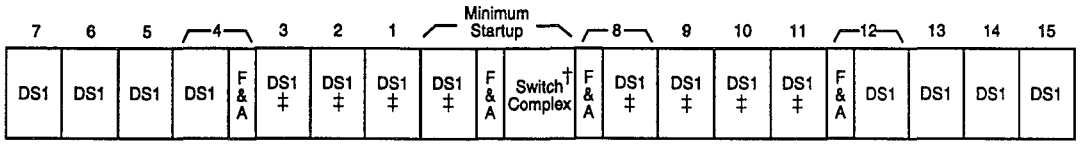
Typical STS1/DS3/DS1 Configuration



Typical STS1/DS3/DS1 Configuration



Typical STS1/DS3 Configuration



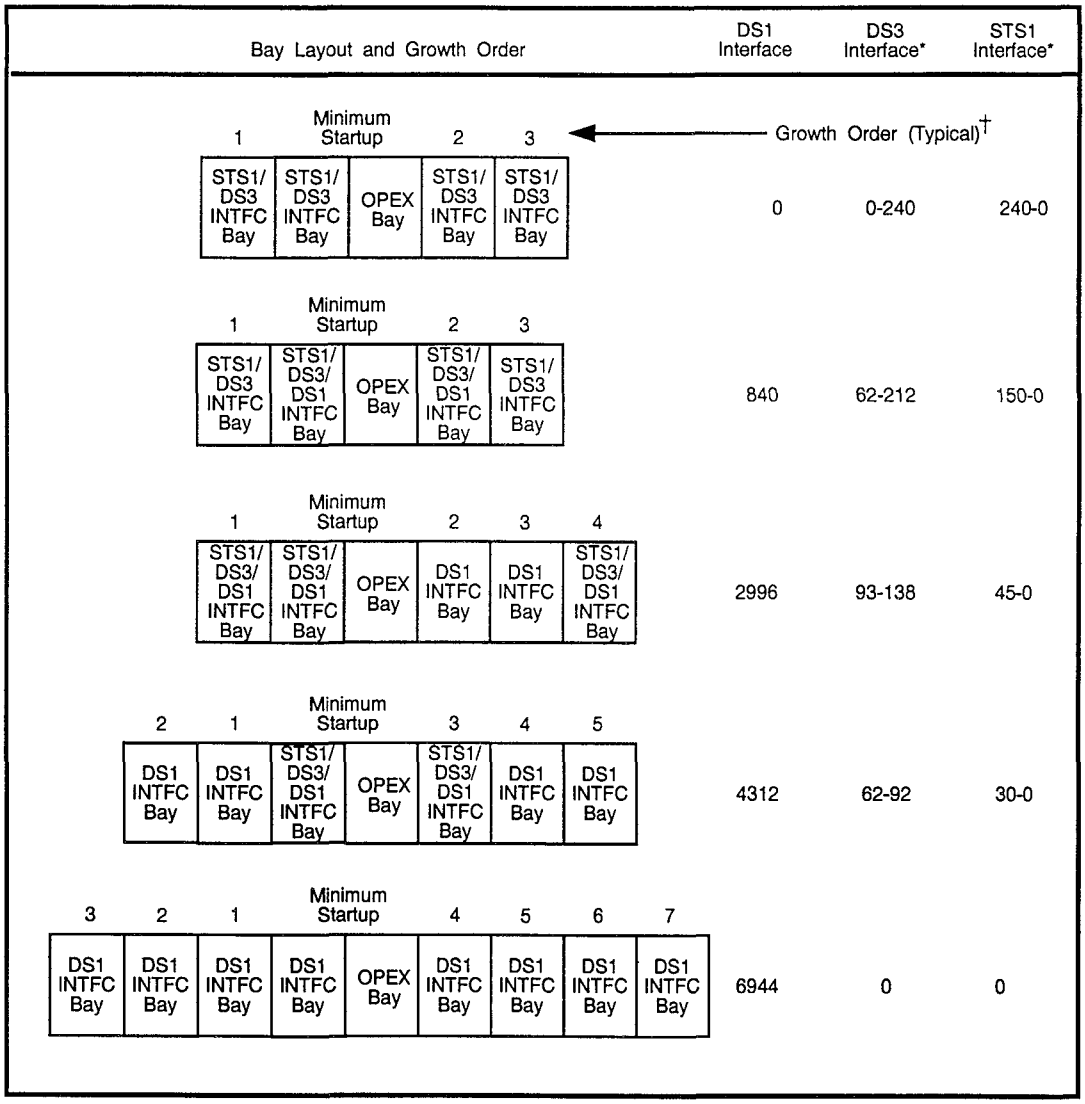
Typical DS1 Configuration

* Adjacent bays can be added to either the left or right side. The growth order shown is for typical growth.

† The Switch Complex is made up of one Main Controller Bay, two Switch Bays, and two Fuse and Alarm (FS & ALM) Bays.

‡ Enhanced bays required to provide additional space for N-rate cables.

Figure 1-4. **Sample Collocated System Configurations**



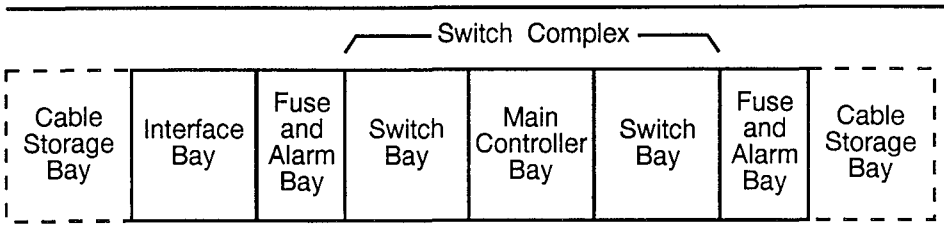
* The designation STS1/DS3/DS1 INTFC Bay indicates a standard configuration of one DS3 Interface-32, one DS3 Interface-16 or STS1 Interface-16, one DS1 Interface, and one DS1 Interface-Protection Module.

† Adjacent bays can be added to either the left or right side; the growth order shown is for typical growth.

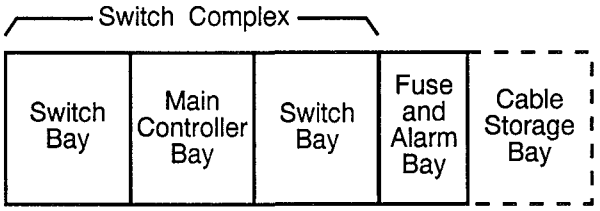
Figure 1-5. **Sample Remote Complex Configurations**

When planning the system 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, or an STS1/DS3 Interface Bay.

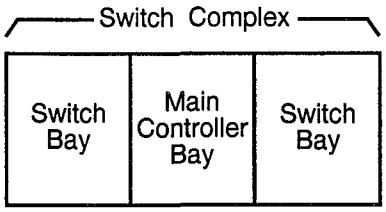
Figure 1-6 shows three configurations for the (512) Switch Complex.



A. Switch Complex with No Remote Complexes



B. Switch Complex with One Remote Complex



C. Switch Complex with Two Remote Complexes

Figure 1-6. **Generalized Minimum Startup Configurations**

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 EMI installations, 26-gauge cable must be used to enter the system. If distance dictates 22-gauge cable in the central office, DSABs are again recommended.

System Features

2

Contents

Contents

Contents

Contents

System Features

2

This chapter introduces the new features that are available with the DACS IV-2000 (512) Release 5.0 and summarizes the features that were introduced with earlier releases.

New Features

The DACS IV-2000 (512) Release 5.0 offers the following new features:

- In-Service Capacity Expansion of DACS IV-2000 (256) System
- Optical Remoting of Interface Bay Complexes
- MUX3 Circuit Pack Supporting DS3 Clear-Channel Cross-Connection or Enhanced DS3 Cross-Connection
- DS3 to STS-1 Gateway Cross-Connection
- DS3 Path Identification for the AT&T Transport Self-Identification Plan
- Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals without Loss of Capacity
- Unframed DS3 Signals
- DS3 Terminal Loopback
- DS3 Test Access
- Identification of VT1.5 or DS1 Tributaries within STS-1 Signals
- Downloadable Synchronizer Firmware Upgrade.

In-Service Capacity Expansion of the DACS IV-2000 (256) System

Capacity expansion allows customers to minimize the number of DACS IV-2000 frames needed in larger offices by absorbing one DACS IV-2000 (256) system into the Switch Complex of a DACS IV-2000 (512) system. This simplifies facility provisioning and reduces the number of facilities required to connect between DACS IV-2000 frames.

With this feature, the capacity of a DACS IV-2000 (256) can be expanded to that of a DACS IV-2000 (512) system while maintaining service and with no need to rearrange the EC-1, DS3, or DS1 cabling to the existing bay lineup. You are able to grow the original (256) system bay lineup to its full capacity of 256 equivalent STS-1/DS3s (service and protection), and grow an additional capacity of 256 equivalent STS-1/DS3s in interface bays located in the same lineup with the DACS IV-2000 (512) Switch Complex or in a second Remote Complex.

Capacity expansion is supported for all allowable system configurations of the DACS IV-2000 (256). The DACS IV-2000 (256) Interface Bays can be located remotely from the DACS IV-2000 (512) Switch Complex (up to 1000 feet cabling distance from the existing system). The DACS IV-2000 (256) system database is automatically converted to Release 5.0, and all cross-connect maps are preserved during the capacity expansion; that is, no service will be lost.

Use of the capacity expansion features reduces the number of intertie facilities necessary.

Once upgraded, the DACS IV-2000 (256) becomes a Remote Complex of the DACS IV-2000 (512), located within 1000 cable feet.

Optical Extension

The capacity of a DACS IV-2000 (256) system is expanded to that of a DACS IV-2000 (512) system by using Optical Extension (OPEX) circuit packs in the DACS IV-2000 (256) to extend the N-rate signals from the interface bays onto fiber-optic cables.The fiber-optic cables terminate on Optical Switch Input/Output (OSWIO) circuit packs in the Switch Complex of the DACS IV-2000 (512).

The OPEX circuit packs receive N-rate data from the facility interface modules, multiplex it to a higher line rate (1.106 Gbps), convert it to an optical signal, and send it over the fiber to its corresponding OSWIO circuit pack at the DACS IV-2000 (512) Switch Complex.

Optical Switch Input/Output

The OSWIO circuit pack, which is plug-compatible with the existing SWIO circuit pack, provides:

- SWIO functionality
- Circuitry for multiplexing and demultiplexing data signals to the optical line rate
- Optical interfaces to send and receive transmission data and timing information to and from the Remote Complex.

Optical Remoting of Interface Bay Complexes for the DACS IV-2000 (512) System

To provide flexibility in the placement of interface bays within a central office, the DACS IV-2000 supports optical remoting of one or two Remote Complexes.

Each Remote Complex can support half the system capacity (that is, 256 equivalent DS3 signals), with the remaining half of the capacity supported by either collocated interface bays or by a second Remote Complex.

The DACS IV-2000 (512) allows optical remoting of up to 248 STS1/DS3 equivalent ports to one Remote Complex and up to 248 STS1/DS3 equivalent ports to another Remote Complex. (This remoting is done through the use of OSWIO-fiber-OPEX links.) A total of 496 STS1/DS3 equivalent capacity can be remoted.

The maximum distance between the DACS IV-2000 (512) Switch Complex and the Remote Complexes is 1000 cable feet of optical fiber.

Remote Communication Links

This feature is associated with the optical remoting feature. The two ECI circuit packs in pre-Release 5.0 High-Capacity Controller Modules provided twelve administrative links (six per ECI circuit pack). These links are identified as CILINK 1-1 through CILINK 1-6 and CILINK 2-1 through CILINK 2-6. As part of the optical remoting feature, the two ECI circuit packs in the (256) system are replaced with one or two Remote Communications Interface (RCI) circuit packs that are interfaced to the ECI circuit packs in the (512) system. The new RCI circuit packs provide two links at the Remote Complex. These additional links for the Remote Complex are identified as CILINK 1-7, 1-8, 2-7, and 2-8.

The two spare links already available on each of the ECI6 circuit packs can provide asynchronous links to the Remote Complexes, thereby giving the central office technician the flexibility to monitor and maintain the DACS IV-2000 system from either a Remote Complex or from the (512) Switch Complex.

Optical Remoting Configurations

The DACS IV-2000 (512) Release 5.0 supports two optical remoting configurations, which are described below and shown in Figure 2-1.

- A single DACS IV-2000 (256) frame that may have been in service and capacity-expanded to a DACS IV-2000 (512) frame. Any facilities that were tied between the (256) and (512) systems are now available for additional capacity (Figure 2-1A).
- Two DACS IV-2000 (256) frames and a DACS IV-2000 (512) Switch Complex. Either or both Remote Complexes may have been capacity-expanded to the (512) (Figure 2-1B).

Figure 2-1C shows a DACS IV-2000 (512) Switch Complex with collocated interface bays. No optical remoting is used.

In Figure 2-1A, the circuit packs within the Switch Bay of the (256) system are replaced, thereby converting the Switch Bay to an Optical Extension (OPEX) Bay. The OPEX Bay is then connected with optical cable to the SWIO Modules in the Switch Complex of a half-equipped (512) system. The (256) system then becomes a Remote Complex of the (512) system.

In Figure 2-1B, the (512) bay lineup consists of only the Switch Complex and circuit packs of two (256) Switch Bays. The two (256) systems (either fully equipped or partially equipped) are located within 1000 cable feet of a (512) Switch Complex. During one capacity expansion procedure, the circuit packs within one of the (256) Switch Bays are replaced, thereby converting the Switch Bay to an OPEX Bay. The OPEX Bay is then connected with optical cable to the Switch Bay in the (512) Switch Complex. This (256) system now becomes a Remote Complex of the (512) system. During a second capacity expansion procedure, a second (256) system can be capacity-expanded onto the (512) Switch Complex. This (256) system now becomes a second Remote Complex of the (512) system.

Upgrade Overview

NOTE:
For additional upgrade information, see "Upgrade" later in this chapter. That section includes "Minimal Upgrade" and "Capacity Expansion."

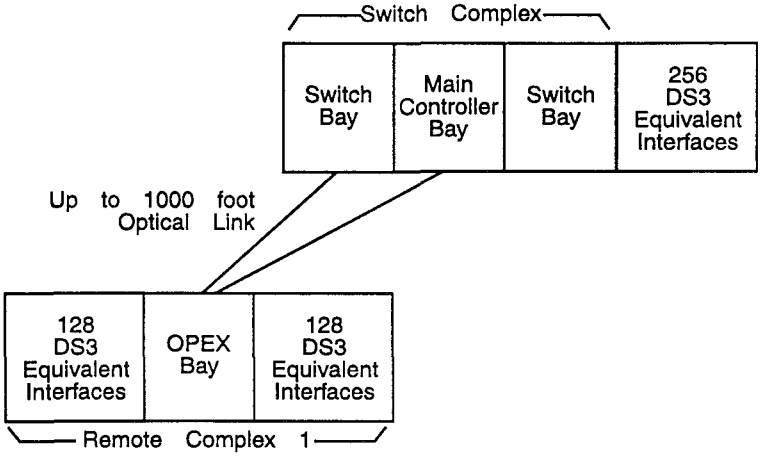
Control of the Remote Complex is accomplished by replacing the Redundant Controller Module circuit packs with new circuit packs that receive control information over fiber-optic cables from the High-Capacity Controller Module circuit pack. The unit controllers (UCs) and clock distributors in the Remote Complex must be replaced with new UCs. The UCs communicate with the Control Complex via a 10-Mbps LAN. The SWIO circuit packs are replaced by OSWIO circuit packs on the associated (512) Switch Bay. In addition, the following changes are made to support capacity expansion and optical remoting:

- The Clock Distributor 2 (CLKDR2) circuit pack replaces the Clock Distributor 1 (CLKDR1) circuit pack.
- The OPEX Module replaces the Switch Module.
- The OPEX PWR Module replaces the Switch Power Module.
- The RUI Module replaces the RC Module (becoming an extension of the HCC Module).
- The RUI PWR Module replaces the RC Power Module.

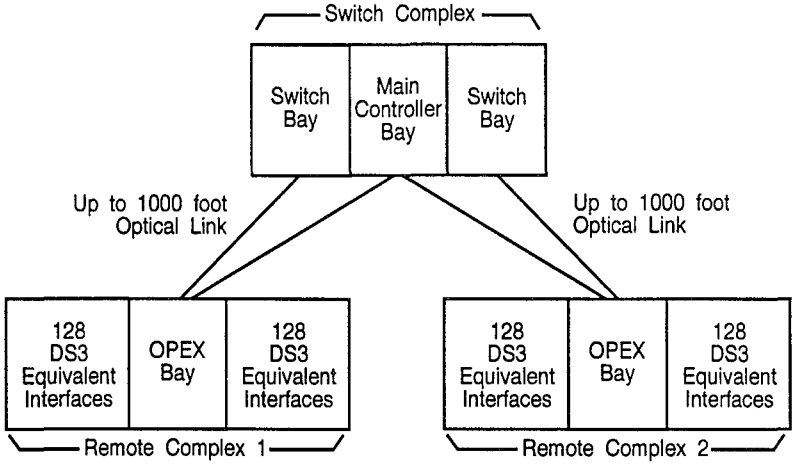
Once upgraded, the DACS IV-2000 (256) becomes a Remote Complex of the DACS IV-2000 (512), located within 1000 cable feet.

The upgrade is accomplished entirely through circuit pack replacement and fiber-optic cable installation. The fiber is connected to the circuit pack faceplates. The only access to the backplane that may be required is:

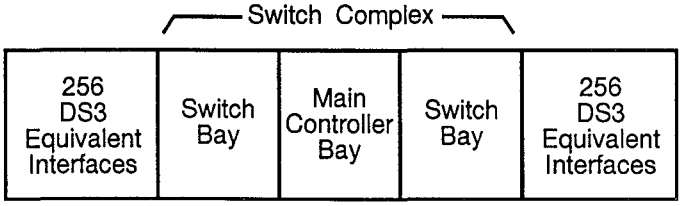
- Installation of a 1-Mbps LAN Interface Assembly to support the DACSmate™ connection for DACS IV-2000 (256) systems that do not already have it installed



Single Remote Complex



Two Remote Complexes



(512) Collocated System (No Optical Remoting)

Figure 2-1. **Optical Remoting Configurations**

- Installation of the new DACSmate cable assembly for DACS IV-2000 (512) systems shipped prior to General Availability (GA) for customers who are upgrading with the optional Remote Communication Links, described later in this chapter.

To perform the upgrade, you need a SPARCstation™ running DACSmate software, which controls both the DACS IV-2000 (256) and the DACS IV-2000 (512) during upgrade, as well as special capacity-expansion software. The workstation is used to store the databases from both systems during the upgrade and to recompute the switch maps required to compress and decompress traffic during the transmission portion of the upgrade. It is also used to control the steps of the upgrade procedure and provide verification and monitoring capability.

If the DACS IV-2000 (256) that is to be capacity-expanded has a Synchronizer Module provisioned, the DACS IV-2000 (512) must have a Synchronizer Module installed and in service. Either version one or version two circuit packs may be installed on the DACS IV-2000 (512), regardless of which version synchronizer is active on the DACS IV-2000 (256).

The DACSmate workstation communicates with each DACS IV-2000 frame via CILINK 1-1 and the frames' internal LANs. Because the DACS IV-2000 (256) has a 1-Mbps LAN and the DACS IV-2000 (512) has a 10-Mbps LAN, DACSlink 2.0 must be used to provide the 10:1 bridge function. The DACSmate must be located within 330 cable feet of the DACS IV-2000 frame; the DACSlink rollup bay must be located within 50 cable feet (RS-232 limitation) of the DACS IV-2000 (512) frame.

Prior to the capacity expansion procedure, an automated consistency check of the system databases must be performed. Inconsistencies (such as hourly vs. 15-minute performance monitoring bins) must be identified and eliminated before proceeding with capacity expansion.

The entire capacity expansion procedure, excluding preparation time, should be completed in one 8-hour period. (Time is measured from the point when facility cross-connect provisioning is unavailable until it becomes available again.) During this time, automatic protection switching and alarm reporting will not be disabled for more than 4 hours.

The upgrade procedure will not cause more than three signal disruptions to any traffic carried by the system. Two disruptions will be less than 250-ms, one less than 60 ms. Prior to the capacity expansion procedure, you will be able to designate up to 233 bidirectional DS1/VT1.5 circuits as high-priority and they should have no signal disruptions of more than 60 ms.

The N-rate and interface cabling within the DACS IV-2000 (256) system will not be moved or otherwise affected during capacity expansion. The -48V power cabling to the DACS IV-2000 (256) system is not moved or otherwise affected during capacity expansion.

MUX3 Circuit Pack Supporting DS3 Clear-Channel Cross-Connection or Enhanced DS3 Cross-Connections

The new DS3 interface circuit pack (MUX3), ported from DACS IV-2000 (256) Release 5.0, offers the features listed below.

- DS3 Clear-Channel Cross-Connection
- DS3 to STS-1 Gateway Cross-Connection
- Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals without Loss of Capacity
- Unframed DS3 Signals
- DS3 Terminal Loopback
- DS3 Test Access.

The DS3 Clear-Channel Interface-16 Module supports all the above new features.

The Enhanced DS3 Interface-16 Module supports the following feature:

- Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals without Loss of Capacity.

The modules are equipped as described in "New Modules for Release 5.0" in Chapter 1, **Introduction.**

The MUX3 circuit pack supports DS3 clear-channel cross-connections to other MUX3 circuit packs, enhanced DS3 cross-connections, 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 loss-of-signal (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.

The MUX3 circuit pack 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 DS3 clear-channel (cc) cross-connection 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.

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-1in 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 circuit pack and an SMUX circuit pack, and a signal label match failure (SLMF) is detected, the DACS IV-2000 Main Controller reports the SLMF facility failure condition as an SMUX-detected failure condition. If a gateway cross-connection exists between a MUX3 and an SMUX circuit pack, and a signal label mismatch is detected by the MUX3 circuit pack, the DACS IV-2000 reports the Switch Signal Label Match Failure (SWSLMF) condition as a MUX3-detected failure condition. When SLMF is detected by a MUX3 circuit pack 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. When SWSLMF is detected by a MUX3 circuit pack cross-connected as a DS3 clear-channel circuit, the DACS IV-2000 Main Controller reports the SWSLMF facility failure condition as a MUX3-detected failure condition. If a MUX3 circuit pack is provisioned for DS3 clear-channel but is not cross-connected, SLMF is not reported.

If a loss-of-signal (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 circuit pack, the MUX3 circuit pack 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.

DS3 Path Identification for the AT&T Transport Self-Identification Plan

The AT&T Transport Self-Identification (TRANSID) Plan uses data links within the DS1 and DS3 facilities to carry unique identifiers that specify the endpoints of the facility, the equipment type and location that generated the signal, and the type of signal (normal traffic, idle signal, or a test signal). TRANSID is available only with the MUX2 (AKM68) and the MUX3 (AKM91) circuit packs.

DS3 path identification lets you assign a set of identifiers to each transmitted C-bit parity DS3 facility. (The identifiers are carried in the row 5 terminal-terminal data link of the C-bit format.) You can also assign an "expected received" identifier to each DS3 port, and the DACS IV-2000 compares the "expected received" identifier with the actual identifier read from the incoming DS3 facility. A mismatch generates autonomous alarms or, provisionable, substitutes DS1 AIS downstream to prevent inadvertent cross-connection of an incorrect facility.

Benefits of DS3 path identification include faster provisioning and testing of circuits, since the facility IDs can be retrieved directly from the DACS IV-2000 rather than requiring separate test signals to confirm path continuity. In the event of a reroute to restore traffic after a failure (such as a cable cut), the DS3 path identification feature can eliminate the need for separate continuity checking of the alternate paths before restoring traffic.

The TRANSID DS3 Path ID feature has four basic capabilities; it can:

- Provision and retrieve the identification for each DS3 signal
- Autonomously transmit and read the DS3 identification in the data link of a C-bit parity format signal; that is, read/write row 5 of the C-bit parity DS3 signal
- Take appropriate actions if a mismatch occurs between the expected and actual Common Language Location Identifier (CLLI) and Common Language Facility Identifier (CLFI), or if a DS3 identification cannot be read on the incoming C-bit parity format signal
- Construct and transmit the appropriate DS3 identification for the C-bit parity format signal if a protection switch occurs.

TRANSID is supported for DS3 signals terminating on MUX2 and MUX3 circuit packs. MUX3 circuit packs that are provisioned for clear-channel cross-connection (either to another DS3 or to an STS1) support reading of the TRANSID identifiers, but not provisioning of the transmitted values or of "expected received" values.

Full-Time Performance Monitoring of DS1 Tributaries within DS3 Signals without Loss of Capacity

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 circuit pack supports the ANSI T1.403 standard.

NOTE:
DS1 far-end performance monitoring, per AT&T TR-54016, is not supported in this release.

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 the ANSI T1.403 Performance Report Message (PRM) protocol on the facility data link.

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 cross-connections, 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 circuit pack). 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 `ED-SECU-USER` and `ENT-SECU-USER` commands are used to set parameters to identify the numbering being used as port numbering or group numbering.

Downloadable Synchronizer Firmware Upgrade

The DACS IV-2000 Synchronizer Module firmware is upgraded in the field automatically through the release software when the SYNC is restored.

Other Features

The DACS IV-2000 (512) Release 5.0 also supports the features listed below.

- SONET Networking
- Upgrade
- Virtual Tributary Number Enhancements
- Cross-Connections
- Special Service (Redlined) Connections
- Bridging and Rolling
- Loopbacks
- Test Access
- Performance Monitoring
- High-Capacity Controller
- Power Redundancy
- Synchronizer Module
- Performance Monitor Test Signal Generator Receiver and Test Signal Identification
- Alarm Reporting
- Communications and OS Interfaces
- Security
- Facility Maintenance

- Frame Maintenance
- Protection Switching
- Automatic Circuit Pack Restoral.

SONET Networking

The DACS IV-2000 (512) Release 5.0 provides full SONET networking. SONET networking is more than the introduction of a SONET interface; it is the ability to perform all of the functionality associated with SONET interconnection. The SMUX circuit pack terminates an Electrical Carrier-1 (EC-1) line and allows for:

- Cross-connection of the entire STS-1 Synchronous Payload Envelope (SPE)
- Demultiplexing of VT1.5-based STS-1 signals and cross-connection of VT1.5 signals to other SONET interfaces
- Cross-connection of DS1 signals.

The SMUX 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 in order to accommodate the SONET performance monitoring feature. The DACS IV-2000 also supports operational, maintenance, and administrative features necessary for full SONET networking capability.

This section describes the following features:

- STS1 Interface
- STS-1 and VT1.5 Cross-Connections
- STS-1 and VT1.5 Bridging and Rolling
- STS-1 and VT1.5 Loopbacks
- STS-1 and VT1.5 Test Access
- STS-1 and VT1.5 Performance Monitoring
- SONET Synchronization
- STS-1 Path Trace Message
- Signal Label Mismatch.

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/DS1 Bay or the STS1/DS3 Interface Bay.

The DS3 Interface-32 Module in the STS1/DS3/DS1 Interface Bay can be replaced with an STS1 Interface-16 Module (ENH DS3 DS3CC); 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.

STS-1 and VT1.5 Cross-Connections

The DACS IV-2000 provides end-to-end SONET cross-connections and SONET/asynchronous gateway connections. In addition to the previously allowed types of cross-connections, this feature allows SONET-to-SONET and SONET-to-asynchronous signal interworking. All cross-connections can be either one-way or two-way for DS1, DS3, VT1.5, and STS-1 facilities. The new cross-connection types are:

- VT1.5 cross-connections between SONET interfaces
- STS-1 clear-channel SPE cross-connections between SONET interfaces
- DS1 cross-connections between SONET interfaces
- DS1 gateway cross-connections between SONET interfaces and DS1 interfaces
- DS3 cross-connections between SONET interfaces
- DS3 gateway cross-connections between SONET interfaces and DS3 interfaces.

For more information, refer to the "Cross-Connections" section later in this chapter.

STS-1 and VT1.5 Bridging and Rolling

All bridging and one-way and two-way rolling capabilities previously supported for DS1 signals are now supported for VT1.5 and STS-1 signals. For more information, refer to the "Bridging and Rolling" section later in this chapter.

STS-1 and VT1.5 Loopbacks

The wideband loopback feature provides for VT1.5 signals within incoming STS-1 signals to be looped back through the switch (on a per-tributary basis) to the outgoing STS-1 of the same STS-1 signal. The STS-1 line loopback feature allows for loopback of incoming STS-1 signals to 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.

For more information, refer to the "Loopbacks" section later in this chapter.

STS-1 and VT1.5 Test Access

This feature supports test access for the STS-1 and VT1.5 signal types introduced by the SONET interface. The DACS IV-2000 supports all the 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). Those supported access modes are: MONE, MONF, SPLTA, SPLTB, SPLTE, SPLTF, LOOPE, LOOPF, MONEF, and SPLTEF. The 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.

STS-1 and VT1.5 Performance Monitoring

This feature allows the DACS IV-2000 to monitor and report on the status of individual SONET lines and individual STS-1 and VT1.5 signal paths. It supports measurement and reporting of any signal degradations in accordance with early ANSI T1M1.3 draft standards. (The DACS IV-2000 supports yellow alarms and the original definitions of unavailable seconds.)

The DACS IV-2000 monitors the performance of the STS-1 section, STS-1 line, STS-1 path, and VT1.5 path layers. VT1.5 path performance is monitored for the near end. Both the near end and far end are monitored for the STS-1 path. A PMGR circuit pack can provide camp-on performance monitoring for a DS1 contained in a VT1.5 within an STS-1 signal — provided the signal is cross-connected as a DS1.

For more information, refer to the "Performance Monitoring" section later in this chapter.

SONET Synchronization

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 DACS IV-2000 switches to the other side.

STS-1 Path Trace Message

The DACS IV-2000 provides you with the ability to retrieve the incoming STS-1 path trace message for incoming STS-1 signals. This information is used to verify that the STS-1 signal is connected to its intended destination.

The DACS IV-2000 also allows you to provision an STS-1 path trace message. When the system creates an STS-1 path by cross-connecting either a DS1 or VT1.5 signal, this STS-1 path trace message is transmitted in the STS-1 path trace byte (J1). The path trace feature is provisioned through the `ED-EC1` command.

Signal Label Mismatch

An STS1 port is provisioned (through the `ED-PORT` command) with the expectation of receiving a particular STS-1 signal label. If the STS-1 signal received at this port does not match the expected provisioned signal label, the DACS IV-2000 generates a Signal Label Mismatch Failure (SLMF) alarm condition to indicate that the wrong signal type is being received. This feature assists you in troubleshooting STS-1 signal failures due to signal type mismatches.

If the DACS IV-2000 is making an STS-1 or VT1.5 cross-connection, the system is not creating the VT or STS path; therefore, the signal label that it transmits is the signal label that it receives.

If the DACS IV-2000 is making a DS1/SONET gateway cross-connection, the VT that is created contains the VT signal label (V5 bits 5-7) set to 010 to indicate an asynchronously-mapped DS1 and the STS-1 signal label (C2) set to 02, indicating floating mode VT1.5 signals. In addition, if a VT1.5 cross-connection is made, the DACS IV-2000 sets the STS-1 signal label to 02.

Upgrade

NOTE:
There is no Release 4.0 for the (512) platform.

The DACS IV-2000 Release 5.0 supports two distinct types of upgrades:

- Capacity expansion upgrade of a DACS IV-2000 (256) Release 3.0, Release 4.0, or Release 5.0 to a DACS IV-2000 (512) Release 5.0. [If you have a DACS IV-2000 (256) Pre-Release 3.0, you must first upgrade to a (256) Release 3.0.]
- Minimal upgrade of a DACS IV-2000 (512) Release 3.0 to a DACS IV-2000 (512) Release 5.0. [If you have a DACS IV-2000 (512) pre-Release 3.0, you must first upgrade to Release 3.0.]

Minimal Upgrade

A minimal upgrade of a DACS IV-2000 (512) Release 3.0 to a DACS IV-2000 (512) Release 5.0 requires no hardware changes. However, to take advantage of the new features, you must replace at least one MUX2 circuit pack with a MUX3 circuit pack (or all MUX2 circuit packs with MUX3 circuit packs to take advantage

of the clear-channel feature). The MUXP2 circuit pack must be replaced by the MUXP3 circuit pack. The PMGR circuit packs are no longer needed, thereby enabling you to provision additional MUX2 and/or MUX3 circuit packs.

Capacity Expansion

The capacity expansion upgrade is accomplished entirely through circuit pack replacement, fiber-optic cable installation, and database mapping in both the (256) and (512) systems.

To support capacity expansion, DACSmate software is required to perform the upgrade. Also, the (256) system must contain a 1-Mbps LAN interface assembly to connect to the DACSmate PC, and a DACSmate cable assembly must be present on the (512) system.

In the case of the (256) platform, the software is upgraded as part of the capacity expansion process. Note that unit numbering must be taken into consideration because some unit numbers on the (256) and the (512) before the expansion may be identical. Associated operations systems must also be upgraded.

To support the capacity expansion upgrade to Release 5.0, circuit packs must be replaced in both systems. The following circuit packs must be replaced in the (512) Switch Complex frame:

- SWIO2 (ERA4) must be replaced with OSWIO (ERY1).
- UI3 (ERA10) must be replaced with OUI (ERT1).
- Some PWRJ (568A) circuit packs must be replaced with PWRJ (568B).
- Filler assemblies and covers must be replaced with applicable equipment.

The following circuit packs must be replaced in the (256) Remote Complex:

- SWIO1 (AWR6) must be replaced with OPEX (ERW3).
- MTC3 (AWR10) must be replaced with UIA (ERW1).
- UI2 (AWR12) must be replaced with UIB (ERW2).
- CPU2 (AWP6) must be replaced with BXC3 (AWP20).
- CLKGN1 (if present) must be replaced with CLKGN2 (AWR7).
- ECI3 (AWP8) must be replaced with RCI (AWP19).
- UC2 (AKM59B) must be replaced with UC4 (AKM88B).
- CLKDR1 (AKM56) must be replaced with CLKDR2 (AKM90).

Transmission Interfaces

The DACS IV-2000 provides the following interface bay types:

- DS1 Interface Bay: contains three DS1 Interface Modules and one DS1 Interface Protection Module, which provide the interface for up to 868 DS1 signals (equivalent to 31 DS3 signals)
- STS1/DS3 Interface Bay: contains a combination of four DS3 Interface-16 or STS1 Interface-16 Modules, which provide the interface for up to 60 DS3 signals (no STS1 Interface Modules) or 60 STS-1 signals (no DS3 Interface-16 Modules)
- STS1/DS3/DS1 Interface Bay, which contains:
  - — One DS1 Interface Module and one DS1 Interface Protection Module, which support up to 420 DS1 signals (equivalent to 15 DS3 signals)
  - — One DS3 Interface-32 Module and one DS3 Interface-16 or STS1 Interface-16 Module.

  When equipped with a DS3 Interface-16 Module, the bay supports up to 46 DS3 signals. When equipped with an STS1 Interface-16 Module, the bay supports up to 31 DS3 signals and 15 STS-1 signals.

Refer to the "Bay Configurations" section of Chapter 1, **Introduction,** for examples of fully configured systems.

Note that the DS3 Interface Bay has been rated Discontinued Availability. The DS3 Interface-32 Module is still available on the STS1/DS3/DS1 Interface Bay. The existing DS3 Interface Bays will continue to be supported.

Virtual Tributary Number Enhancements

The requirements for DACS IV-2000 (256) Release 3.0, the initial release of SONET that provided STS-1 interfaces and SONET cross-connections, were primarily based on Bellcore TR-NWT-000253, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria* (Issue 2, December 1991). Bellcore changed that document to make the VT1.5 numbering scheme less confusing to the customers. The DACS IV-2000 (256) Release 5.0 reflected the Bellcore change, as does the DACS IV-2000 (512) Release 5.0.

Cross-Connections

The DACS IV-2000 electronically cross-connects DS1, DS3 (MUX3 circuit packs only), VT1.5, and STS-1 signals. The cross-connections are implemented with a three-state 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 (SMUX circuit packs). By cross-connecting STS-1 (clear-channel SPE) signals, STS-1 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 signals between DS3 and DS3/STS-1 interfaces.

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 additional data regarding input ports that are mapped to output ports. In addition, data can be retrieved for DS1 ports that are transmitting a quasi-random signal.

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) connection.

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

Bridging and Rolling

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

The DACS IV-2000 performs STS-1 facility rolling by bridging an STS1 input port to an STS1 output port without affecting service in the existing path. Rolling consists of breaking the old connection while simultaneously establishing a new con-

nection in less than 2 ms. The DACS IV-2000 supports one-way rolls (each direction of transmission rolled separately) and two-way rolls (both directions rolled together).

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 DS3 cross-connection by cross-connecting the DS3 input port to a DS3 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, STS-1, and VT1.5 signals. The DS1, DS3, STS-1, and VT1.5 loopbacks are shown in Figure 2-2.

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 MUX2) DS3 interface circuit pack can retransmit an incoming signal back to the output. The DS3 line loopback is supported in both clear-channel (MUX3 circuit pack only) and

DS1 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 loop-

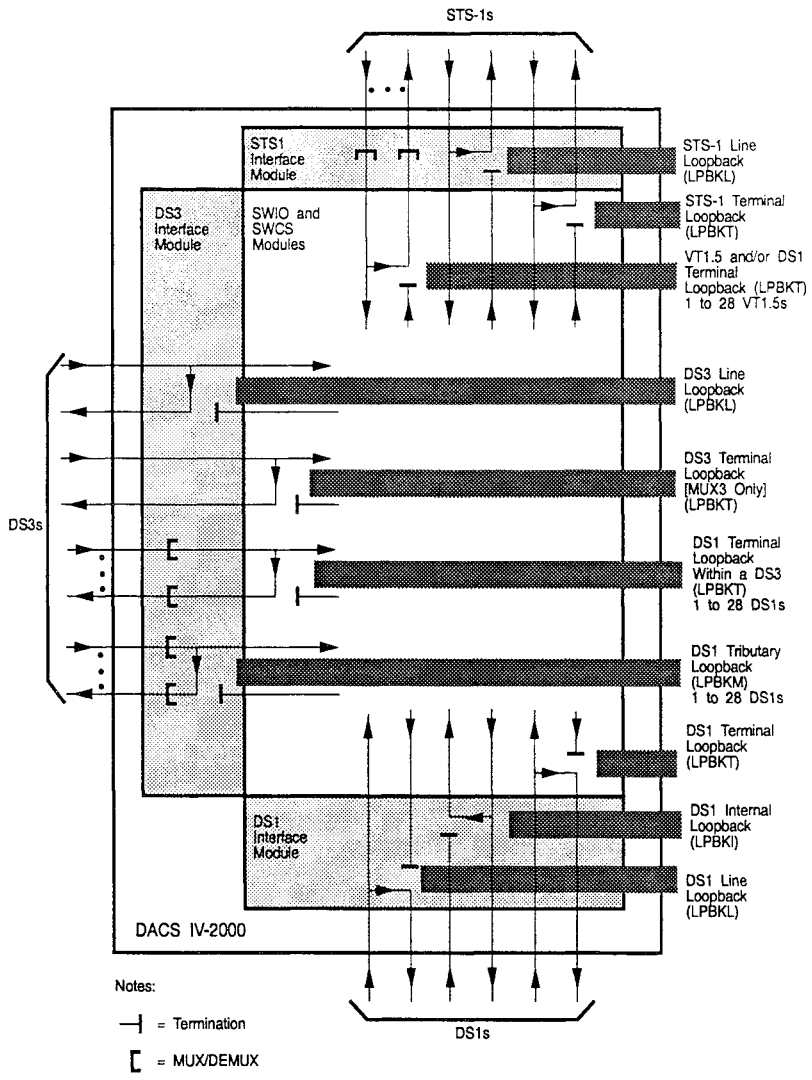


Figure 2-2. **STS-1/VT1.5/DS3/DS1 Loopbacks**

back happens directly in the MUX 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 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 circuit pack). Bipolar violations are not preserved for terminal loopbacks.

STS-1 Loopbacks

The STS-1 line loopback feature allows incoming STS-1 signals to be looped back in the output direction, and maintains all incoming signal code and format violations and timing.

STS-1 loopbacks can be operated on a specified STS1 port or range of STS1 ports, either towards the facility or through the switch matrix of an STS1 Interface Module.

STS-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 STS1 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.

The STS-1 loopback feature is performed without changing any bits in the looped-back signal.

VT1.5 Loopbacks

The VT1.5 loopback feature allows VT1.5s within incoming STS-1 signals to be looped back through the switch (on a per-tributary basis) to the outgoing STS-1 of the same STS-1 signal.

VT1.5 loopbacks can be operated on a specified VT tributary of an STS-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.

The VT1.5 loopback features is performed without changing any bits in the looped-back signal.

Test Access

The DACS IV-2000 supports all the DS1, DS3, 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): 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). The ability to supply and monitor DS1, DS3, VT1.5, and STS-1 test signals, to split connections, and to perform loopbacks can simplify facility turnup and assist in trouble isolation.

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 circuit pack) by bridging the signal to a separate PMGR1 circuit pack (via camp-on monitoring or scan monitoring), which reduced the effective system capacity.

In Release 5.0, 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, the DS1 tributaries on the received DS3 facility are monitored. 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 nonrepeatered applications (Severely Errored Framing 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 STS-1 and VT1.5 performance monitoring parameters.

Near-End Section Parameters

The following section parameters are available for SONET:

Severely Errored Framing 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 circuit pack 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 network terminating element, NTE) performance monitoring data is 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, 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 circuit packs 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 monitored DS1s can be from DS1 interfaces, DS1 tributaries within a DS3, or DS1s extracted from a VT1.5.

The system provides two types of camp-on monitoring options:

- 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: 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 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)
Path Degraded Minute (DM) (only for ESF).

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.

The parameters defined for near-end paths (except OOFS) are also available for far-end paths. In addition, far-end path parameters include:

Severely Errored Frame Second (SEFS)
Slip Second (SLS).

Trouble Condition Reporting

Facility alarm messages are generated if there is a 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, which is 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.

If a MUX3 circuit pack 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 is lost. If a MUX3 circuit pack is extracted from its slot, performance monitoring for all DS1 tributaries of that DS3 stops and the collected PM data on that circuit pack is 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 circuit pack 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 circuit pack 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 is 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 circuit pack 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` commands.

Optional TABS DS3 PM Reports

The optional DS3 Performance Monitoring (DS3PM) circuit pack supports reporting of DS3 performance parameters over TABS protocol links in accordance with CB-149 specifications. The TABS links (for 128 DS3 equivalents; that is, eight DS3PM circuit packs if equipped with two DS3/STS-1 Bays) can be multipoint-connected to a single General Telemetry Processor (GTP) port. The DS3PM circuit packs are not required for reporting DS3 performance over the X.25 or Snider links.

NOTE:
The DS3PM circuit pack is supported in collocated interface bays but not in optically connected interface bays.

High-Capacity Controller

The DACS IV-2000 is equipped with two Control Complexes, which maximize control availability and reliability by providing redundancy in the critical parts of the high-capacity controller and autonomous recovery from controller failures. The High-Capacity Controller (HCC) Module provides administrative link protection and nonvolatile backup memory. The following sections describe additional features provided with the HCC Module.

Administrative Links

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

To support the optical remoting feature, the optional RCI circuit packs (two in each Remote Complex) provide up to four additional Snider links via the ECI circuit packs in the HCC Module. These links are identified as CILINK 1-7 and CILINK 2-7, CILINK 1-8 and CILINK 2-8. Each RCI gets a single link from the ECI. RCI-1 terminates the CILINK from ECI-1, and RCI-2 terminates the CILINK from ECI-2.

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 backups. The optical disk also backs up the hard disks.

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 primary 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). Functionally, the SSS is responsible for database backup and storage and also downloading the software release.

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

- Volatile RAM memory to store relevant system information (such as switch settings and cross-connect maps)
- Primary nonvolatile memory (PRI-1 and PRI-2) of 248 Mbytes
- A SEC, that is, an optical disk drive, which:
  - — has storage capacity of 128 Mbytes
  - — stores system database and the program control out of the equipment or off-site for backup purposes.

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

Power Redundancy

The DACS IV-2000 (512) is configured to operate with one or two Lineage® 2000 (or equivalent) battery plants (-48 Vdc nominal) in a central office environment. For further information, see "Power Specifications" in Appendix A, **Technical Specifications.**

Synchronizer Module

DACS IV-2000 synchronization allows the DACS IV-2000 to act as a gateway between synchronous and asynchronous networks. The DACS IV-2000 (512) Release 5.0 provides 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).

Performance Monitor Test Signal Generator Receiver and Test Signal Identification

This section describes the Performance Monitor Test Signal Generator Receiver (PMGR) and DS1 Signal Identification (TSID).

PMGR Provisioning

Each PMGR circuit pack supports either the DS1 performance monitoring features or the DS1 TSID feature. You can provision each PMGR circuit pack in the system to specify which of these features it supports. By equipping the system with multiple PMGR circuit packs, both DS1 PM and DS1 TSID features can be simultaneously supported.

DS1 Test Signal Identification

The DACS IV-2000 provides test signal generators and receivers (TSGRs) at the DS1 rate. This allows the DACS IV-2000 to provide DS1 test signals with unique Test Signal Identification (TSID). The DACS IV-2000 is capable of generating and receiving a TSID signal at the DS1 rate. The DACS IV-2000 provides these capabilities through the performance-monitoring generator receiver (PMGR1) circuit pack. The DACS IV-2000 can also transmit and receive the DS1 TSID through any DS3 multiplexer (MUX) port interface.

With a DS1 TSID, you can:

- Query the system to determine the number of test signal generators and receivers in the system, the test signals that are idle, and the test signals that are being used and by whom they are being used.
- Generate a DS1 quasi-random signal with an ID embedded in the DS1 extended superframe (ESF) and data link (DL).
- Receive a DS1 quasi-random signal with an ID embedded in the DS1 ESF DL and request an ID report. Also, any defined error conditions that occur are reported.
- Request the system to read and report the ID from the DS1 ESF DL.

Alarm Reporting

There are three levels of 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.

Local 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 STS1 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 protocol 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:
The DACS IV-2000 (512) Release 5.0 Software Release Description (AT&T 365-340-905) is available with the software. Please check it 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 Office Alarms

The DACS IV-2000 provides four remote office alarms: critical, major, minor, and processor major, with local status indicators on the status panel. 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 (version two) 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 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.

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 "Link Specifications" section of Appendix A, **Technical Specifications.**

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 provides communications 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 is 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 TA-TSY-000009, *Asynchronous Digital Multiplexer Requirements and Objectives,* Issue 1, May 1986, or ANSI TI.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 to interface with current Bellcore OSs and for full support of the current DACS IV-2000 features, the following releases (or later) of the NMA, OPS/INE, and TIRKS software must be used:

NMA - Release 6.0
OPS/INE - Release 2.1
TIRKS - Release 17.1

Figure 2-3 depicts a typical Bellcore environment.

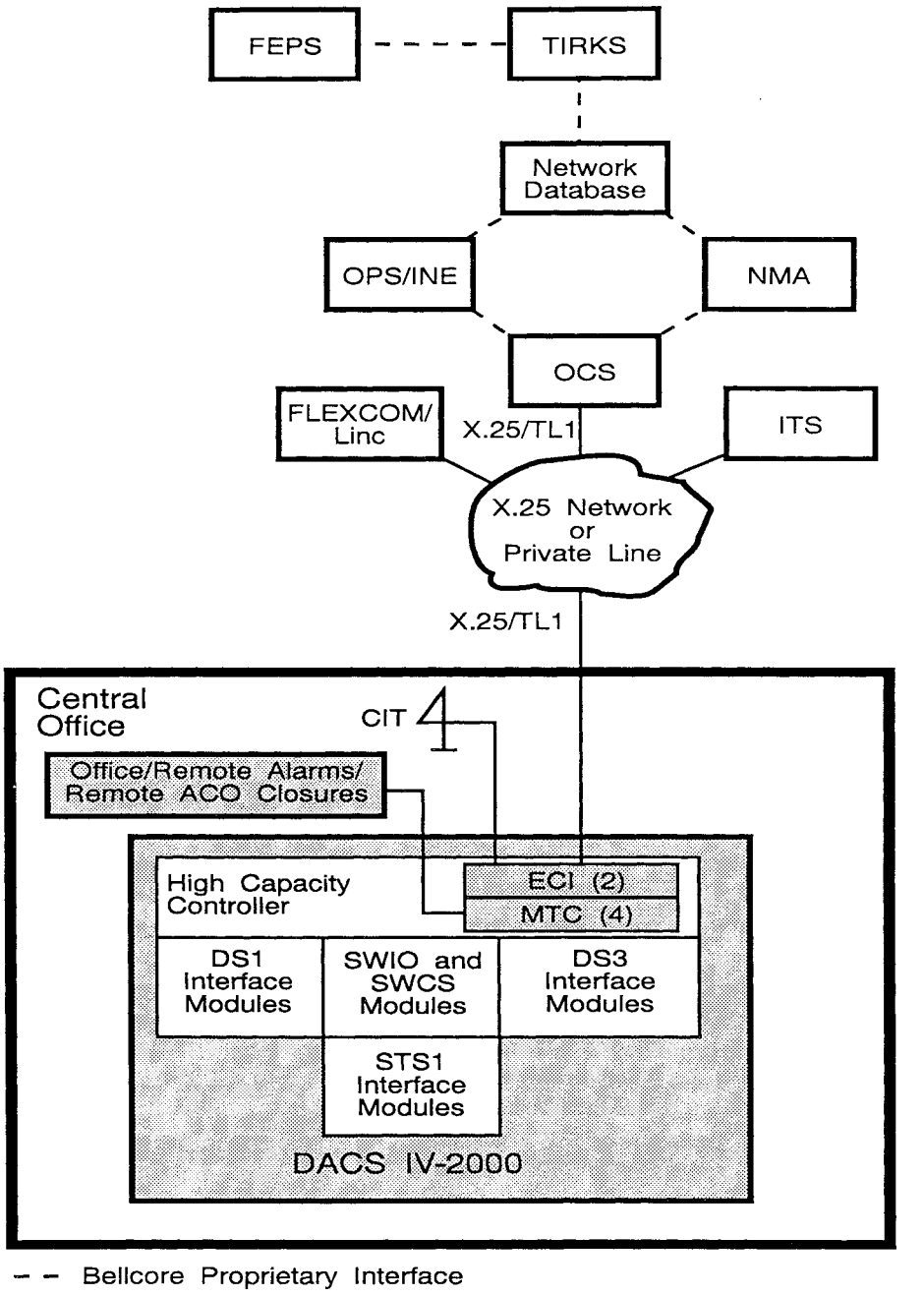


Figure 2-3. **Typical Bellcore Operations Systems Environment**

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 6.0.0.12
SCCS - Release 13.3
TNM - Release 2.4

Figure 2-4 depicts a typical AT&T environment.

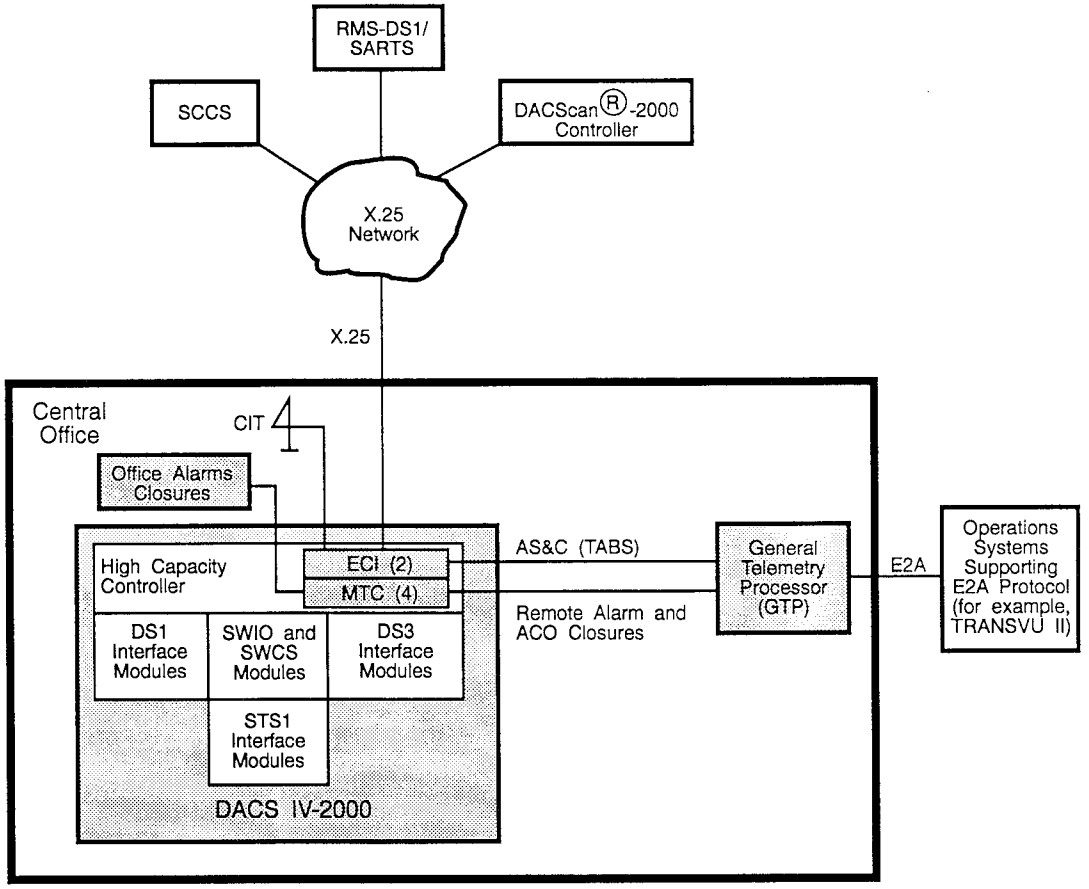


Figure 2-4. **Typical AT&T Operations Systems Environment**

Input Command Routing

Input commands and acknowledgment codes from any administrative link at the DACS IV-2000 frame can 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.

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` (test access) command or `RLS-LPBK` (loopback) command.

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 that 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-user and per-link 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, the processor executes the last command first. If two commands have the same priority, 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 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` option takes longer than 10 minutes.

X.25 Links

The DACS IV-2000 supports the X.25 Packet Assembler/Disassembler (PAD) and provides X.25 clear-to-send detection and X.25 flow control.

X.25 Packet Assembler/Disassembler

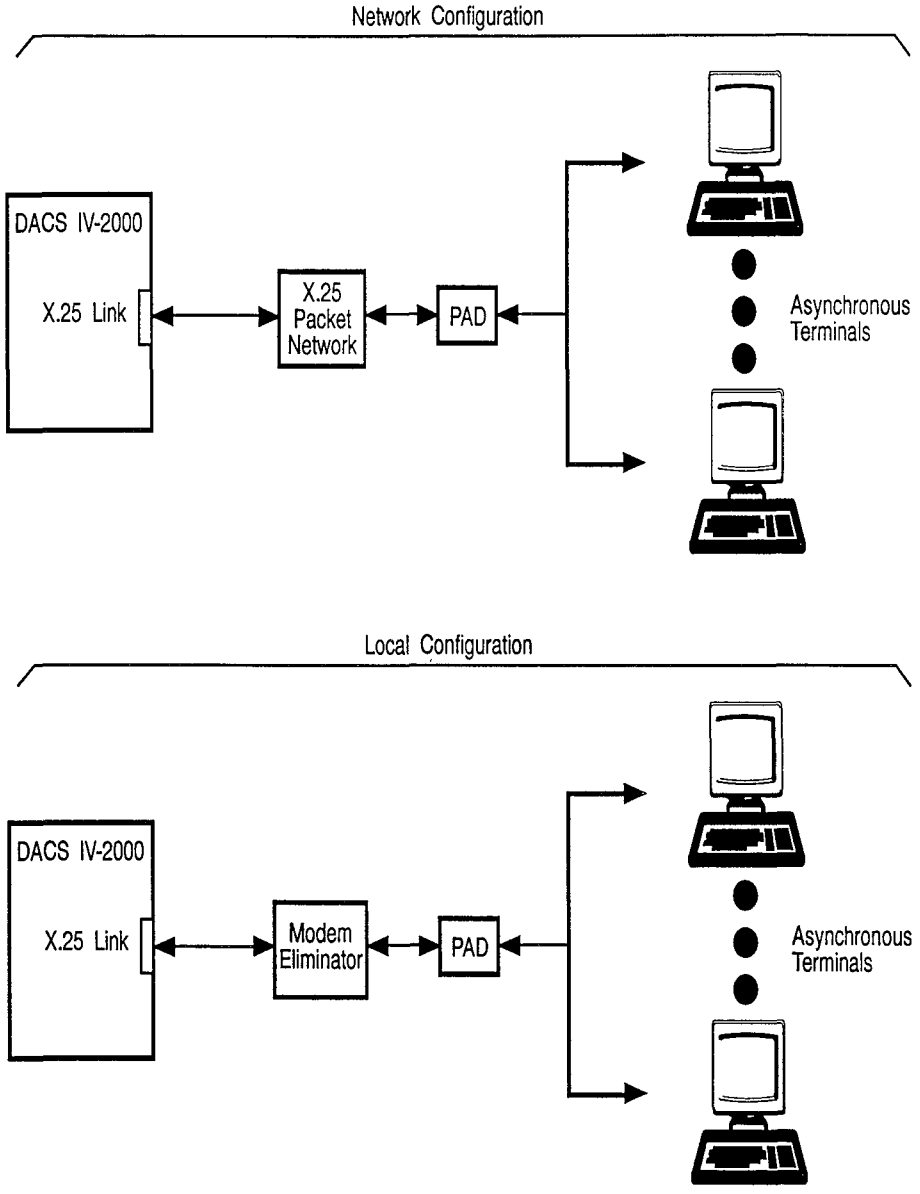
Using an external PAD, an X.25 link can be converted into multiple asynchronous terminal interfaces. The PAD can be used to connect asynchronous terminals to the system for local operation, or to modems for remote (networking) operation (see Figure 2-5).The recommended PAD is a MICOM® box Type 2 X.25 asynchronous PAD.

X.25 Clear-to-Send Detection

When a Clear-to-Send signal is lost on an X.25 administrative link, the system places the link out of service and logs out all users on virtual circuits for that link. When the Clear-to-Send signal is restored, the link issues a prompt, indicating that you can log in. A report alarm link message is generated and the appropriate Alarm, Scan, and Control (AS&C) point is set. For more information on AS&C points, see Appendix A, **Technical Specifications.**

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.



PAD = Packet Assembler and Disassembler

Figure 2-5. **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 idle (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.

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 4 (UC4) 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`.

Input Port Status

The input port status is provisioned in the DACS IV-2000 to mark DS1/DS3/ECI input ports as shown below. (The input status values for a DS1 tributary within a DS3 signal associated with a MUX3 circuit pack are DRVN and NDRVN; INIT is not supported.)

- 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 is 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.
- QRSS (Quasi-Random Signal Source) – for DS1 ports only: A command given to the system 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.

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 MUX2 or 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 2-6 provides examples of the automated facility turnup test.

Remote Multiplexer Communications

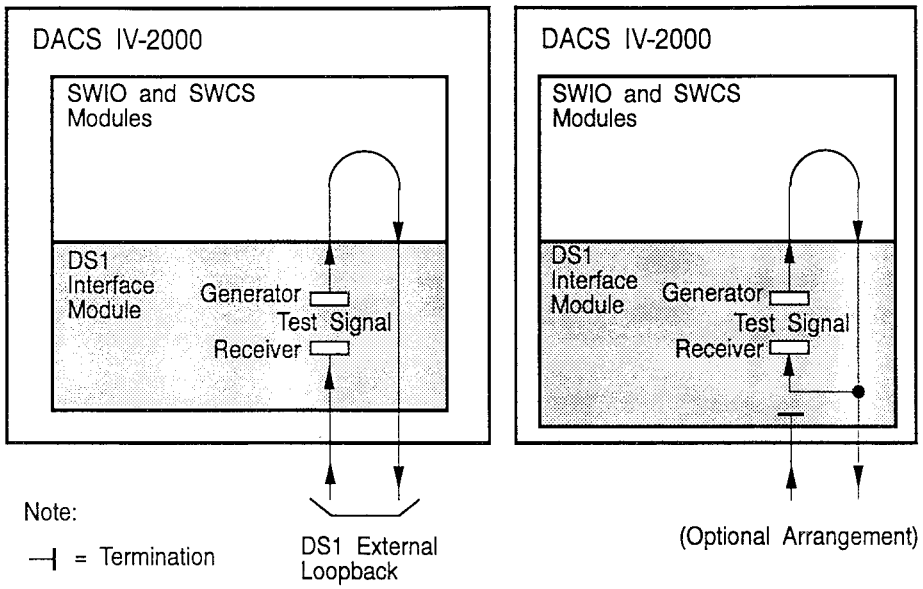
This feature enables the DACS IV-2000 to communicate with far-end multiplexers by using DS3 overhead bits. It allows:

- 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.

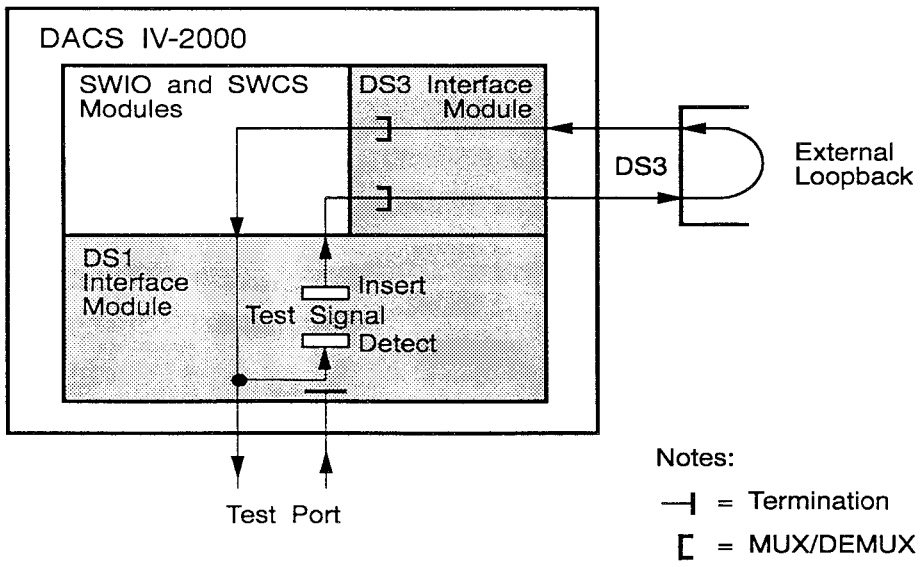
This feature supports the following protocols for communications with multiplexers at the far end of the DS3 facilities:

- DS3 X-bit signaling that indicates far-end DS3 alarm conditions
- DS2 X-bit signaling that indicates far-end DS2 out-of-frame condition
- 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)
- 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.



Automated Loopback Transmission Test on a DS1 Port



Automated Loopback Transmission Test on a DS3 Port

Figure 2-6. **Automated Facility Turnup Test**

Frame Maintenance

The features and capabilities of the frame maintenance mechanism are described in the 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 in-service (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 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.

Fan Assembly

Fan assemblies are provided in the Switch Bay and STS1/DS3 Interface Bays. The fan assemblies are used to cool vertically mounted modules. Each fan assembly consists of three horizontally mounted fans with a filter, and control

switches and indicators. You must keep the air intake (under the assembly) free of obstructions. In addition, the fan filter needs to be replaced on a routine basis. For fan assemblies ED-2C816-30,G1 and ED-2C906-30 an autonomous message (REPT FAN FILTER) is generated (after the recommended filter replacement interval of 91 days has occurred) to remind you that the fan filter needs to be replaced. For fan assemblies ED-9C130-30,G1 and ED-9C130-30,G2 a minor FILTER alarm LED on the fan assembly turns on when the fan filter must be replaced.

Fan Filter Replacement Indication

For ED-2C816-30 or ED-2C906-30 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 90 days has passed. 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 device is provided.
- Risks are reduced when handling coaxial lines, because they are kept from the backplane areas.
- A more robust connection is available.
- The coaxial cable 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 precabling are facilitated. Cables can be pulled from either end with less risk, and, if necessary, can be trimmed and reterminated 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 deemed necessary.

EMI Enclosures

When fitted with the optional electromagnetic interference (EMI) 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:
EMI enclosures are not available for capacity expanded or optically remoted systems.

NOTE:
Enclosures must be ordered with any new frame and cannot be field retro-fitted.

With the EMC option, the entire front of the DACS IV-2000 is covered with EMI doors. Because of this, the visual alarm indicators are only visible when viewed from the front. However, the EMI enclosure provides Header Designation Assemblies (HDA) at the top of each Switch Bay to house duplicate 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 protection group are not protected. Multiple failures occurring in multiple protection 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 a single DS3 Interface-32 Module, which is 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 SWIO 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 thirty-second 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 protection 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, OPEX, SWIO, and OSWIO 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 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.

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, OPEX, SWIO, OSWIO, 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.

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 unit 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.

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 high-capacity controller, synchronizer, and DS3PM RUI circuit packs.

The UC and DS3PM 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.

Applications

3

Contents

Contents

Applications

3

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 STS1 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
- DS3 Clear-Channel Cross-Connection
- DS1/VT1.5 Grooming
- Electronic DSX-1 (EDSX-1)
- Test Access and Performance Monitoring
- Networking
- Digital Switch Cutover.

SONET Connectivity

The DACS IV-2000 Release 5.0 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. Similar to the STS-1 clear-channel SPE cross-connect, 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 digital cross-connect system similar to a DACS IV-2000. 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.

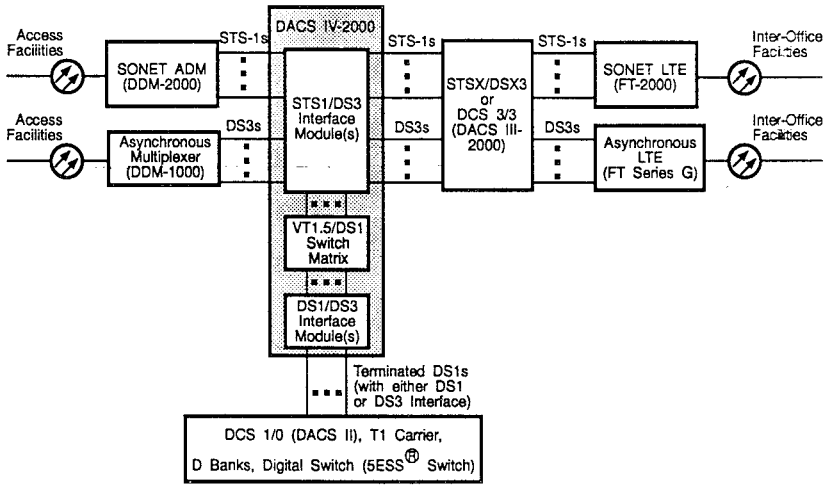


Figure 3-1. **SONET Office Architecture with the DACS IV-2000**

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. Thus, the DACS IV-2000 serves as a gateway between the asynchronous network (incoming DS1s and DS3s) and the synchronous network (outgoing STS-1s) as shown in Figure 3-2.

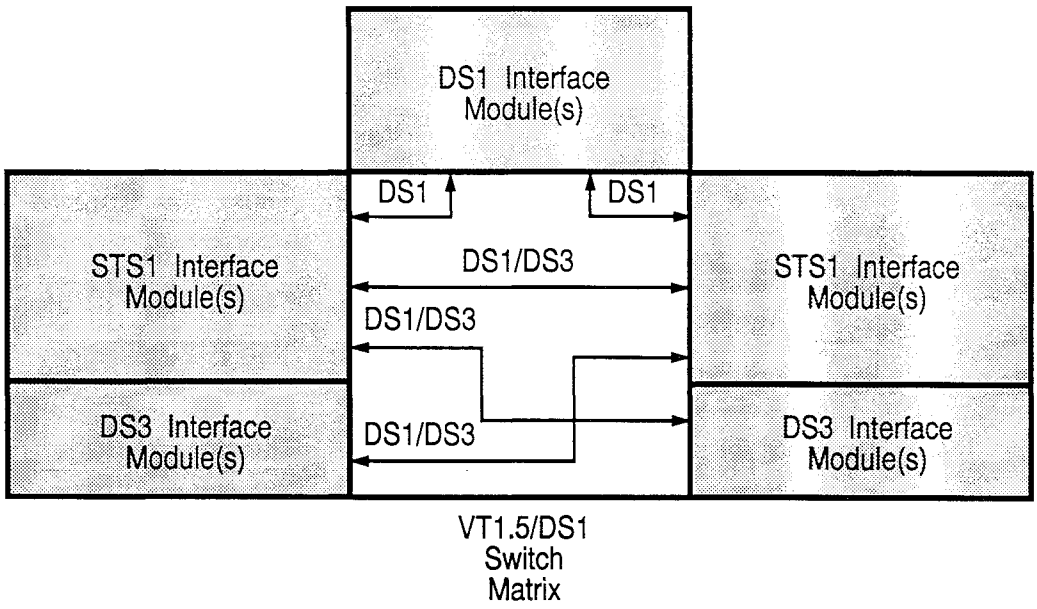


Figure 3-2. **The DACS IV-2000 Asynchronous Gateway to SONET**

DS3 Clear-Channel Cross-Connection

The DACS IV-2000 Release 5.0 provides clear-channel cross-connection of a DS3 signal between DS3 or STS1 interfaces. This is especially valuable for customers with applications that require high bandwidth, such as video services. Performance monitoring is supported for DS1 tributaries of DS3 signals, and DS3 test access is provided.

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 STS-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 and terminating equipment (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.

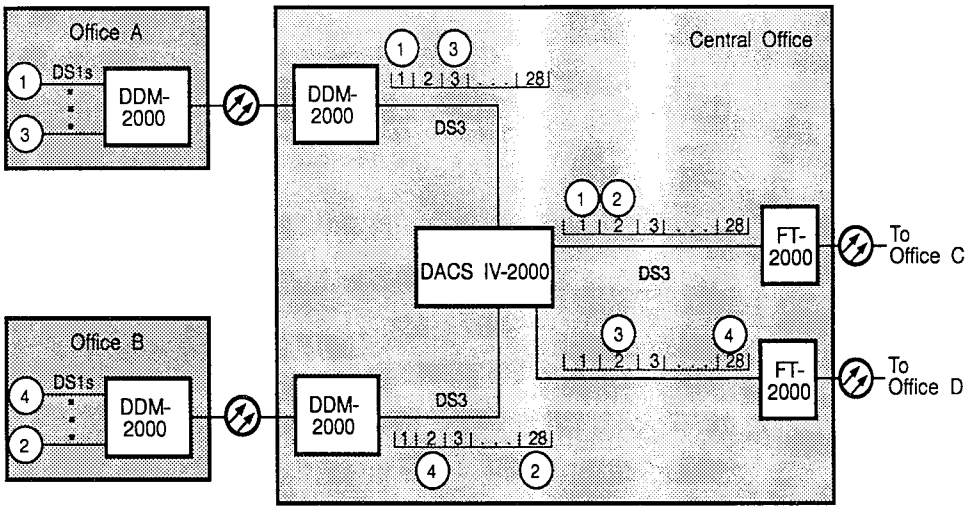


Figure 3-3. **DACS IV-2000 Grooming Application**

Access Grooming

Access grooming is the rearrangement of tributaries on terminated facilities that come into central offices from customer sites or remote terminals.

The 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 STS-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 provides 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 having 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 process of terminating fiber from the loop. Figure 3-5 shows the arrangement with a DACS IV-2000.

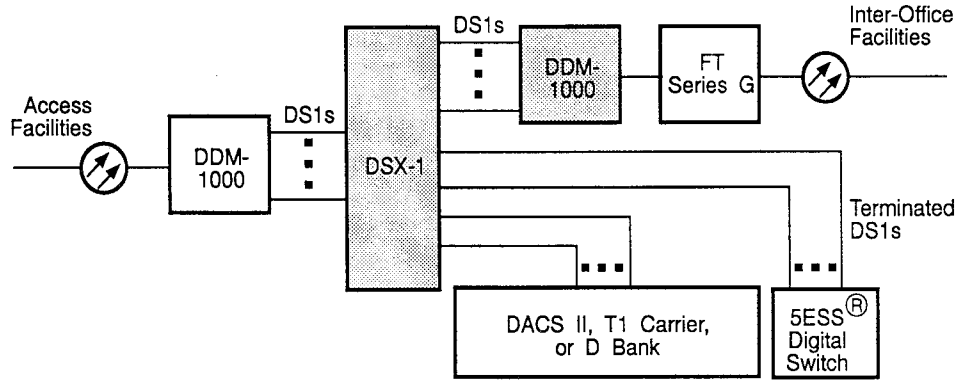


Figure 3-4. **Manual Fiber Loop Access Arrangement**

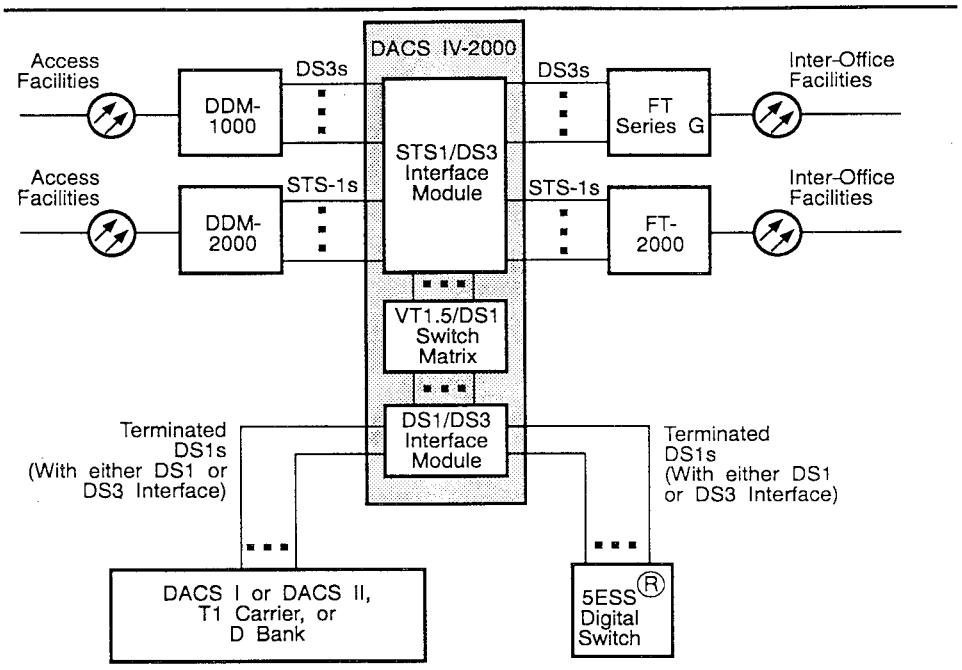


Figure 3-5. **Fiber Loop Access with the DACS IV-2000**

Interoffice Grooming

Grooming is the rearrangement of VT1.5 or DS1 tributaries on terminated interoffice STS-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 STS-1/DS3 facility can be cross-connected in the DACS IV-2000 to other interoffice STS-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.

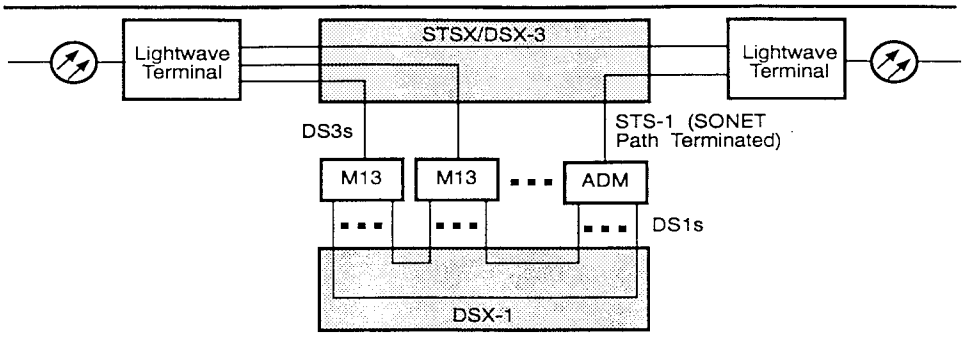


Figure 3-6. **Interoffice DS1 Grooming with Back-to-Back Multiplexers**

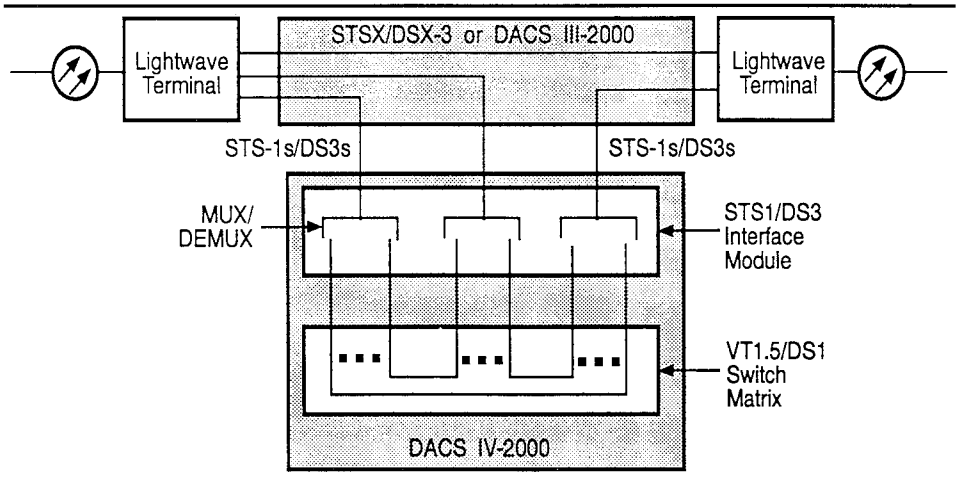


Figure 3-7. **Interoffice DS1 Grooming with the DACS IV-2000**

Because the VT1.5 signals carried within an STS-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 can not 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 signals and cross-connected at the DS1 level. This break in SONET end-to-path continuity is shown in Figure 3-8.

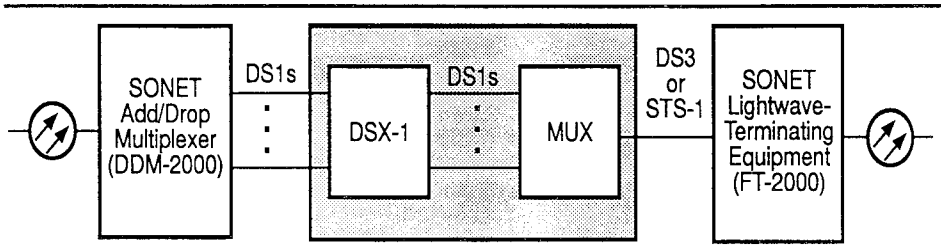


Figure 3-8. **Tributary Grooming without the DACS IV-2000**

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

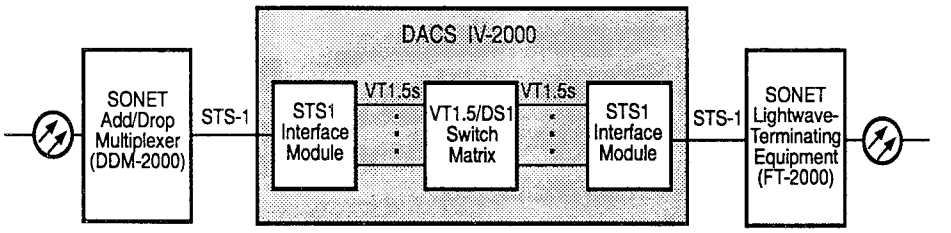


Figure 3-9. **End-to-End Path Connectivity with the DACS IV-2000**

Intraoffice Grooming

As other network elements are enhanced to provide STS-1 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 STS-1/DS3 facility. This office architecture provides cost savings by allowing the use of lower-cost STS-1/ 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 levels. 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 inter-exchange 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 IEC 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 STS-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 STS-1 facility. The original interface can then be removed.

Electronic DSX-1 (EDSX-1)

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-1 cross-connect frame and to provide the equivalent functions for the VT1.5 signals. Figure 3-10 shows this configuration.

The DACS IV-2000 provides all of the functions now performed at manual DSX-1 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 arrive at the DACS IV-2000 via DS1 facilities or as tributaries of a DS3 or as tributaries of an STS-1. The VT1.5 signals arrive at the DACS IV-2000 as tributaries of an STS-1.

The centralized control allows faster response time for facility and service orders and faster resolution of trouble reports. This arrangement allows 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.)

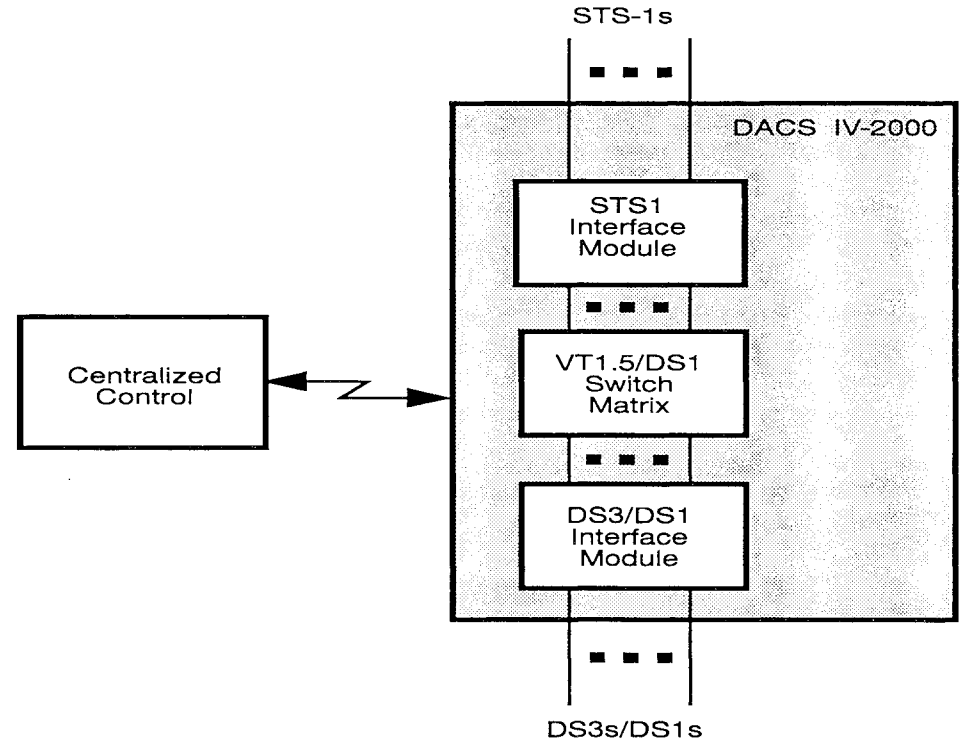
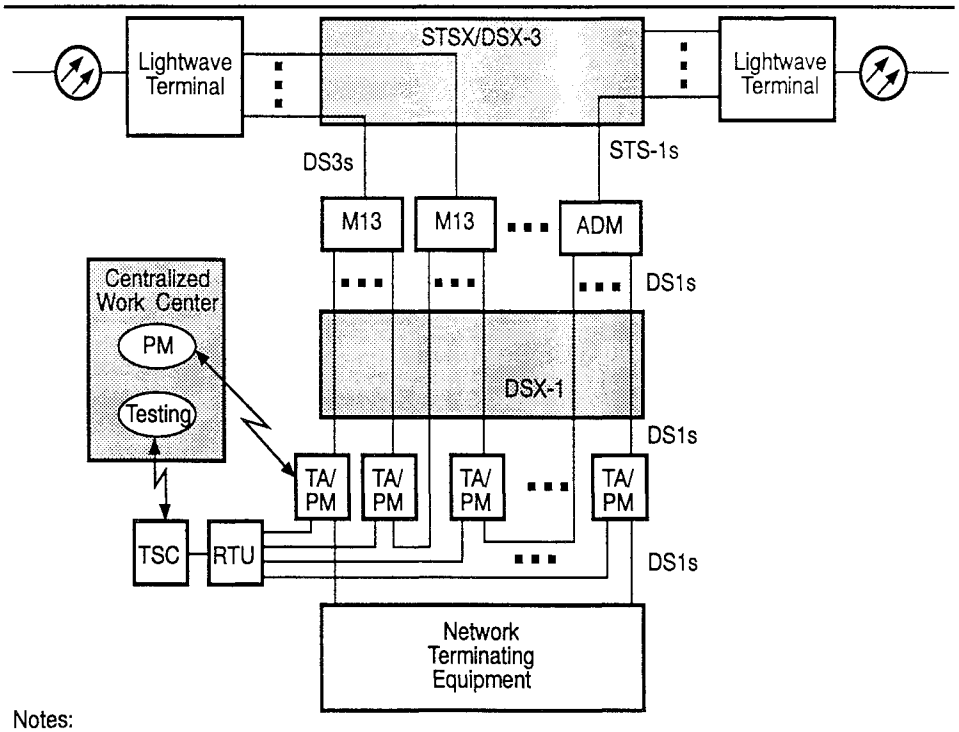


Figure 3-10. **The DACS IV-2000 as an Electronic DSX-1 (EDSX-1)**

Test Access and Performance Monitoring

Detailed Performance Monitoring (PM) data must be available for through-facilities and terminating facilities. This is especially important when high-capacity services are provided with DS1 or DS3 signals terminating on customer equipment, and when DS1 or DS3 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 externally provided. (See Figure 3-11.)



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**

Purchase of this 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.

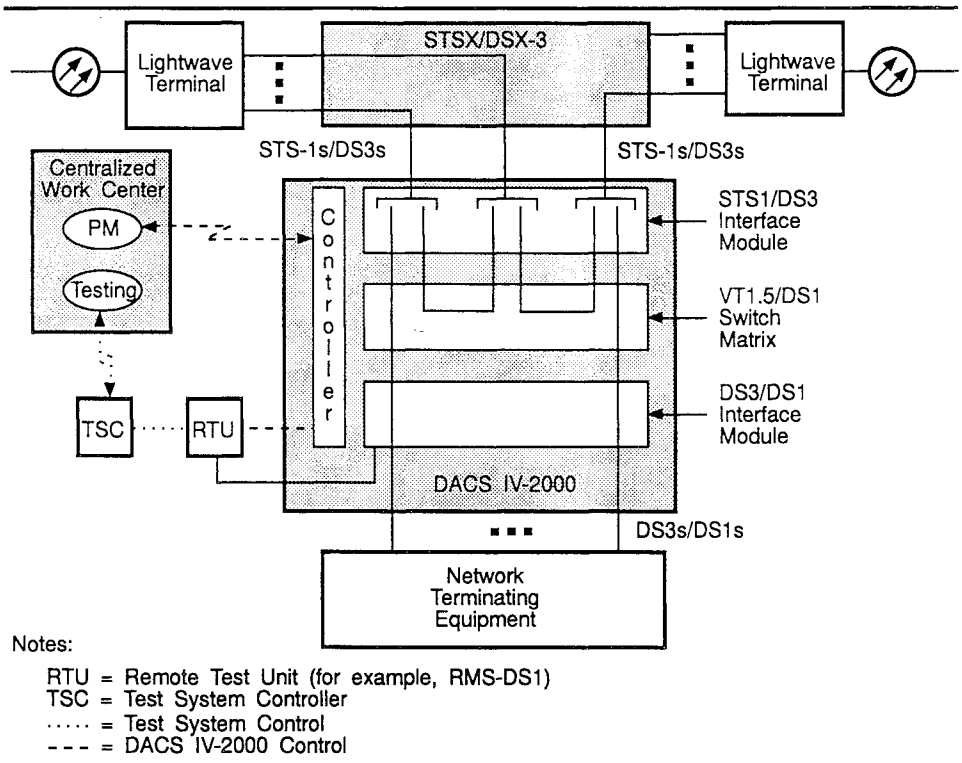


Figure 3-12. **DACS IV-2000 Test Access and Performance Monitoring**

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.

SONET Performance Monitoring

As the asynchronous network evolves to SONET, performance monitoring is a required feature for both VT1.5 and STS-1. SONET networking with 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 monitoring data is sent directly from the DACS IV-2000 to a centralized work center via one of its administrative links. This is illustrated in Figure 3-13.

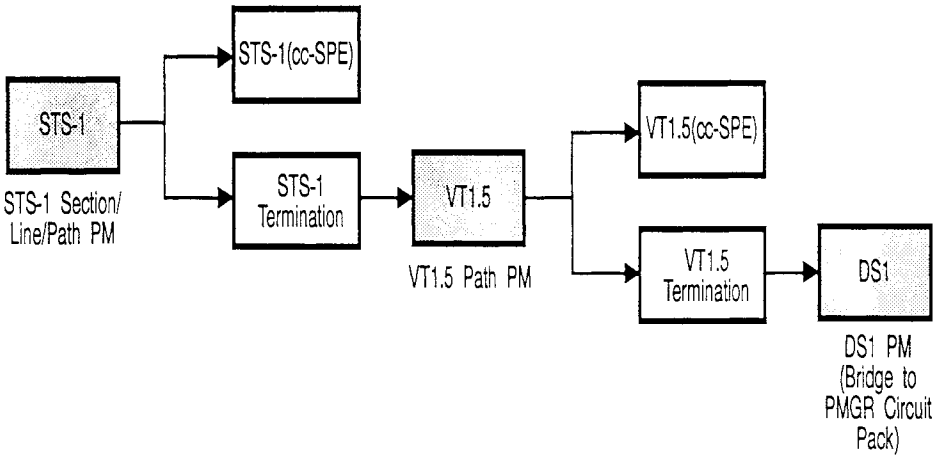


Figure 3-13. **DACS IV-2000 SONET Performance Monitoring**

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 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 STS-1 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 was supported for the DS1 signal in previous releases by bridging to a PMGR circuit pack. (The use of a PMGR circuit pack results in the loss of the equivalent of one DS3 of capacity.) In Release 5.0. the MUX3 circuit pack supports performance monitoring of DS1 signals terminating on DS3 facilities as tributaries of DS3 signals, as well as performance monitoring of clear-channel DS3 signals, without the loss of capacity associated with the PMGR circuit pack.

Network Applications

The DACS IV-2000 offers the following network applications, which can provide significant network savings:

- Ring interworking
- Centralized network control
- 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 DACS IV-2000s at the ring intersection nodes. Significant savings (25 percent in network studies) can be realized by using 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 STS-1 would be required for each far-end destination; as a result, each STS-1 would contain a small 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 STS-1. This provides greater utilization of the STS-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.

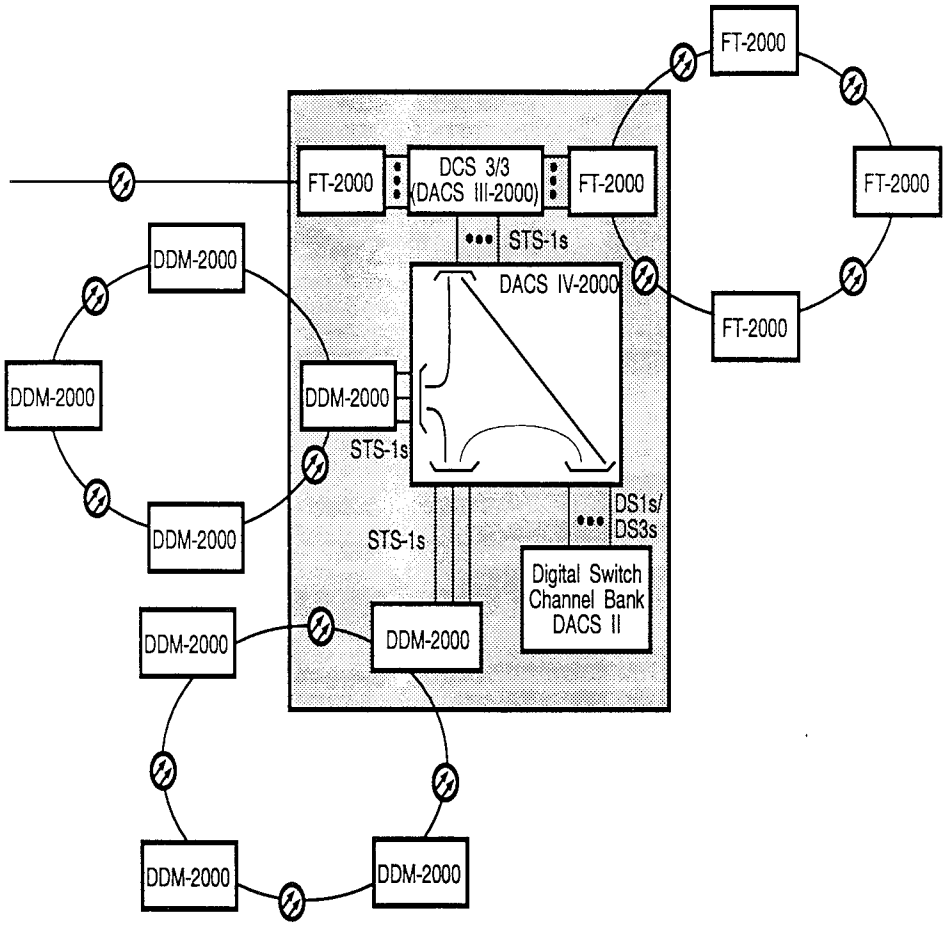


Figure 3-14. **DACS IV-2000 Ring Interworking**

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.

Two centralized control opportunities that use the DACS IV-2000 features and capabilities are network provisioning and network maintenance, which 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.

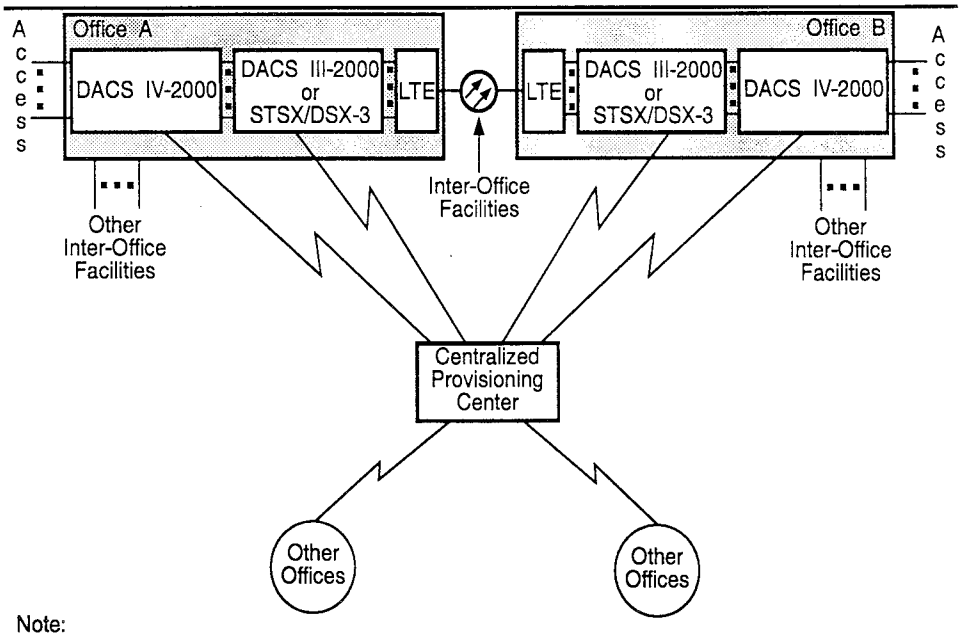


Figure 3-15. **DACS IV-2000 Centralized Provisioning**

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, as shown in Figure 3-16.

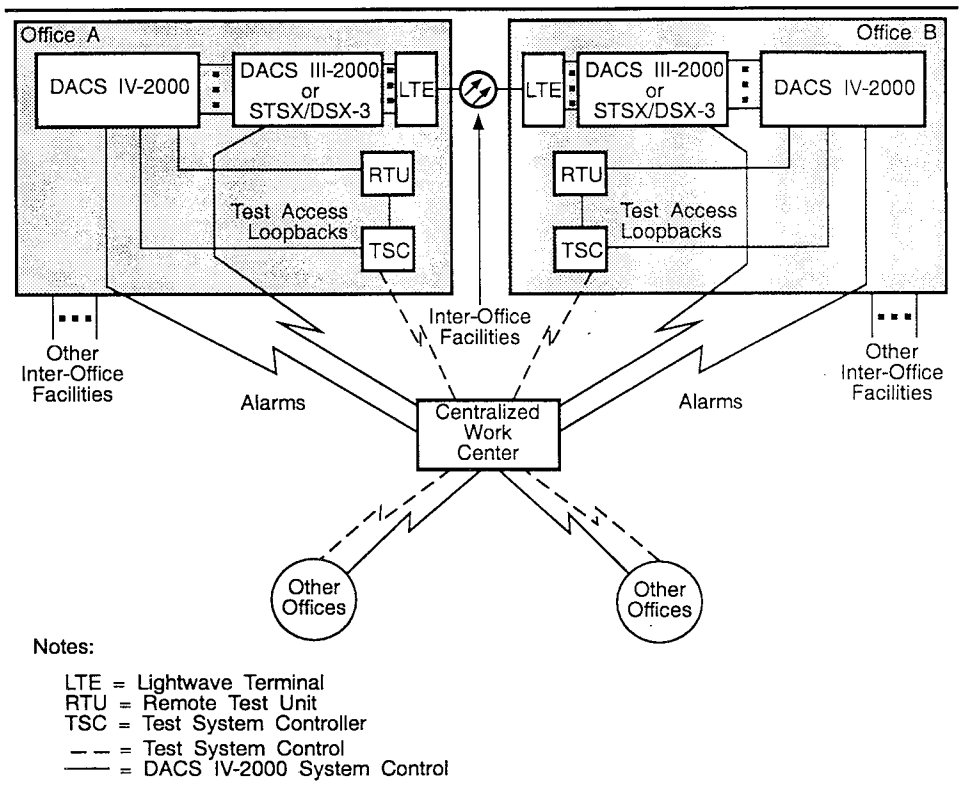


Figure 3-16. **DACS IV-2000 Centralized Maintenance**

When a centralized DS1 test system is also deployed, you can test any DS1 cross-connected in the DACS IV-2000 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 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 could be either a dedicated STS-1/DS3 facility through-connected in the office or, if the demand is large enough, a dedicated fiber route.

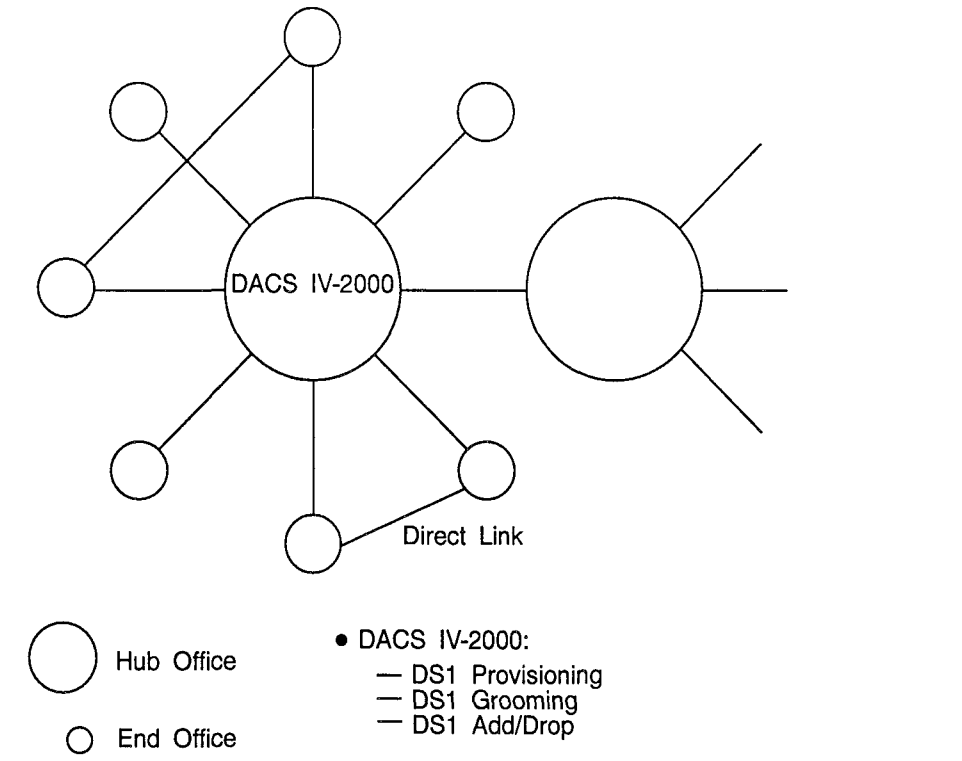


Figure 3-17. **DACS IV-2000 Hub Network Application**

DS1 Add/Drop

In addition to through-connected VT1.5s/DS1s on STS-1/DS3 facilities, there can be DS1s in the STS-1/DS3 facilities that 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-1 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 STS-1/DS3 facilities and the DS1-to-DS1 cross-connections within the office.

Use of the DACS IV-2000 for add/drop functions can result in significant savings in equipment and operating costs, floor space, 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.

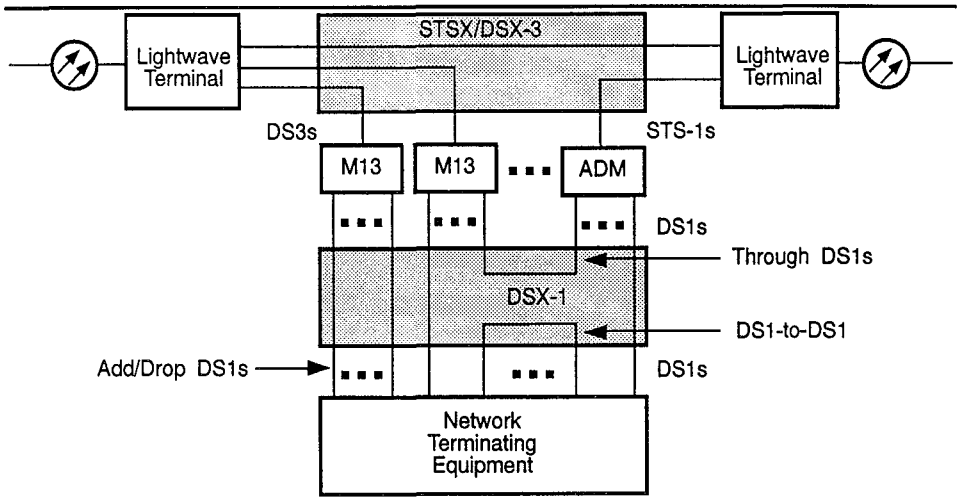


Figure 3-18. **DS1 Add/Drop with Multiplexers**

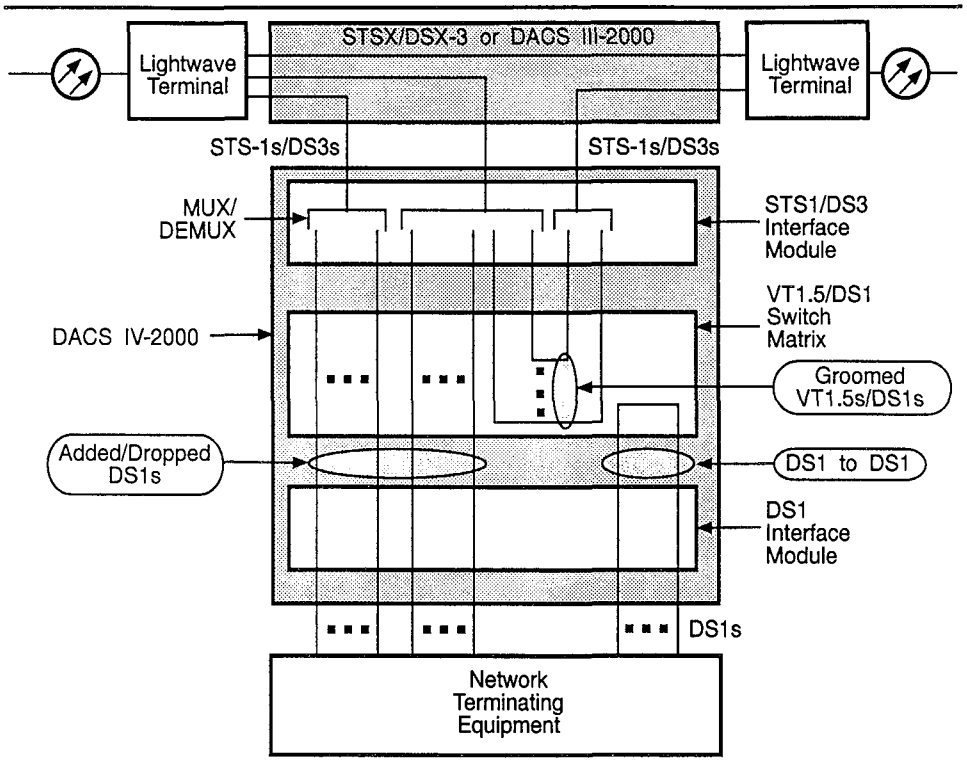


Figure 3-19. **DS1 Add/Drop with the DACS IV-2000**

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 STS-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 DS1 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 STS-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.

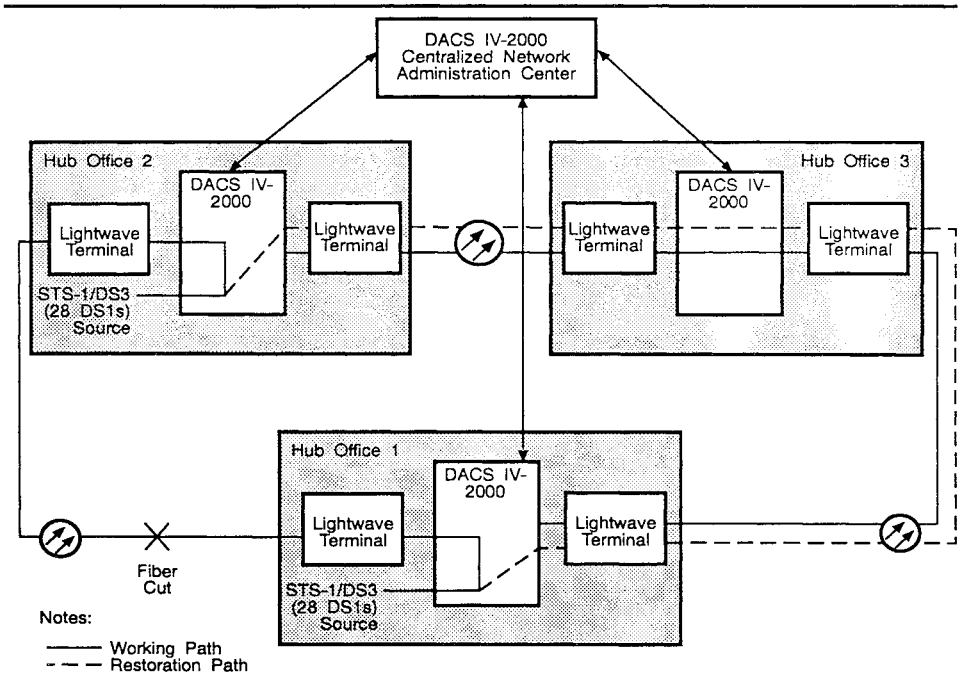


Figure 3-20. **Route Restoration with the DACS IV-2000**

With a 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 need to coordinate several technicians at different locations to restore service.

Total Network Application of DACS Products

Figure 3-21 shows a total network application of DACS products and the AT&T DACScan-2000 controller. The DACS II system 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.

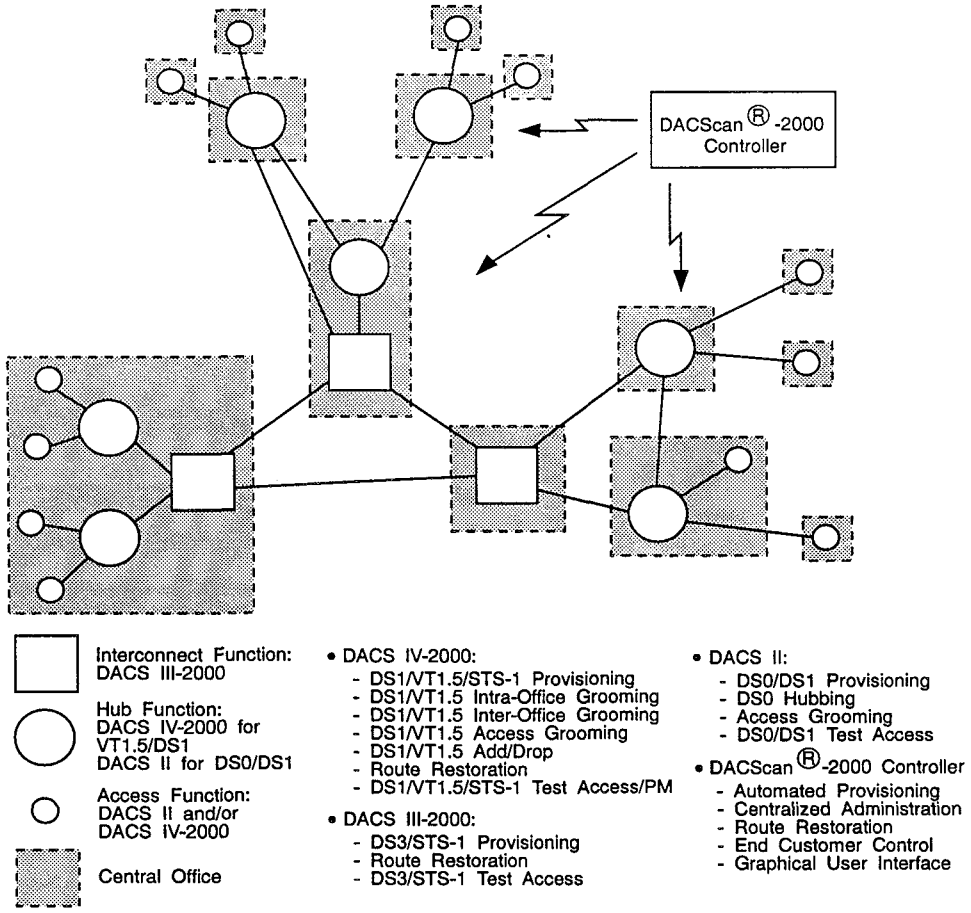


Figure 3-21. **DACS Products Total Network Application**

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 cutover 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.

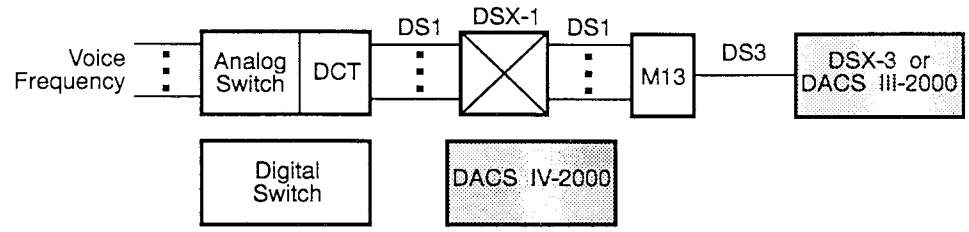
Simultaneously with the Voice Frequency (VF) side cut from the analog to the digital switch, commands are issued to roll the associated DS1s in the DACS IV-2000 to the new digital switch. Figure 3-22 (C) illustrates the final arrangement. The rolling of the associated DS1s is done over an administrative 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.

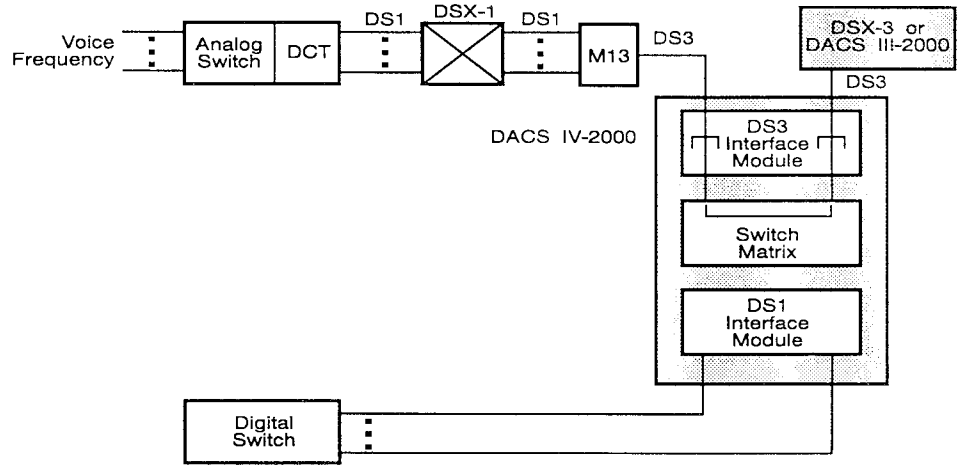
In addition to through-connecting the trunk side, the access side is through-connected in the DACS IV-2000, as shown in Figure 3-23 (B). This allows simplified board-to-board (office-to-office) testing of the new switch prior to the cutover with significant savings. The DACS IV-2000 is used to roll both the access and trunk sides. Figure 3-23 (B) also shows:

- 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
- The Main Distributing Frame and SLC-2000 Central Office Terminals have been replaced by a DACS II.

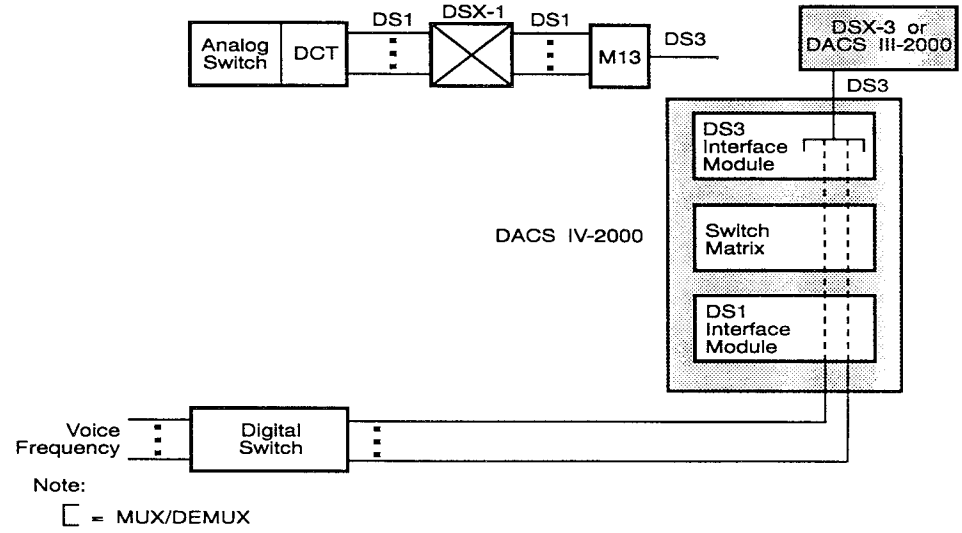
After the switch cutover is complete, the DACS IV-2000 can be used for other grooming and add/drop applications.



A. Initial Configuration

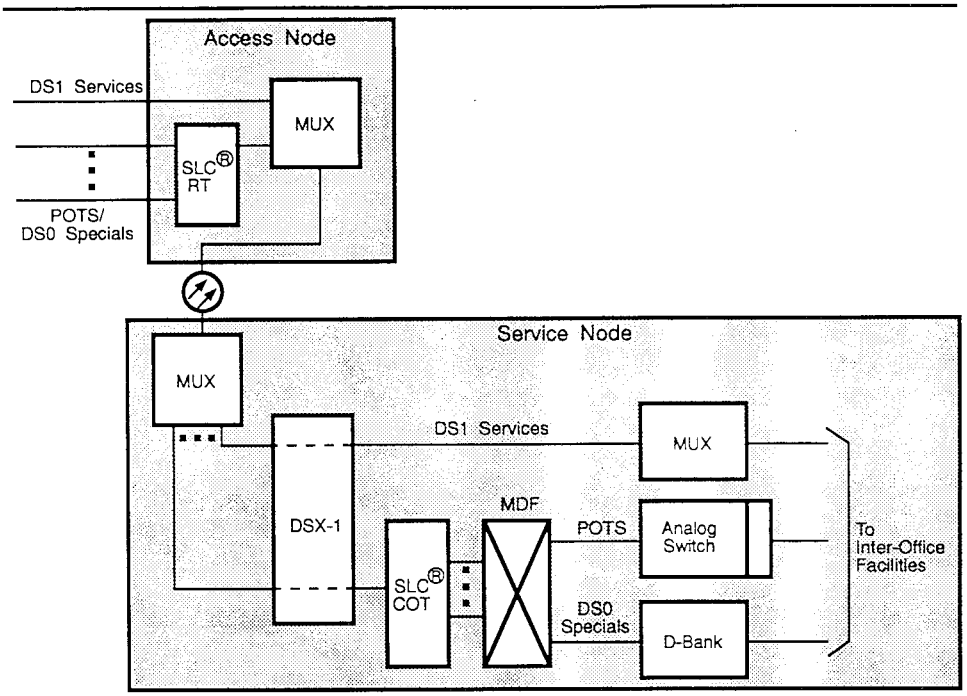


B. DS3s Through-Connected in the DACS IV-2000

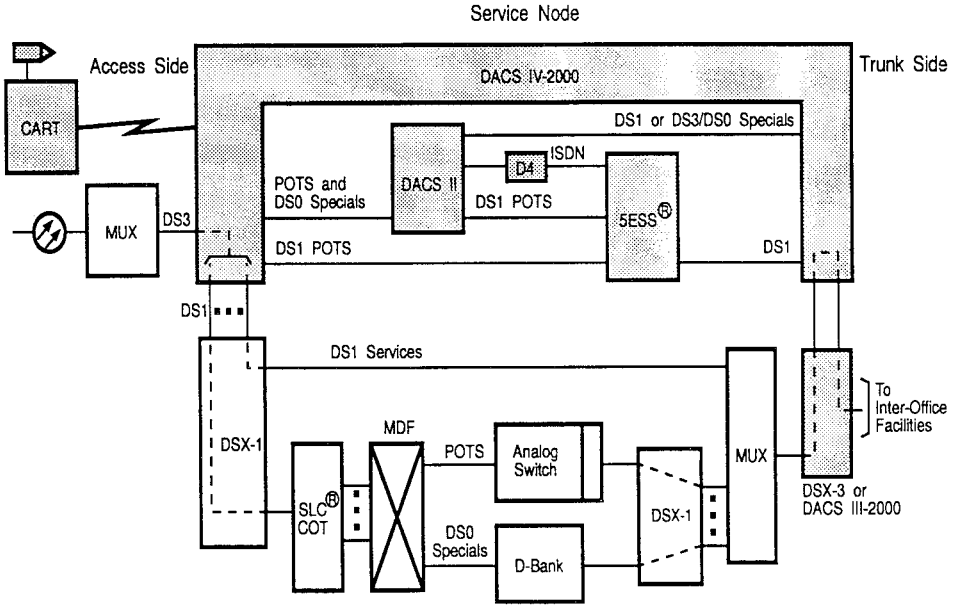


C. After Cutover

Figure 3-22. Digital Switch Trunk Side Cutover Assistance

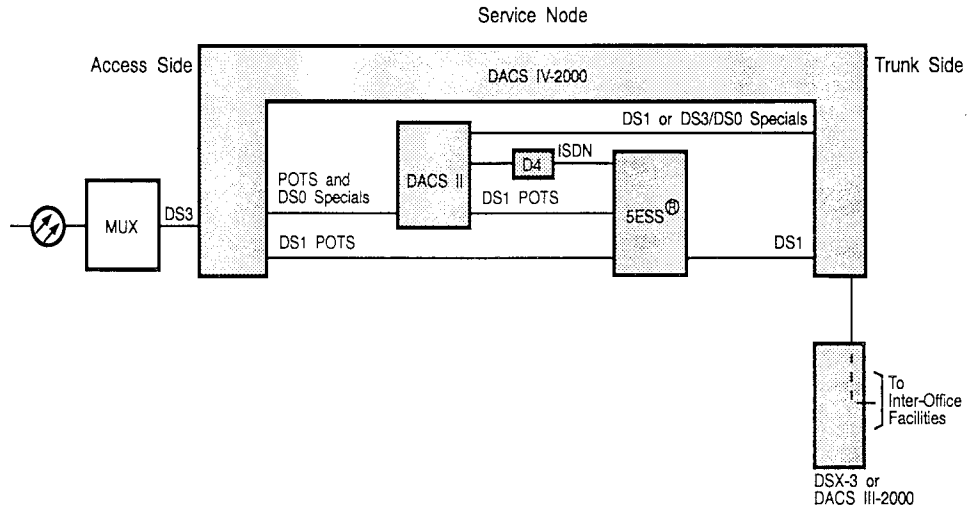


A. Initial Configuration



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

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

Contents

Contents

Ordering Information

4

The lists in this chapter provide order numbers and component information (grouped in sets for ordering convenience) and the quantity of each type of component required for various configurations.

Release 3.0 systems can be minimally upgraded to Release 5.0 by adding the Multiplexer 3 circuit packs and upgrading to Release 5.0 Software (see J98786SL-3). [There is no DACS IV-2000 (512) Release 4.0.] However, to take advantage of the capacity expansion and optical remoting features, you need to make additional changes.

Capacity Expansion and Optical Remoting

Note that with the optional capacity expansion and optical remoting features, circuit packs are replaced in either one or two DACS IV-2000 (256) systems and the (256) system(s) is connected to the (512) system, effectively becoming a Remote Complex of the (512) system. A DACS IV-2000 (256) system running pre-Release 3.0 software must be upgraded to Release 3.0 or 5.0 before it can be expanded to a DACS IV-2000 (512) Release 5.0 system. The switching functionality of the (256) system is performed in the (512) Switch Complex.

Configurations

New hardware configurations for the (512) system are listed under six separate J-drawings. Each drawing has the same J number (J98786), but with a different letter appended to each one. These six J-drawings are listed below:

- J98786A-1 Remote Complex

- J98786B-1 Switch Complex
- J98786C-1 STS1/DS3/DS1 Interface Bay
- J98786D-1 DS1 Interface Bay
- J98786F-1 Growth Fuse and Alarm Bay
- J98786S-1 STS1/DS3 Interface Bay.

Connector information is grouped under one ED number: ED-2C646-30 TTY Connector Adapters.

In addition, software information is listed under one J number: J98786SL-3 Release 5.0 Software.

NOTE:
To order a factory-built OPEX bay, please contact your AT&T account executive.

NOTE:
If you plan to use optional EMC enclosures, they must be ordered as part of the initial system order.

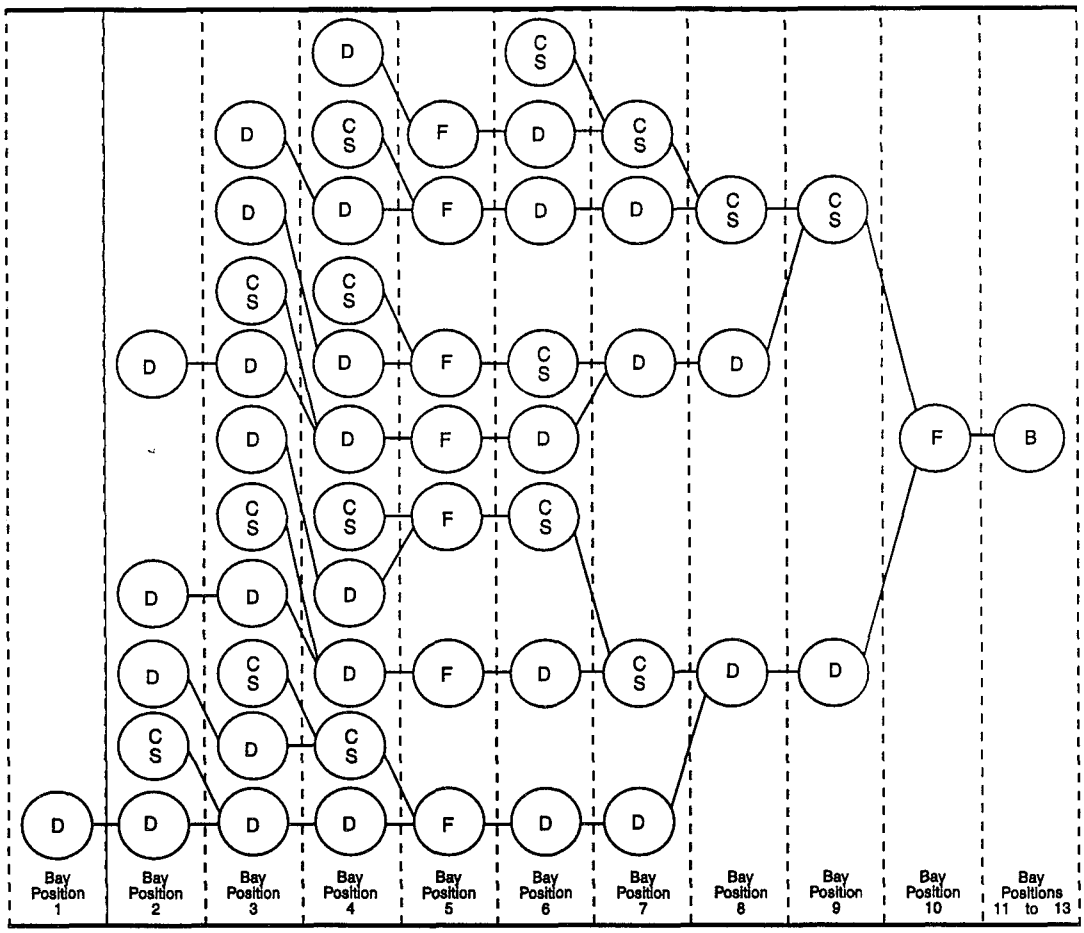
Bay Arrangements

Figure 4-1 shows the possible bay arrangements for collocated DACS IV-2000 (512) interface bays. 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 248/240 equivalent DS3/STS-1 lines be connected on either side of the Switch Complex. The Switch Complex (bay positions 10 through 14) must be filled first. Bays can then be added to the left, then to the right. A maximum of four STS1/DS3/DS1 Interface Bays, four DS3 Interface Bays or STS1/DS3 Interface Bays, or eight DS1 Interface Bays can be located on either side of the Switch Complex.

NOTE:
Though the DS3 Interface Bay has been rated Discontinued Availability (DA) for Release 5.0, this bay is still supported in existing systems.

Table 4-1 shows the circuit pack equipment associated with the DACS IV-2000 Switch Complex. Table 4-2 shows the circuit pack equipment associated with the DACS IV-2000 OPEX Bay. Table 4-3 shows the circuit pack equipment associated with the interface bays.

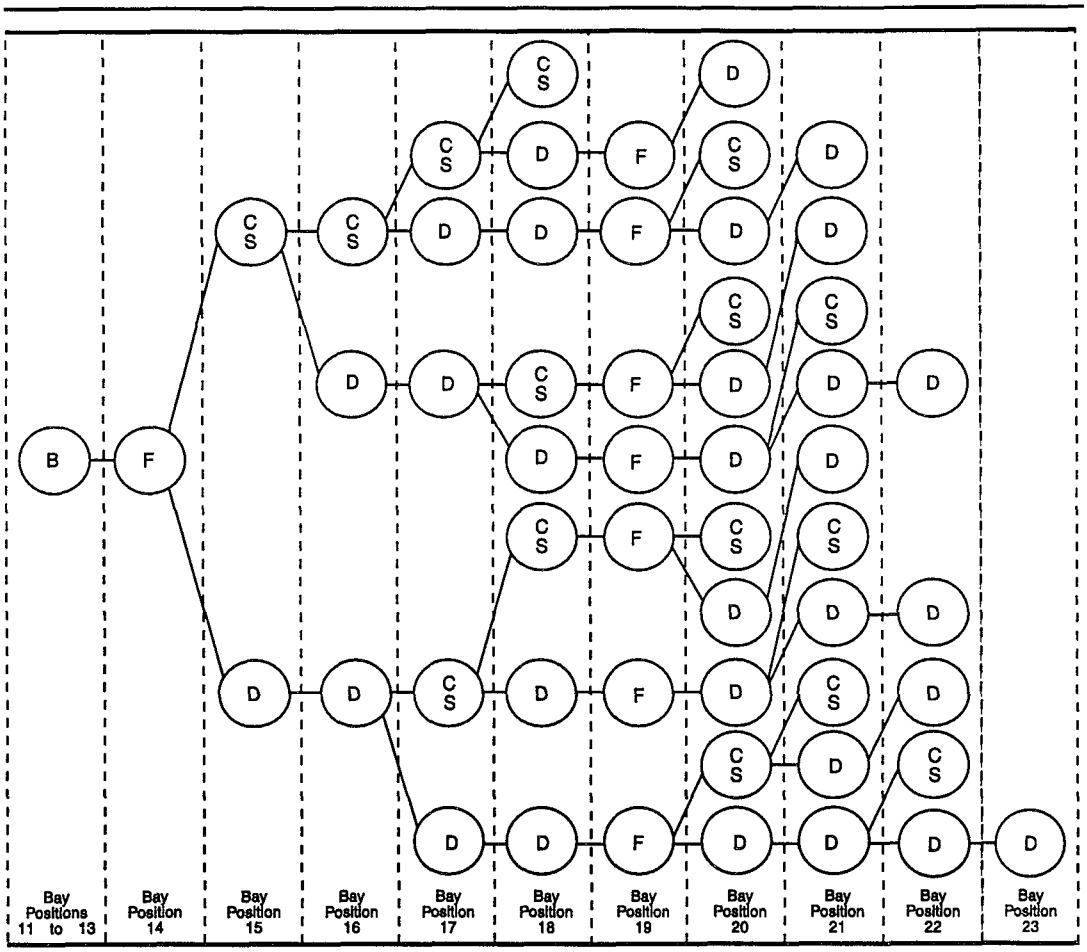
NOTE:
You do not need to order Growth Fuse and Alarm Bays for a system that includes one or two Remote Complexes. They are included in the OPEX Bay.



B - J98786B-1, Switch Complex (2 Switch Bays and 1 Main Controller Bay)
C - J98786C-1, STS1/DS3/DS1 Interface Bay (See Note)
D - J98786D-1, DS1 Interface Bay (See Note)
F - J98786F-1, Growth Fuse and Alarm Bay
S - J98786S-1, STS1/DS3 Interface Bay (See Note)

Note: The enhanced bay type, which provides the seismic bay framework, can be used in any interface bay position but is required if the bay is used for the first 124 equivalent DS3s of capacity on either side of the Switch Complex in order to accommodate the large cable bundle from the Switch Complex. The DS3 Interface Bay has been rated Discontinued Availability.

Figure 4-1. **Possible Bay Arrangements for the DACS IV-2000 (512) Collocated Interface Bays (Sheet 1 of 2)**



B - J98786B-1, Switch Complex (2 Switch Bays and 1 Main Controller Bay)
C - J98786C-1, STS1/DS3/DS1 Interface Bay (See Note)
D - J98786D-1, DS1 Interface Bay (See Note)
F - J98786F-1, Growth Fuse and Alarm Bay
S - J98786S-1, STS1/DS3 Interface Bay (See Note)

Note: The enhanced bay type, which provides the seismic bay framework, can be used in any interface bay position but is required if the bay is used for the first 124 equivalent DS3s of capacity on either side of the Switch Complex in order to accommodate the large cable bundle from the Switch Complex. The DS3 Interface Bay has been rated Discontinued Availability.

Figure 4-1. **Possible Bay Arrangements for the DACS IV-2000 (512) Collocated Interface Bays (Sheet 2 of 2)**

Table 4-1. Circuit Pack Equipment for the Switch Complex

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
AWS-type filler assembly	846960664	SYNC Mod	2	
Apparatus blank cover (SWIO slots)	847055563	SWIO Mod	As required	1
CLKGN4 (clock generator 4)	ERA6B	SWCS Mod	1 per module	2
CPU3 (central processing unit 3)	ERA2	HCC Mod	2	
DPLL2 (digital phase lock loop 2)	AWP15	SYNC Mod	2	3
DS1TX2 (DS1 timing extractor 2)	AWS9	SYNC Mod	2	3
ECI6 (enhanced communications interface 6)	ERA1B	HCC Mod	2	4
FBJ (fuse board J)	ERE2	MEM Mod	1	
FBK (fuse board K)	ERD1	SW PWR Mod	4	
FBL (fuse board L)	ERE3	MEM Mod	1	
FBM (fuse board M)	ERD2	SW PWR Mod	3	
MTC4 (maintenance interface 4)	ERA9	HCC Mod	4	5
OSWIO1 (optical switch input/output 1)	ERY1	SWIO Mod	0-16	6,7,8
OUI1 (optical unit interface 1)	ERT1	HCC Mod	2	9
PRI4 (primary off-line storage 4)	ERB2	MEM Mod	2	
PWRG (power G)	428AB	MEM Mod	2	
PWRJ (power J)	568A or 568B	SW PWR Mod	6 per module	10
SCI4 (switch communications interface 4)	ERA8	HCC Mod	4	
SEC4 (secondary off-line storage 4)	ERB3	MEM Mod	1	

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

Table 4-1. **Circuit Pack Equipment for the Switch Complex (Continued)**

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
SSC4 (secondary storage controller 4)	ERA7	HCC Mod	2	
STPNL2 (status panel 2)	ED-9C138-30,G2	HCC Mod	1	
SWCS3 (switch center stage 3)	ERA5	SWCS Mod	16	11
SWIO2 (switch input/ output 2)	ERA4	SWIO Mod	0-16	12,13
TBS32 (time base stratum 3 2)	AWS8	SYNC Mod	2	3
UI3 (unit interface 3)	ERA10	HCC Mod	2	14

Notes:

1. The blank apparatus covers (double width) are installed in the SWIO Module in place of SWIO (ERA4) or OSWIO (ERY1) circuit packs when the four SWIO Modules are not equipped with the full complement of 64 SWIO/OSWIO circuit packs.
2. Must use two identical CLKGN4 circuit packs (slots labeled CLKGN in the SWCS Modules).
3. Version 2 synchronizer circuit packs replace version 1 circuit packs for new systems. Existing systems can use either version circuit packs. Version 1 and 2 circuit packs can not be mixed within the same SYNC Module.
4. Two ECI6 circuit packs can exist; the administrative links associated with each circuit pack are 1-1 through 1-6 for ECI-1, and 2-1 through 2-6 for ECI-2.
5. Must use two identical MTC4 circuit packs (slots labeled MTC in the HCC Module).
6. No SWIO or OSWIO circuit packs can be contained in an SWIO Module provided at least one SWIO Module contains two SWIO or OSWIO circuit packs.
7. The SWIO, OSWIO, and OPEX circuit packs are installed in pairs. SWIO and OSWIO circuit packs can not be mixed within the same Switch Bay.
8. OSWIO circuit packs replace the SWIO circuit packs in the SWIO Modules of the Switch Bay associated with the equipped Remote Complex.
9. OUI1 circuit packs can be used in a collocated arrangement; however, UI3 circuit packs cannot be present if at least one Remote Complex is provisioned.
10. For systems with at least one Remote Complex, SW PWR Modules 1 and 3 must be equipped with eight new PWRJ (568B) circuit packs (that is, PWRJ-{1,3}-{1,2,5,6}). For systems with only collocated interfaces, SW PWR Modules 1 and 3 can have either version of PWRJ circuit packs (that is, 568A or 568B). SW PWR Module 2 can be equipped with either version of PWRJ circuit packs (that is, 568A or 568B).
11. Two identical SWCS Modules are required.
12. No SWIO circuit packs can be contained in an SWIO Module provided at least one SWIO Module contains two SWIO circuit packs.
13. The SWIO circuit packs are installed in pairs. SWIO and OSWIO circuit packs can not be mixed within the same Switch Bay.
14. UI3 circuit packs can not be present if at least one Remote Complex is provisioned.

Table 4-2. **Circuit Pack Equipment for the OPEX Bay**

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
Apparatus blank (RCI slots)	847640919	RUI Mod	0 or 2	
AWR-type filler assembly	846103760	OPEX Mod	As required	1
BXC1 (bus extender C 1)	AWP20	RUI Mod	1	
CLKGN3 (clock generator 3)	AWR11	OPEX Mod	1 (upper tier)	
FBA (fuse board A)	ED2C962-30	OPEX PWR Mod	1	
FBB (fuse board B)	ED2C960-30	OPEX PWR Mod	4	
FBC (fuse board C)	ED2C963-30	OPEX PWR Mod	1	
FBD (fuse board D)	ED2C961-30	OPEX PWR Mod	4	
FBF (fuse board F)	ED9C051-30	RUI PWR Mod	1	
FBG (fuse board G)	ED9C052-30	RUI PWR Mod	1	
FBH (fuse board H)	ED9C053-30	RUI PWR Mod	1	
FBI (fuse board I)	ED9C055-30	RUI PWR Mod	1	
OPEX1 (optical extension 1)	ERW3	OPEX Mod	2-32	2
PWRA (power A)	552A (standard) 566A (duplex)	OPEX PWR Mod	4	3
PWRF (power F)	427AA/427AB	RUI PWR Mod	2	
RCI1 (remote communications interface 1)	AWP19	RUI Mod	0 or 2	4
SCI3 (switch communications interface 3)	AWR2C	RUI Mod	1	
STPNL1 (status panel 1)	ED-9C049-30	RUI Mod	1	

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

Table 4-2. **Circuit Pack Equipment for the OPEX Bay (Continued)**

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
UIA1 (unit interface A 1)	ERW1	RUI Mod	1	
UIB1 (unit interface B 1)	ERW2	RUI Mod	1	

Notes:

1. The AWR-type filler assemblies are installed in the OPEX Module in place of OPEX (ERW3) circuit packs when the OPEX Module is not equipped with the full complement of 32 OPEX circuit packs.
2. The SWIO, OSWIO, and OPEX circuit packs are installed in pairs. SWIO and OSWIO circuit packs can not be mixed within the same Switch Bay.
3. PWRA (552A) circuit packs can only be used in OPEX Bays wired in the standard power configuration. PWRA (566A) circuit packs are required for OPEX Bays wired in the duplex power configurtion.
4. Two RCI1 circuit packs can exist; the administrative link associated with RCI-1 is 1-7 or 1-8 and the administrative link associated with RCI-2 is 2-7 or 2-8.

Table 4-3. **Circuit Pack Equipment for the Interface Bays**

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
Apparatus blank	847578663	DS3 INTFC-32 Top Shelf	1	1
BXA1 (bus extender 1)	AKM64	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3CC INTFC-16 Mod ENH DS3 INTFC-16 Mod STS1 INTFC-16 Mod	As required	2
CLKDR2 (clock distributor 2)	AKM90	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod DS3CC INTFC-16 Mod ENH DS3 INTFC-16 Mod STS1 INTFC-16 Mod	2 2 2 4 2 2 2	
DS1IF1 (DS1 interface 1)	AKM46B	DS1 INTFC Mod DS1 INTFC-P Mod	0-16 0-14	3,4,6 3,4,6
DS1IP1 (DS1 interface protection 1)	AKM47	DS1 INTFC-P Mod	2	

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

Table 4-3. **Circuit Pack Equipment for the Interface Bays (Continued)**

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
DS1RY1 (DS1 relay 1)	AKM48	DS1 INTFC Mod DS1 INTFC-P Mod	4	
DS3PM2 (DS3 performance monitor 2) [optional]	AKM89	DS3 INTFC-16 Mod DS3 INTFC-32 Mod	1	3,7
MUX2 (multiplexer 2)	AKM68B	DS3 INTFC-16 Mod DS3 INTFC-32 Mod ENH DS3 INTFC-16 Mod	1-15 1-31 0-15	3,5 3,5 3,5,8
MUX3 (multiplexer 3)	AKM91	ENH DS3 INTFC-16 Mod DS3CC INTFC-16 Mod	0-15 1-15	3,5,8 3,5
MUXP2 (multiplexer protection 2)	AKM70	DS3 INTFC-16 Mod DS3 INTFC-31 Mod ENH DS3 INTFC-16 Mod	1	5,9
MUXP3 (multiplexer protection 3)	AKM92	ENH DS3 INTFC-16 Mod DS3CC INTFC-16 Mod	1	5,9
MUXPS1 (multiplexer protection switch 1)	AKM53	DS3 INTFC-16 Mod DS3 INTFC-31 Mod ENH DS3 INTFC-16 Mod DS3CC INTFC-16 Mod STS1 INTFC-16 Mod	1	
PMGR1 (performance monitor generator/ receiver 1) [optional]	AKM66	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-32 Mod	0-8 0-7 0-14 0-16	10 10 10 10
PWRE3 (power E3)	556B/556C	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-31 Mod ENH DS3 INTFC-16 Mod DS3CC INTFC-16 Mod STS1 INTFC-16 Mod	2	
SMUX1 (SONET multiplexer 1)	AKM84	STS1 INTFC-16 Mod	1-15	3,5
SMUXP1 (SONET multiplexer protection 1)	AKM85	STS1 INTFC-16 Mod	1	5

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

Table 4-3. Circuit Pack Equipment for the Interface Bays (Continued)

Functional Name	Circuit Pack or Equipment Code	Used In	Number Required	See Note
SWIF2 (switch interface 2)	AKM50	DS1 INTFC Mod DS1 INTFC-P Mod	0-8 1-8	3,4,11 3,4,11
UC4/UC4B (unit controller 4/4B)	AKM88/AKM88B	DS1 INTFC Mod DS1 INTFC-P Mod DS3 INTFC-16 Mod DS3 INTFC-31 Mod ENH DS3 INTFC-16 Mod DS3CC INTFC-16 Mod STS1 INTFC-16 Mod	1	12

Notes:

1. Used to cover top tier of DS3 Interface-32 Module converted to an Enhanced DS3 Interface-16, DS3 Clear-Channel Interface-16, or STS1 Interface-16 Module.
2. The BXA1 circuit packs are installed in unused DS1IF, SWIF, MUX, DS3PM, and SMUX circuit pack slots. They must not be installed in any other circuit pack slots (that is, UC, CLKDR, DS1RY, MUXPS, PWRE, and protection [DS1IP, SWIF-P, MUXP, and SMUXP] circuit pack slots).
3. Unused DS1IF, SWIF (not protection), MUX, DS3PM, and SMUX circuit pack slots must contain BXA circuit packs.
4. One protection group and at least one service group of circuit packs within an interface bay must be installed.
5. One protection and at least one service circuit pack must be installed.
6. Must be installed in adjacent pairs.
7. DS3PM2 circuit packs can only be used in collocated DS3 Interface-16 or DS3 Interface-32 Modules. DS3PM2 circuit packs can not be used in Remote Complex interface modules or Enhanced DS3 Interface-16 and DS3 Clear-Channel Interface-16 Modules.
8. An Enhanced DS3 Interface-16 Module must contain at least one MUX2 or MUX3 circuit pack.
9. A MUXP3 circuit pack is required in a DS3 Interface Module that contains at least one MUX3 circuit pack.
10. PMGR circuit packs are installed in SWIF (not protection) or MUX circuit pack slots. PMGR circuit packs can not be installed in Enhanced DS3 Interface-16, DS3 Clear-Channel Interface-16, or STS1 Interface-16 Modules.
11. SWIF2 circuit packs are required for full-time DS1 performance monitoring of DS1 Interface Modules.
12. UC4 (AKM88) circuit packs are required for collocated interface modules. UC4B (ALM88B) circuit packs are required for Remote Complex interface modules.

(256) Switch Bay (J98786A-1)

See the *DACS IV-2000 (256) Release 5.0 Applications, Planning, and Ordering* guide (AT&T 365-340-804) for the lists associated with the (256) system. In addition, the following information must be considered when planning and ordering a system with capacity expansion or optical extension.

Lists 262, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 10, C, AF, 109

NOTE:
Transmission cable: Thirty-four (32 + 2 spare) 407476118 single-mode dual-fiber cables are required to connect one DACS IV-2000 (256) remote complex (RX) to the DACS IV-2000 (512) switch complex (OSWIO). The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) on the DACS IV-2000 (512) Switch Bay (1 or 2) and the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 20 feet must be the total cable length specified in the order (maximum length 1,000 feet).

NOTE:
Control cable: Two 407476092 multimode four-fiber ribbon cables are required to connect one DACS IV-2000 (256) remote complex (RX) to the DACS IV-2000 (512) Switch Complex Main Controller (MC) bay. The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) on the DACS IV-2000 (512) MC bay and the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 15 feet must be the total cable length specified in the order (maximum length 1,000 feet).

NOTE:
Remote communications interface cable: Two remote communications interface cables (ED-8C837-22,G1) are required to connect one DACS IV-2000 (256) Remote Complex (RX) to the DACS IV-2000 (512) Switch Complex Switch Bay 1 and Switch Bay 3. The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) between the DACS IV-2000 (512) Switch Bay 1 and Switch Bay 2 to the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 15 feet must be the length specified in the order (maximum length 1,000 feet).

NOTE:
Upgrade cable assembly: One 407449073 cable to connect the DACSlink module to the DACSmate PC or workstation via LAN connectors. The line engineer determines the distance between the bay cable entry point (top

for overhead cable system or bottom for raised floor) between the DAZCS IV-2000 (512) Switch Bay 1 and Switch Bay 3 to the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 15 feet must be the length specified in the order (maximum length 1,000 feet).

NOTE:

In the second DS1 interface shelf of a List 204 bay, or in the second, third or fourth DS1 interface shelf of a List 206 bay, List 271 must be equipped before the first List 231. For List 204 bays, one List F (DS1 front covers) must be provided if List 271 is not provided for each DS1 interface shelf not equipped with a List 271 (one List F per List 204 bay, and three List F per List 206 bay).

List 272 must be equipped before the 15th List 241. One List AF (DS3 front cover) must be provided if List 272 is not specified. List 42 or List C must be provided for each List 272 specified.

List 273 must be equipped before the first List 241. The second List 273 must be equipped before the 15th List 241. The third List 273 must be equipped before the 29th List 241. The fourth List 273 must be equipped before the 43rd List 241. One List AF (DS3 front cover) must be provided if List 273 is not specified. List 42 or List C must be provided for each List 273 specified.

List 42 or List C must be provided for each List 274 specified.

Upgrade Notes

To upgrade an existing R2.2 frame configuration per List 201 or List 204 to R3.0, the following hardware is required:

1. A redundant controller and synchronizer shelf assembly per List 62, 362, and 64 or a synchronizer unit per List 361 and 362 (if redundant controller previously provided).
2. An I/O bay with STS1 interface capabilities (List 305), or List 201 modified per List 341, 342, and 345 or 346, or List 204 modified per List 341, 342, and 345 or 346.
3. STS1/DS3 Interface-16 Modules equipped with 556C power units per List 257 (as required).
4. STS1/DS3 Interface-16 Modules equipped with common circuit packs per List 343 (as required).

To upgrade an existing R2.2 frame configuration per List 302 or List 305 to R3.0, the following hardware is required:

1. A synchronizer unit per List 361 and 362 (if synchronizer not previously provided).
2. SMUX circuit pack(s) for STS1 interfaces (List 341).
3. SMUXP circuit pack for protection (List 342).
4. Common circuit packs per List 343 (as required).

To upgrade an existing R2.2 frame configuration per List 201 or List 204 to R3.0, the following hardware is required:

1. A redundant controller and synchronizer shelf assembly per List 62, 364, and 64, or a synchronizer unit per List 36 and 364 (if redundant controller previously provided).
2. An I/O bay with STS1 interface capabilities (List 305), or List 201 modified per List 341, 342, and 345 or 346, or List 204 modified per List 341, 342, and 345 or 346.
3. STS1/DS3 Interface-16 Modules equipped with 556C power units per List 257 (as required).
4. STS1/DS3 Interface-16 Modules equipped with common circuit packs per List 343 (as required).

To upgrade an existing R2.2 frame configuration per List 302 or List 305 to R3.0, the following hardware is required:

1. A synchronizer unit per List 361 and 364 (if synchronizer not previously provided).
2. SMUX circuit pack(s) for STS1 interface (List 341).
3. SMUXP circuit pack for protection (List 342).
4. Common circuit packs per List 343 (as required).

When modifying an existing Redundant Controller shelf into a Remote Unit Interface (RUI) Module in the field, the power converter G (PWRG) slots must be unequipped and covered using the 847640893 panel assembly provided in List 264. The synchronizer shelf, if present, must be covered as required using the 847640901 panel assembly provided in List 264.

List 262

Circuit packs required in addition to List 201, 204, 302, or 305 or for field modification to provide interfacing for additional DS3 service signal for DACS IV-2000 (256) Release 5.0 and above features in a DS3 Interface-16 or STS1/DS3 Interface-16 Module only. Provides DS3 clear-channel cross-connection, full-time DS1 performance monitoring, and support of unframed DS3.

Maximum: Fifty-six List 259 per List 302 or 305. Fourteen List 262 per List 201 or 204.

List 264

Equipment required for field modification of a (256) Switch Bay equipped with a Redundant Controller per List 60 through List 64 or 363 to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

Maximum: One List 264 per Remote Complex.

NOTE:

The length of the interframe transmission, control, and remote communications interface cables must be specified by the line engineer. The following rules are used to determine the overall length of the cables:

- Transmission cable: Thirty-four (32 +2 spare), 407476118 AMP, or 407476100 (Gore Assoc.) single-mode dual-fiber patch cables are required to connect one DACS IV-2000 (256) Remote Complex (RX) to the DACS IV-2000 (512) Switch Complex (OSWIO). The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) on the DACS IV-2000 (512) Switch Bay (1 or 2) and the DACS IV-2000 (256) Remote Complex (1 or 2) OPEX Bay. This distance plus 24 feet must be the total cable length specified in the order (maximum length 1,000 feet).
- Control cable: Two 407476092 multimode 4-fiber ribbon cables are required to connect one DACS IV-2000 (256) Remote Complex (RX) to the DACS IV-2000 (512) Switch Complex Main Controller (MC) Bay. The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) on the DACS IV-2000 (512) MC Bay and the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 15 feet must be the total cable length specified in the order (maximum length 1,000 feet).
- Remote communications interface cable: Two remote communications interface cables ED-8C837-22, G1, are required to connect one DACS IV-2000 (256) Remote Complex (RX) to the DACS IV-2000 (512) Switch Complex Switch Bay 1 and Switch Bay 2. The line engineer determines the distance between the bay cable entry point (top for overhead cable system or bottom for raised floor) between the DACS IV-2000 (512) Switch Bay 1 and Switch Bay 2 to the DACS IV-2000 (256) RX (1 or 2) OPEX Bay. This distance plus 20 feet must be the length specified in the order (maximum length 1,000 feet). Add 1 upgrade cable DACS to DACSmate, 407449073. Distance between bays plus 15 feet.

(1) 847578119	Filler Panel Assembly
(1) 847634417	Panel Assembly
(1) 847634425	Panel Assembly
(1) 847640893	Panel Assembly
(1) 847640901	Panel Assembly
(1) 847680774	Cable Organizer
(2) 847672929	Cable Organizer
(1) 847586534	Panel Assembly
(2) 847578200	Cover Cable Assembly
(1) 847623709	Cover Cable Assembly
(1) 847577962	Channel Assembly
(1) 847577970	Right Cable Duct Channel Assembly
(2) 847577939	Cable Duct Channel Assembly

(1) 847577905	Rail Guard
(1) 847577988	Left Front Stile Cover Assembly
(1) 847577996	Right Front Stile Cover Assembly
(2) 847586567	Designation Label
(1) 847591971	Designation Label
(1) 847586575	Designation Label
(1) 847586583	Designation Label
(1) 847591989	Designation Label
(1) 847586559	Designation Label
(1) 847608973	Retaining Clip
(1) 847570538	Designation Label
(1) 847592540	Designation Label
(1) 847608965	Designation Label
(1) 847586666	Designation Label
(1) 847586674	Designation Label
(1) 847588019	Designation Label
(1) 847588027	Designation Label
(1) 847634524	Mounting Designation Label
(1) 847634532	Mounting Designation Label
(1) 847634540	Mounting Designation Label
(1) 847626934	Mounting Designation Label
(1) 847626942	Mounting Designation Label
(1) 847626959	Mounting Designation Label
(1) 847626967	Mounting Designation Label
(1) 847648250	Designation Label

List 265

Remote Unit Interface Module circuit packs required for field modification to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

(1) AWP20	BXC (bus extender C)
(1) ERW1	UIA (unit interface A)
(1) ERW2	UIB (unit interface B)

List 266

Circuit packs required for field modification of existing DS1 or DS3 Interface-16/STS1 Interface-16 I/O Modules to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

Maximum: One List 266 per DS1 or DS3 Interface-16/STS1 Interface-16 I/O Module.

(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributer 2)

List 267

Circuit packs required for field modification of existing DS3 Interface-32 I/O Modules to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

Maximum: One List 267 per DS3 Interface-32 I/O Module.

(1) AKM88B	UC4 (unit controller 4)
(4) AKM90	CLKDR2 (clock distributer 2)

List 268

Circuit packs required in addition to List 204 to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

(2) AKM88B	UC4 (unit controller 4)
(4) AKM90	CLKDR2 (clock distributer 2)
(4) ERW3	OPEX (optical extender)
(4) ERY1	OSWIO (optical switch input/output)

List 269

Circuit packs required in addition to List 206 to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributer 2)
(2) ERW3	OPEX (optical extender)
(2) ERY1	OSWIO (optical switch input/output)

List 270

Circuit packs required in addition to List 305 to provide DACS IV-2000 (512) Release 5.0 optical remoting and/or capacity expansion capability to a (512) Switch Complex.

(2) ERW3	OPEX (optical extender)
(2) ERY1	OSWIO (optical switch input/output)

List 271

Circuit packs required in addition to List 204 or 206 to provide DACS IV-2000 (512) Release 5.0 optical remote switching for the first 28 DS1 service signals in an unequipped DS1 Interface Module. Do not order with List 230.

Maximum: Three List 271 per List 206. One List 271 per List 204.

(2) AKM46B	DS1IF1 (DS1 interface 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(1) AKM50	SWIF2 (switch input/output 2)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributer 2)
(2) 556C	PWRE3 (power E3)

NOTE:
In the second DS1 Interface shelf of a List 204 bay, or in the second, third, or fourth DS1 Interface shelf of a List 206 bay, List 271 must be equipped before the first List 231. For List 204 bays, one List F (DS1 front covers) must be provided if List 271 is not specified. For List 206 bays, one List F must be provided for each DS1 Interface shelf not equipped with a List 271.

List 272

Circuit packs required in addition to List 204 to provide DACS IV-2000 (512) Release 5.0 optical remote switching for the first DS3 service signal in an unequipped DS3 Interface-32 Module. Do not order with List 240.

Maximum: One List 272 per List 204.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(1) AKM88B	UC4 (unit controller 4)
(4) AKM90	CLKDR2 (clock distributer 2)
(2) 556C	PWRE3 (power E3)

NOTE:
List 272 must be equipped before the fifteenth List 241. One List AF (DS3 front cover) must be provided if List 272 is not specified. List 42 or List C must be provided for each List 272 specified.

List 273

Circuit packs required in addition to List 305 to provide DACS IV-2000 (512) Release 5.0 optical remote switching for the first DS3 service signal in an unequipped STS1/DS3 Interface-16 Shelf. Do not order with List 243.

Maximum: Four List 273 per List 305.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(2) AKM90	CLKDR2 (clock distributer 2)
(1) AKM88B	UC4 (unit controller 4)
(2) 556C	PWRE3 (power E3)

NOTE:
List 272 must be equipped before the first list 241. The second List 272 must be equipped before the 15th List 241. The third List 272 must be equipped before the 29th List 241. The fourth List 272 must be equipped before the 43rd List 241. One List AF (DS3 front cover) must be provided if List 273 is not specified. List 42 or List C must be provided for each List 273 specified.

List 274

Circuit packs required in addition to List 305 to provide DACS IV-2000 (512) Release 5.0 optical remote switching for the first STS1 service signal in an unequipped STS1/DS3 Interface-16 Module. Do not order with List 343.

Maximum: Four List 274 per List 305.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM84	SMUX1 (SONET multiplexer 1)
(1) AKM85	SMUXP1 (SONET multiplexer protection 1)
(2) AKM90	CLKDR2 (clock distributer 2)
(1) AKM88B	UC4 (unit controller 4)
(2) 556C	PWRE3 (power E3)

NOTE:
List 42 or List C must be provided for each List 274 specified.

List 275

Equipment and circuit packs required for field upgrade of a List 201 or 204 DS3 Interface-32 Module unequipped with DS3 service to an STS1/DS3 Interface-16 Shelf with Release 5.0 optical remoting and/or capacity expansion capability. Do not order with List 346

(1) 846519528	Assembly, chassis cover
(1) 846519536	Assembly, chassis cover
(1) 846138337	Assembly, small apparatus blank
(1) 847578663	Assembly, panel
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)

List 276

Circuit packs required in addition to List 204, 206, or 305, or for field modification to provide DACS IV-2000 (512) Release 5.0 optical remote switching for an additional 16 DS3 service signals. Provides two OSWIO circuit packs (OPEX1 and OPEX2). Do not order with List 20.

Maximum: One List 276 per List 206. Two List 276 per List 204.

(2) ERW3	OPEX (optical extender)
(2) ERY1	OSWIO (optical switch input/output)

List 277

Equipment required in addition to List 22 or for field upgrade to provide a retaining clip for DACS IV-2000 (512) Release 5.0 remoting applications.

Maximum: Three List 271 per List 206.

(1) 847608973	Retaining Clip

List 278

Circuit pack required for field modification to provide DACS IV-2000 Release 5.0 with Remote Communications Link.

(2) AWP19	RCI (remote communications interface)

List 279

Equipment required when List 278 is not required.

(2) 847640919 Apparatus Filler Blanks

List 10

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

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, 204, 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, or 204.
Four List F per List 302 or 305.

(1) 847038791 DS3 Interface Module Front Cover

List 109

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

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

(512) Switch Complex (J98786B-1)

Lists 1, 2, 3, 4, 5, 9, 10, 11, 13, 19, 21, 22, 23, 24, 31, 40, 41, 42, 43, 44, 50, 100, 101, A, B, C, F

Framework, assembly, wiring and equipment for one DACS IV-2000 (512) switch and high-capacity controller with a switch capacity of 512 DS3 equivalents and interface capacity of up to 496 working DS3 equivalents. (List 19 or 42 must be ordered in conjunction with List 1 to provide the required circuit packs.)

List 1

(1) ED-9C192-30,G1	Assembly, Switch Complex Bays
(1) ED-9C195-30,G1	Assembly, Fuse and Alarm Bay (left)
(1) ED-9C195-30,G2	Assembly, Fuse and Alarm Bay (right)

Maximum: One List 1 per frame.

List 2

Equipment required to provide an optional EMC enclosure. List 2 must be ordered with List 1.

List 3

Framework, assembly, wiring, and equipment for one DACS IV-2000 (512) Switch Complex equipped with remoting or collocating options and having a switch capacity of 512 DS3 equivalents and an interface capacity of up to 496 working equivalents.

(1) ED-9C192-30,G3	Switch Bay Complex Assembly
(1) 406923292	Removal Tool
(1) 406935346	Cleaning Brush
(1) 406942102	Cleaning Kit
(1) 407097534	Mounting Plate Support
(4) 845633106	U-Channel Clip
(3) 846166494	Label, ESD
(16) 846169654	Front Stile Bracket Assembly
(8) 846855781	Caution Label, ESD
(1) 847143906	Channel Support, Long
(1) 847161619	Panel, Rear (bottom)
(1) 847161635	Panel, Rear (MC top)
(4) 847133550	Assembly, Support
(1) 847269016	Angle, Support Assembly (long)
(2) 847468162	Assembly, Upright
(3) 847468303	Panel, Cable Protection
(1) 847475274	Cable Bracket
(2) 847475282	Switch Protection Cover

List 4

Wiring and equipment required in addition to List 3 to provide a collocated (256) DS3 Interface to the left of the Switch Complex.

(1) ED-9C192-30,G4	Switch Bay Complex Assembly
(2) 846166494	Label, ESD
(1) 847113651	Designation Label
(1) 847161619	Panel, Rear (bottom)
(2) 847161643	Panel, Rear (switch top)
(1) 847466042	Clamp, Stile Strip
(1) 847468303	Panel, Cable Protection
(1) 847468311	Panel, Cable Protection
(1) 847468337	Assembly, Stile Strip

List 5

Wiring and equipment required in addition to List 3 to provide a collocated (256) DS3 Interface to the right of the Switch Complex.

(1) ED-9C192-30,G5	Switch Bay Complex Assembly
(2) 847161643	Panel, Rear (switch top)
(2) 846166494	Label, ESD
(1) 847113651	Designation Label
(1) 847161619	Panel, Rear (bottom)
(1) 847466042	Clamp, Stile Strip
(1) 847468303	Panel, Cable Protection
(1) 847468311	Panel, Cable Protection
(1) 847468329	Assembly, Stile Strip

List 9

Equipment and wiring required to provide one high-performance fan assembly retrofit with power filtering and autonomous power alarm reset features.

(1) ED-9C130-30,G7	Fan Assembly

List 10

Apparatus required to provide one high-performance fan assembly retrofit kit to support the autonomous power alarm reset feature.

(1) ED-9C130-30,G9	Fan Assembly

List 11

Cover assembly required in addition to List 4.

(1) 847468212	Panel, Rear (top)
(1) 847468238	Panel, Rear (bottom)
(1) 847468295	Assembly, Bottom Cover
(1) 847310687	Assembly, Cover Plate
(1) 847468113	Assembly, Upright

List 13

Cover assembly required in addition to List 5.

(1) 847468220	Panel, Rear (top)
(1) 847468268	Panel, Rear (bottom)
(1) 847468287	Assembly, Bottom Cover
(1) 847310679	Assembly, Cover Plate
(1) 847468105	Assembly, Upright

List 19

Common circuit packs for use in the Switch Complex. List 19 is only orderable with List 1.

(2) ERA1	ECI6
(2) ERA2	CPU3
(32) ERA5	SWCS3
(2) ERA6	CLKGN4
(2) ERA7	SSC4
(4) ERA8	SCI4
(4) ERA9	MTC4
(2) ERA10	UI3
(2) ERB2	PRI4 (primary)
(1) ERB3	SEC4 (secondary)
(12) ERD1	FBK (fuse board)
(9) ERD2	FBM (fuse board)
(1) ERE2	FBJ (fuse board)
(1) ERE3	FBL (fuse board)
(2) 428AB	PWRG (power unit)
(18) 568A	PWRJ (power unit)
(2) 70B	2A Fuse
(26) 70G	0.5A Fuse
(8) KS-19780L2	10A Fuse
(18) KS-19780L4	20A Fuse
(10) KS-23543L77E	Indicating Fuse
(27) KS-23543L77H	Indicating Fuse
(131) KS-23543L77J	7.5A Fuse
(3) KS-23543L78E	Indicating Fuse
(123) KS-23543L78H	Indicating Fuse
(32) 847055563	Removable Blank Panel

NOTE:
List A is always required in addition to List 19 to replace two ERA6s (CLKGN4) with two ERA6Bs (CLKGN4).

List 21

Circuit packs required for field modification or factory-installed systems to provide Synchronizer Module 1 to support STS1 interfaces.

(2) AWP9B	DPLL1 (Digital Phase-Lock Loop1)
(2) AWS3	TBS31 (Time Base 1)
(2) AWS5	DS1TX1 (DS1 Timing Extractor 1)
(2) 846960664	AWS-type Filler Assembly

NOTE:
For SONET Interface, system must have two ERA6B (CLKGN4) if not already present.

List 22

Apparatus and wiring required in addition to List 19 and List B to provide optional 1200-baud Link Interface.

(2) 104371547	Retainer
(2) 847428869	Terminal Designation
(2) 847428877	Jumper Assemblies

List 23

Apparatus, wiring, and circuit packs required in addition to List 19 and List B to provide optional 1200-baud Link Interface.

(2) 104371547	Retainer
(2) 847428869	Terminal Designation
(2) 84742887	Jumper Assemblies
(2) ERA1B	ECI6

List 24

Circuit packs required for field modification or factory-installed systems to provide Synchronizer Module 2 to support STS1 interfaces.

(2) AWP15	DPLL2 (Digital Phase-Lock Loop 2)
(2) AWS8	TBS32 (Time Base 2)
(2) AWS9	DS1TX2 (DS1 Timing Extractor 2)
(2) 846960664	AWS-type Filler Assembly

List 31

Blank cover required when SWIO circuit pack pairs are not provided. List 31 is only orderable with List 1.

Maximum: 32 per List 1.

(1) 847055563 Removable Blank Cover

NOTE:
If SWIO circuit packs are included in the order, the number of List 31 covers is reduced. Each cover occupies two SWIO positions.

List 40

Equipment required for field modification of the Switch Complex to support the first Release 5.0 Optical Remote Bay.

Maximum: One List 40 per Switch Complex.

(1) 847592029 Label (top)
(2) 847591245 Label (controller)
(1) 847591252 Label (OSWIO)
(3) 847623741 Cable Organizer
(3) 847578168 Cable Assembly
(2) 847578028 Left cable duct channel Assembly
(2) 847578036 Right cable duct channel Assembly
(1) 847578044 Left Front Stile Cover Assembly
(1) 847578069 Left Front Stile Cover Assembly
(2) 847577897 Rail Guard
(1) 847578051 Right Front Stile Cover Assembly
(1) 847578077 Right Front Stile Cover Assembly

List 41

Equipment required for field modification of the Switch Complex to support the second Release 5.0 Optical Remote Bay.

Maximum: One List 41 per Switch Complex.

(2) 847591245	Label (controller)
(1) 847591252	Label (OSWIO)
(2) 847623741	Cable Organizer
(2) 847578168	Cable Assembly
(1) 847578028	Left Cable Duct Channel Assembly
(1) 847578036	Right Cable Duct Channel Assembly
(1) 847578069	Left Front Stile Cover Assembly
(1) 847577897	Rail Guard
(1) 847578077	Right Front Stile Cover Assembly

List 42

Circuit packs required in addition to List 3 to provide Release 5.0 optical remoting and/or capacity expansion.

Maximum: One List 42 per (512) frame.

(12) ERD1	FBK
(9) ERD2	FBM
(1) ERE2	FBJ
(1) ERE3	FBL
(2) ERB2	PRI4
(1) ERB3	SEC4
(2) ERA1B	ECI6
(2) ERA7	SSC4
(2) ERA2	CPU3
(4) ERA8	SCI4
(4) ERA9	MTC4
(32) ERA5	SWCS3
(2) ERA6B	CLKGN4
(2) ERT1	OUI
(10) 568A	PWRJ (power J)
(8) 568B	PWRJ (power J)
(2) 428AB	PWRG (power G)
(26) 70G	0.5A Fuse
(2) 70B	2A Fuse
(131) KS-23543L77J	7.5 Fuse
(27) KS-23543L77H	Indicating Fuse
(10) KS-23543L77E	Indicating Fuse
(123) KS-23543278H	Indicating Fuse
(3) KS-23543L78E	Indicating Fuse
(8) KS-19780L2	10A Fuse
(18) KS-19780L4	20A Fuse

List 43

Circuit packs required for field modification to provide Release 5.0 optical remoting and/or capacity expansion.

Maximum: One List 43 per (512) frame.

(2) ERT1	OUI
(8) 568B	PWRJ (power J)

List 44

Equipment required in addition to List 31 or for field upgrade to provide a retaining clip for Release 5.0 remoting applications.

Maximum: One List 44 per (512) frame.

(1) 847608973	Retaining Clip

List 50

Equipment required in addition to List 1 for retrofit of LAN (0, 1) Connector Interface.

(2) ED-9C129-30,G2	LAN Interface Adapter
(4) 840059836	Pan Head Screws
(1) 847335593	Designation Label Kit

List 100

Equipment required in addition to List 1 to provide TTY connector adapters for use when connecting to a modem (less than 50 feet). List 100 is only orderable with List 1.

(1) ED-2C646-30,G1	PWB Assembly, TTY Connector Adapters

List 101

Equipment required in addition to List 1 to provide TTY connector adapters for use when connecting to a modem (less than 50 feet) and when an accurate Clear-to-Send (CTS) signal loss is required.

(1) ED-2C646-30,G13	Power Assembly, TTY Connector Adapters

List A

List A is always required in addition to List 19 to replace two ERA6s (CLKGN4) with two ERA6Bs (CLKGN4). List A is only orderable with List 19.

(2) ERA6B	CLKGN4 (Clock Generator 4)

List B

Always required in addition to List 19 to replace two ERA1s with two ERA1Bs.

(2) ERA1B	ECI6 (Enhanced Communications Interface 6)
(2) ERA2	CPU3
(32) ERA5	SWCS3
(2) ERA6	CLKGN4
(2) ERA7	SSC4
(4) ERA8	SCI4
(4) ERA9	MTC4
(2) ERB2	PRI4 (primary)
(1) ERB3	SEC4 (secondary)
(12) ERD1	FBK (fuse board)
(9) ERD2	FBM (fuse board)
(1) ERE2	FBJ (fuse board)
(1) ERE3	FBL (fuse board)
(2) ERT1	OUI
(2) 428AB	PWRG (power G)
(10) 568A	PWRJ (power J)
(8) 568B	PWRJ (power J)
(2) 70B	2A Fuse
(26) 70G	0.5A Fuse
(8) KS-19780L2	10A Fuse
(18) KS-19780L4	20A Fuse
(10) KS-23543L77E	Indicating Fuse
(27) KS-23543L77H	Indicating Fuse
(131) KS-23543L77J	7.5A Fuse
(3) KS-23543L78E	Indicating Fuse
(123) KS-23543L78H	Indicating Fuse

List C

Equipment always required in addition to List 1.

(1) ED-9C192-30,GA	Switch Complex Bay Assembly

List F

Equipment required in addition to List 1 for LAN (0, 1) Connector Interface. List F is always required for factory-built systems.

(2) ED-9C192-30,GD	LAN Interface Adapter
(4) 840059836	Pan Head Screws
(1) 847335593	Designation Label Kit

STS1/DS3/DS1 Interface Bay (J98786C-1)

Lists 1, 2, 3, 4, 5, 9, 10, 11, 20, 50, 229, 230, 231, 239, 240, 241, 245, 249, 261, 262, 341, 342, 345, 346, 349, A, B

Framework, assembly, wiring, and equipment for one STS1/DS3/DS1 Interface Bay providing for up 420 DS1 service channels and either 46 DS3 service channels or 31 DS3 service channels and 15 STS-1 service channels. Lists 229 and 239, 249, or 349 must be ordered in conjunction with List 1 to provide the required circuit packs for DS1, DS3, and STS-1 interfaces, respectively.

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 261 and/or List 262 is required.

If the lower DS3 Interface-16 Module is to be used as an STS1 Interface-16 Module, List 349 is also required.

This bay can be ordered in conjunction with the J98786B-1 Switch Complex for initial DS3, DS1, and STS-1 service, or separately if ordering for growth arrangement. Circuit packs required for each interface bay are listed on their respective J-drawings.

List 1

Maximum: One List 1 per frame.

(1) ED-2C934-30,G7	Initial Bay Framework
(1) ED-93090-20,G1	Cable Assembly
(4) ERA4	SWIO2 (switch input/output 2)
(1) ED-2C963-30,G1	FBC (fuse board C)
(10) 70G	0.5A Fuse
(3) KS-19780,L2	10A Fuse
(9) KS-19780,L8	12A Fuse

List 2

Equipment required to provide an optional EMI enclosure. This must be ordered at the same time as List 1. This list also includes the BNC interconnect panel.

(1) ED-2C934-30,G8	Framework, STS1/DS3/DS1 Interface Bay

List 3

Equipment that provides for a BNC interconnect panel if List 2 is not ordered.

(1) ED-2C934-30,G9	Non-EMC BNC Interconnect Panel

List 4

Equipment required in addition to List 1 when List 240 is not specified. This list provides a front cover for one DS3 Interface Module.

Maximum: One per List 1.

(1) 847038791	Front Cover

List 5

Equipment required in addition to List 1 when List 230 is not specified. This list provides a front cover for one module.

Maximum: One per List 1.

(1) 846286896	Front Cover

List 9

Equipment and wiring required to provide one high-performance fan assembly retrofit with power filtering and autonomous power alarm reset features.

(1) ED-9C130-30,G10	Fan Assembly

List 10

Equipment and wiring required to provide one high-performance fan assembly retrofit with power filtering and autonomous power alarm reset features.

(1) ED-9C130-30,G9	Fan Assembly

List 20

Circuit packs required in addition to List 1. This equipment provides switching for an additional 16 DS3 equivalent service signals in the switch shelf assembly.

(2) ERA4	SWIO2 (switch input/output 2)

List 50

Circuit pack required in addition to List 1 to provide bus extension and forced air cooling.

(1) AKM64 BXA1 (bus extender A1)

Each unused circuit pack position for a DS1 interface circuit pack and SWIF circuit pack in a partially equipped DS1 Interface Module must be equipped with a bus extender circuit pack (AKM64) for proper circuit operation. Unequipped DS1 Interface Modules without DS1 precabling do not require these bus extenders, but do require a cover for air flow. Order the number of Lists 50 needed to fill all unequipped slots. Refer to the appropriate table in the J98786C-1 drawing to determine the number of circuit packs required for the module.

Each unused circuit pack position for a DS3 multiplexer circuit pack in a partially equipped STS1/DS3 Interface or DS3 Interface-32 Module must be equipped with a bus extender circuit pack (AKM64) for proper circuit operation. A DS3 Interface-32 Module without any circuit packs does not require these bus extenders, but does require a cover for air flow. Order the number of Lists 50 needed to fill all unequipped slots. Refer to the appropriate tables in the J98786C-1 drawing to determine the number of circuit packs required for the module.

List 229, B

NOTE:
List B must be ordered with List 229.

Circuit packs always required in addition to List 1 to support the first 28 DS1 service channels.

Maximum: One per bay.

(2) AKM46B DS1IF1 (DS1 interface 1)
(2) AKM47 DS1IP1 (DS1 interface 1)
(4) AKM48 DS1RY1 (DS1 relay 1)
(2) AKM50 SWIF2 (switch interface 2)
(1) AKM64 BXA1 (bus extender A1)
(1) AKM88B UC4 (unit controller 4)
(2) AKM90 CLKDR2 (clock distributor 2)
(2) 556C PWRE3 (power E3)

List 230, B

Circuit packs required in addition to List 1 to support the first 28 DS1 service channels on the second DS1 shelf.

Maximum: One per bay.

NOTE:
List B must be ordered with List 230.

(2) AKM46B	DS1IF1 (DS interface 1)
(4) AKM48	DS1RY1(DS1 relay)
(1) AKM50	SWIF2 (switch interface 2)
(1) AKM64	BXA1 (bus extender A1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)

List 231

Circuit packs required in addition to List 1 to provide interfacing for 28 additional DS1 service channels.

Maximum: Thirteen per bay.

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

List 239, B

NOTE:
List B must be ordered with List 239.

Circuit packs required to support the first DS3 service channel on the STS1/DS3 Interface-16 shelf (only orderable with List 1).

Maximum: One per bay.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank Cover (DS3PM)

List 240, B

NOTE:
List B must be ordered with List 240.

Circuit packs required in addition to List 1 to support the DS3 service channels on the DS3 Interface-32 shelf.

Maximum: One per bay.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection switch 2)
(1) AKM88B	UC4 (unit controller 4)
(4) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank Cover (DS3PM)

List 241

Circuit pack required in addition to List 1 to provide interfacing for an additional DS3 service channel.

Maximum: Forty-four per bay.

(1) AKM68B MUX2 (multiplexer 2)

List 245

Circuit pack required in addition to List 1 to support DS1 performance monitoring and DS1 test signal generation and reflection.

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

List 245 provides optional features and can be installed in SWIF or MUX circuit pack positions. When installed in a SWIF circuit pack position in a DS1 Interface Protection Module or DS1 Interface Module, the DS1 interface circuit pack positions within the same service group must be equipped with the BXA1 (AKM64) circuit packs contained in List 50.

Maximum: One per bay.

List 249

Circuit packs required to support the first DS3 service channel on the STS1/DS3 Interface-16 shelf (only orderable with List 1).

Maximum: One List 249 per List 201 or 204.

(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)
(1) 846138337	Small apparatus blank assembly
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM90	CLKDR2 (clock distributer 2)
(1) AKM88B	UC4 (unit controller 4)
(2) 556C	PWRE3 (power unit E3)

NOTE:
List 249 requires Release 5.0 or later.

NOTE:
In an Enhanced DS3 Interface-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 may be equipped.

List 261

Circuit pack required in addition to List, or for field modification to provide interfacing for an additional DS3 service signal for Release 5.0 and above features in a DS3 Interface-16 module only. List provides clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 signals.

Maximum: Fourteen List 261 per module.

(1) AKM91	MUX3 (multiplexer 3)

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 and 261 may be equipped.

List 262

Circuit packs required for field retrofit to provide Enhanced DS3 capability and its protection in an Enhanced DS3 Interface-16 Module only for Release 5.0 and above. List provides clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 signals.

In an Enhanced DS3 Interface-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 (MUX3P) circuit pack. When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUX3P) circuit packs per List 259, 261, or 262 may be used.

Do not order with List 241 or 341.

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

List 341

Circuit pack required to provide interfacing for an additional STS1 service channel in an STS1 Interface-16 Module assembly.

Maximum: Fourteen per module.

(1) AKM84	SMUX1 (SONET multiplexer 1)

NOTE:
An STS1/DS3 Interface-16 Shelf must be dedicated to either all SMUX or all MUX circuit packs.

List 342

Circuit pack required to provide interfacing for one STS1 protection line in an STS1 Interface-16 Module assembly.

Maximum: One per module.

(1) AKM85	SMUXP1 (SONET multiplexer protection 1)

List 345

Equipment required when upgrading a currently ***equipped*** DS3 Interface-32 Module to an STS1/DS3 Interface-16 Module. (Lists 341 and 342 are also required to provide STS-1 service and protection. Lists 261 and 262 are also required to provide broadband capability, clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 service and protection.)

Maximum: One per bay.

(1) 846138337	Blank Cover (DS3PM)
(1) 846519528	Chassis Cover Assembly
(1) 846519536	Chassis Cover Assembly
(1) 847055563	Blank Cover (SWIO)

List 346, B

NOTE:
List B must be ordered with List 346.

Equipment and circuit packs required when upgrading an ***unequipped*** DS3 Interface-32 Module to an STS1/DS3 Interface-16 Module. (Lists 341 and 342 are also required to provide STS-1 service and protection. Lists 261 and 262 are also required to provide broadband capability, clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 service and protection.)

Maximum: One per bay.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank Cover (DS3PM)
(1) 846519528	Chassis Cover Assembly
(1) 846519536	Chassis Cover Assembly
(1) 847055563	Blank Cover (SWIO)

List 349

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

The interface types (STS1 and DS3) cannot be mixed within and STS1/DS3 Interface Module assembly. If List 1 is used for STS1 interlaces, then the Switch Complex must contain List 24 Synchronizer and Clock Generator circuit packs per J98786B-1.

Do not order with List 239 or 249.

(1) 846138337	Small apparatus blank assembly
(1) AKM84	SMUX1 (SONET multiplexer 1)
(1) AKM85	SMUXP1 (SONET multiplexer protection 1)
(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(2) AKM90	CLKDR2 (clock distributor 2)
(1) AKM88B	UC4 (unit controller 4)
(2) 556C	PWRE3 (power E3 unit)

List A

Designation label; always required in addition to List 1.

Maximum: One per bay.

(1) ED-2C394-30,GF	STS1/DS3/DS1 Interface Bay Framework

DS1 Interface Bay (J98786D-1)

Lists 1, 2, 4, 9, 10, 11, 20, 50, 229, 230, 231, 245, A, B

Framework, assembly, wiring, and equipment for one DS1 Interface Bay providing for up to 420 DS1 service channels. (List 229 must be ordered in conjunction with List 1 to provide the required circuit packs.)

List 1

Maximum: One List 1 per frame.

(1) ED-2C870-30,G4	Initial Bay Framework (including two temporary cable end guard assemblies)
(4) ERA4	SWIO2 (switch input/output 2)
(10) 70G	0.5A Fuse
(3) KS-19780,L2	10A Fuse
(7) KS-19780,L8	12A Fuse

The DS1 Interface Bay can be ordered in conjunction with the J98786B-1 Switch Complex for initial service, or separately if ordering for growth arrangement. Circuit packs required for each interface bay are listed on their respective J-drawings.

List 2

Equipment required to provide an optional EMC enclosure. This list must be ordered at the same time as List 1.

(1) ED2C870-30,G5	Assembly, DS1 Interface Bay Framework

List 4

Equipment required in addition to List 1 when List 230 is not specified. This list provides a front cover for an unequipped DS1 interface shelf assembly.

Maximum: Three per List 1.

(1) 846487163	Front Cover

List 9

Equipment and wiring required to provide on high-performance fan assembly retrofit with power filtering and autonomous power alarm reset features.

(1) ED-9C130-30,G10	Fan Assembly

List 10

Apparatus required to provide one high-performance fan assembly retrofit to support the autonomous power alarm reset feature.

(1) ED-9C130-30,G9	Fan Assembly

List 20

Circuit packs required in addition to List 1 to provide switching for an additional 448 DS1 service signals in the switch shelf assembly.

Maximum: One per List 1.

(2) ERA4	SWIO2 (switch input/output 2)

List 50

Circuit pack required in addition to List 1 to provide bus extension and forced air cooling.

(1) AKM64	BXA1 (bus extender A1)

Each unused circuit pack position for a DS1 interface circuit pack (AKM46B) and SWIF circuit pack (AKM50) in a partially equipped DS1 Interface Module must be equipped with a bus extender circuit pack (AKM64) for proper circuit operation. Unequipped DS1 Interface Modules without DS1 precabling do not require these bus extenders, but do require a cover for air flow. Order the number of Lists 50 needed to fill all unequipped slots. Refer to the appropriate table in the J98786D-1 drawing to determine the number of circuit packs required for the module.

List 229, B

NOTE:
List B must be ordered with List 229.

Common circuit packs always required to provide support for the first 28 DS1 service channels and protection for DS1 channels. List 229 is only orderable with List 1.

Maximum: One per bay.

(2) AKM46B	DS1IF1 (DS1 interface 1)
(2) AKM47	DS1IP1 (DS1 interface 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(2) AKM50	SWIF2 (switch interface 2)
(1) AKM64	BXA1 (bus extender A1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)

List 230, B

NOTE:
List B must be ordered with List 230.

Circuit packs required in addition to List 1 to provide support for DS1 channels and protection for 28 DS1 service channels on the second, third, and fourth shelves.

Maximum: Three per bay.

(2) AKM46B	DS1IF1 (DS1 interface 1)
(4) AKM48	DS1RY1 (DS1 relay 1)
(1) AKM50	SWIF2 (switch interface 2)
(1) AKM64	BXA1 (bus extender A1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)

List 231

Circuit packs required in addition to List 1 to provide interfacing for an additional 28 DS1 service channels.

Maximum: Twenty-seven per bay.

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

List 245

Circuit pack required in addition to List 1 to provide DS1 performance monitoring and DS1 test signal generation and reception.

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

List 245 provides optional features and can be installed in SWIF or MUX circuit pack positions. When installed in a SWIF circuit pack position in a DS1 Interface Protection Module or DS1 Interface Module, the DS1 interface circuit pack positions within the same service group must be equipped with the BXA1 (AKM64) circuit packs contained in List 50. List 245 cannot be used with the MUX3 circuit pack.

List A

Designation label; always required in addition to List 1.

(1) ED-2C870-30,GA DS1 Interface Bay Framework

Growth Fuse and Alarm Bay (J98786F-1)

Lists 1, 2, 3

One Fuse and Alarm Bay is required beyond four interface bays on either side of the Switch Complex.

List 1

Equipment and cables required to provide -48V power, fusing, and alarm capability for up to four adjacent interface bays with left growth.

(1) ED-9C195-30,G1 Assembly, Fuse and Alarm Bay

List 2

Equipment and cables required to provide -48V power, fusing, and alarm capability for up to four adjacent interface bays with right growth.

(1) ED-9C195-30,G2 Assembly, Fuse and Alarm Bay

List 3

Wiring and equipment required in addition to List 1 or List 2 to provide EMC shielding.

(1) ED-9C195-30,G3 Assembly, Fuse and Alarm Bay

STS1/DS3 Interface Bay (J98786S-1)

Lists 1, 2, 3, 4, 20, 42, 50, 241, 243, 245, 261, 262, 263, 341, 342, 343

Framework, assembly, wiring, and equipment for one DACS IV-2000 (512) STS1/ DS3 Interface Bay to accommodate interfacing for a total of 60 DS3 or 60 STS1 service channels.

List 1

Maximum: One List 1per frame.

(1) ED-2C090-30,G6	Initial Bay Framework (including two temporary cable end guard assemblies and built-in redundant controller)
(1) ED-2C090-30,G1	Cable Assembly
(4) ERA4	SWIO2 (switch input/output 2)
(10) 70G	0.5A Fuse
(3) KS-19780,L2	10A Fuse
(9) KS-19780,L8	12A Fuse

This bay can be ordered in conjunction with the Switch Complex (J98786B-1) for initial DS3 or STS1 service, or separately if ordering for a growth arrangement. Circuit packs required for each interface bay are listed on their respective J-drawings.

NOTE:
This bay, if used for STS1 interfaces, must have Synchronizer and ERA6B (CLKGN4) circuit packs in the Switch Complex (see J98786B-1).

List 2

Equipment required in addition to List 1 to provide an optional EMI enclosure. This list also includes the BNC interconnect panel. List 2 must be ordered at the same time as List 1.

(1) ED-9C090-30,G7	Framework, STS1/DS3 Interface Bay

List 3

Equipment required in addition to List 1 to provide a BNC interconnect panel if List 2 is not ordered.

(1) ED-9C090-30,G8	Framework, STS1/DS3 Interface Bay

List 4

Equipment required in addition to List 1 to provide a front cover for a DS3 Interface Module when List 243, 263, or 343 is not specified.

Maximum: Four per List 1.

(1) 847038781 Front Cover

List 20

Circuit packs required in addition to List 1 to provide switching for an additional 16 DS3 service signals in the switch shelf assembly.

Maximum: Three per List 1.

(2) ERA4 SWIO2 (switch input/output 2)

List 42

Circuit pack required in addition to List 243 to provide optional TABS protocol reporting of DS3 performance monitoring in an STS1/DS3 Interface (16 STS1/DS3) Module assembly.

Maximum: One per List 243.

(1) AKM89 DS3PM2 (DS3 performance monitor 2)

List 50

Circuit pack required in addition to List 1 to provide bus extension and forced air cooling.

(1) AKM64 BXA1 (bus extender A1)

Each unused circuit pack position for a DS3 or STS1 multiplexer circuit pack in a partially equipped STS1/DS3 Interface Module must be equipped with a bus extender circuit pack (AKM64) for proper circuit operation. STS1/DS3 Interface Modules without any circuit packs do not require these bus extenders, but do require a cover for air flow. Order the number of Lists 50 needed to fill all unequipped slots. Refer to the appropriate table in the J98786S-1 drawing to determine the number of circuit packs required for the module.

List 241

Circuit pack required in addition to List 243 to provide interfacing for an additional DS3 service channel in a DS3 Interface (16 STS1/DS3) Module assembly.

Maximum: Fourteen per List 243.

(1) AKM68B	MUX2 (multiplexer 2)

List 243, B

NOTE:
List B must be ordered with List 243.

Circuit packs required in addition to List 1 to support the first DS3 service channels in an unequipped STS1/DS3 Interface (16 STS1/DS3) Module assembly.

Maximum: Four per bay.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM68B	MUX2 (multiplexer 2)
(1) AKM70	MUXP2 (multiplexer protection 2)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank Cover (DS3PM)

List 245

Circuit pack required in addition to List 1 to provide DS1 performance monitoring and DS1 test signal generation and reception.

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

List 245 provides optional features and may be installed in SWIF or MUX circuit pack positions (see the J98786S-1 drawing for details).

List 261

Circuit pack required in addition to List 1, or for field modification to provide interfacing for an additional DS3 service signal for Release 5.0 and above features in an Enhanced or Clear-Channel DS3 Interface-16 module only. List provides clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 signals.

Maximum: One List 261 per module.

(1) AKM91	MUX3 (multiplexer 3)

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 and 261 may be equipped.

List 262

Circuit packs required for field retrofit to provide Enhanced DS3 capability and its protection in an Enhanced DS3 Interface-16 Module only for Release 5.0 and above. List provides clear-channel DS3 cross-connection, full-time DS1 performance monitoring, and support of unframed DS3 signals.

In an Enhanced DS3 Interface-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 (MUX3P) circuit pack. When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUX3P) circuit packs per List 259, 261, or 262 may be used.

Do not order with List 241 or 341.

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

List 263

Circuit packs required in addition to List 1 or for field modification 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.

Maximum: One List 263 per module.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(1) AKM91	MUX3 (multiplexer 3)
(1) AKM92	MUXP3 (multiplexer protection 3)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank cover

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.

When using the clear-channel DS3 cross-connection feature, only AKM91 (MUX3) and AKM92 (MUXP3) circuit packs per List 249, 261, or 262 may be equipped.

List 341

Circuit pack required in addition to List 343 to provide interfacing for an additional STS1 service channel in an STS1 Interface (16 STS1/DS3) Module assembly.

Maximum: 14 per List 343.

(1) AKM84	SMUX1 (SONET multiplexer 1)

NOTE:
STS1/DS3 Interface-16 Module must be dedicated to either all SMUX1 or all MUX2 circuit packs.

List 342

Circuit pack required in addition to List 343 to field-upgrade a DS3 Interface-16 Module to an STS1 Interface-16 Module to provide interfacing for one STS1 protection line in an STS1/DS3 Interface-16 Module assembly.

Maximum: Four per List 1.

(1) AKM85	SMUXP1 (SONET multiplexer protection 1)

NOTE:
STS1/DS3 Interface-16 Module must be dedicated to either all SMUX1 or all MUX2 circuit packs.

List 343, B

NOTE:
List B must be ordered with List 343.

Circuit packs required in addition to List 1 to support the first STS1 service channels in an unequipped STS1/DS3 Interface (STS1-16/DS3-16) Module assembly.

Maximum: Four per bay.

(1) AKM53	MUXPS1 (multiplexer protection switch 1)
(1) AKM84	SMUX1 (SONET multiplexer 1)
(1) AKM85	MUXP1 (SONET multiplexer protection 1)
(1) AKM88B	UC4 (unit controller 4)
(2) AKM90	CLKDR2 (clock distributor 2)
(2) 556C	PWRE3 (power E3)
(1) 846138337	Blank Cover (DS3PM)

TTY Connector Adapters (ED-2C646-30)

Groups 3, 21, 22, 27, 28, 29, A

Group 3

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

Group 21

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

Group 22

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

Group 27

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

Group 28

Wiring and equipment for one DACS TTY connector adapter to provide a direct connection of four pairs of signal leads. This list can be used for RS-422/423 and TABS links.

Group 29

Assembly, wiring, and equipment with three resistors for one DACS connector adapter to convert from a 37-pin connector (RS-449/443 standard) to a 25-pin connector (RS-232/422 standard) when connecting to an interface unit (CIU).

Group A

Equipment for DACS TTY connector adapters. Always required in addition to Group 1 through Group 11, and Groups 21, 22, 27, 28 and 29.

(2) 843987603 Screws

Release 5.0 Software (J98786SL-3)

NOTE:
Replacement/spare copies of the generic software are orderable separately as follows:

Release 5.0 (512)	J98786SL-3 List 4

List 1

Assembly and equipment required to provide DACS IV-2000 (512) Release 5.0 software for initial orders and retrofits from Release 3.0 (512). List 1 includes one optical disk and the Software Release Description (SRD) for Release 5.0.

(1) PG2C702-50,GA1
(1) DACS IV-2000 (512) Release 5.0 SRD; AT&T 365-340-905

NOTE:
Additional copies of the Software Release Description are orderable by comcode, as follows, from AT&T Merrimack Valley:

C107286650	DACS IV-2000 (512) Release 5.0 Software Release Description

List 3

Assembly and equipment required to provide one blank optical disk for creating backup copies of DACS IV-2000 (512) Release 5.0 software and databases.

List 4

Assembly and equipment required to provide one spare optical disk of DACS IV-2000 (512) Release 5.0 software.

List 5

Assembly and equipment required to provide DACS IV-2000 (512) Release 5.0 software for initial orders and retrofits from Release 3.0 (512) for customers requiring four optical disks. List 5 includes four optical disks and the SRD.

(1) PG2C702-50,GA2
(1) DACS IV-2000 (512) Release 5.0 SRD; AT&T 365-340-905

List A

Documentation kit always required in addition to List 1 or List 5.

(1) DACS IV-2000 (512) Release 5.0 Document Kit:

AT&T 365-340-900	Reference Manual
AT&T 365-340-901	Operations and Maintenance
AT&T 365-340-902	Commands and Messages
AT&T 365-340-903	Quick Reference Job Aids

NOTE:
Additional copies of the above documents may be ordered by their respective document numbers from the AT&T Customer Information Center (CIC).

List B

Assembly and equipment required for one system startup optical disk; always required in addition to List MIR for initial orders of DACS IV-2000 (512) Release 5.0 software.

List M1R

Application software right-to-use fee always required in addition to List 1 or List 5 on initial orders of DACS IV-2000 (512) Release 5.0 software.

List M1S

Application software right-to-use fee always required in addition to List 1 or List 5 on retrofits from DACS IV-2000 (512) Release 3.0 software to Release 5.0.

List P1R

Operating software right-to-use fee always required in addition to List 1 or List 5 on initial orders of DACS IV-2000 (512) Release 5.0 software.

List P1S

Operating software right-to-use fee always required in addition to List 1 or List 5 on retrofits from DACS IV-2000 (512) Release 3.0 software to Release 5.0.

List M2S

Application software right-to-use fee always required in addition to M1R or M1S on upgrades from DACS IV-2000 (256) Release 5.0 to (512) Release 5.0.

ROADS Ordering Information

This section contains ordering information for the new DACS IV-2000 (512) Rapid Order and Delivery System (ROADS) standard product configurations. These configurations are listed in Table 4-4.

Table 4-4. **(512) ROADS Standard Product Configurations**

Configuration Name	Application Code
DACS IV-2000 (512) New System	KJ
(512) I/O Growth Upgrades	K8
(256 to 512) Capacity Expansion	K9

DACS IV-2000 (512) New System

Application Code: KJ

This product configuration includes a (512) switch bay, zero to four collocated I/O bays (see options below), 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 option can be ordered with this configuration:

- Optical Remote Arrangement
- DS1 Bay (zero to four)
- STS-1/DS3 Bay (zero to four)

NOTE:
If more I/O bays are needed, use Application Code K8.

(512) I/O Growth/Upgrades

Application Code: K8

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

NOTE:
To qualify for ROADS delivery, the order must contain certain hardware and software components. For hardware, either a DS1 or STS-1/DS3 I/O bay is required. For software, an upgrade from Release 3.x to Release 5.x is required.

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

DS1 I/O Bay

- Additional DS1 Service (28 DS1 signals)
- Fuse Bay

STS-1/DS3 I/O Bay

- Enhanced DS3 (Release 5.x) Service
- STS-1 Service
- Fuse Bay

(256 to 512) Capacity Expansion

Application Code: K9

This product configuration includes hardware, software, and circuit packs for both the (256) and (512) systems (to be optically connected).

NOTE:
To qualify for ROADS delivery, the customer must have certain hardware and software components in place. For hardware, a (256) bay should already by installed; if a (512) bay is not already installed, one needs to be ordered through Application Code KJ. For software, the most current version is required.

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

(256) Bay

- Remote Craft Interface Packs
- Combination Bay Upgrade
- DS1 Bay Upgrade
- STS-1 Bay Upgrade
- Additional OPEX/OSWIO Packs

NOTE:
A (256) Release 5.x to (512) Release 5.x upgrade or a (256) Release 3.x to (512) 5.x upgrade is required.

(512) Bay

- Optically Remoted One Side
- Optically Remoted Both Sides

NOTE:
Release 5.x must be running on the (512) bay.

Product Support

5

Contents

Contents

Product Support

5

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.

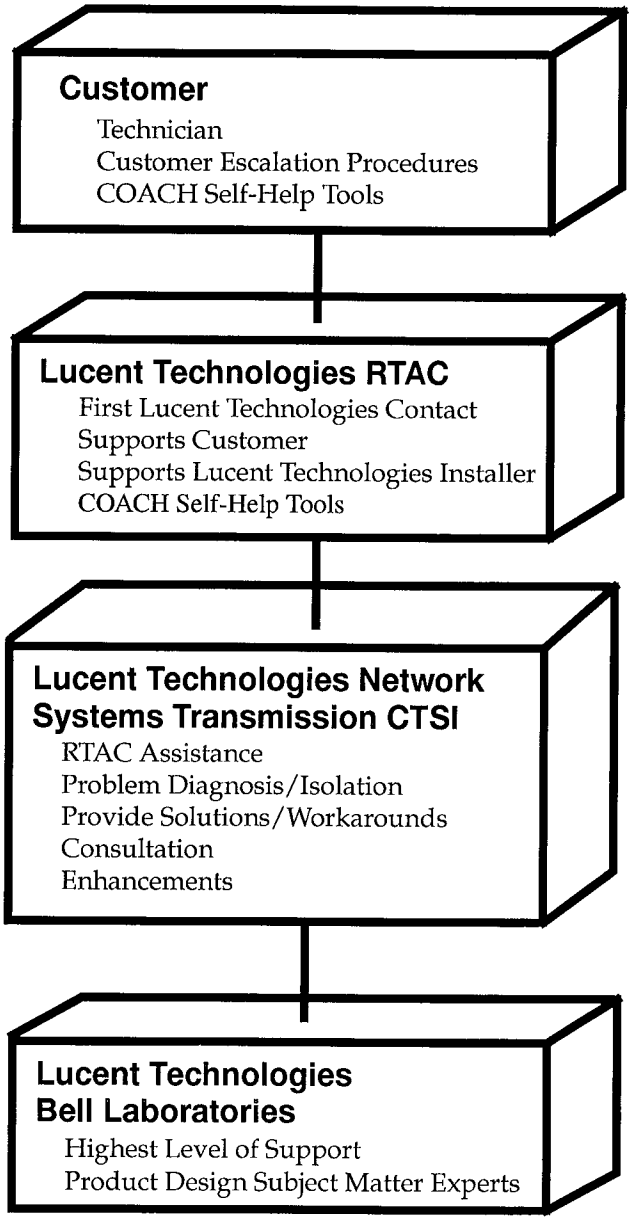


Figure 5-1. **Product Support**

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 Product Information (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 Number: (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.

Technical Specifications

A

Contents

Contents

Technical Specifications

A

This appendix describes the technical specifications that must be considered when engineering the DACS IV-2000 (512) Release 5.0 into a network. It provides technical specifications for the following areas:

- Interface
- System Performance
- Power
- Physical
- Environmental
- Availability and Reliability.

Interface Specifications

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

Transmission Characteristics

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 addressed in this section, and the particular specifications and requirements associated with each area are included.

Port Capacity

Port capacity defines the number of DS1, DS3, and/or STS-1 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:

- 13,888 DS1 ports for an arrangement consisting of all DS1 ports (496 equivalent DS3s)
- 496 DS3 ports for an arrangement consisting of all DS3 ports
- 480 STS-1 ports for an arrangement consisting of all STS-1 ports.

Bay arrangements include:

- A collocated arrangement, in which the Switch Complex and the interface bays are physically and electrically connected.
- A remoted arrangement, in which the Switch Complex and up to half the interface bay capacity (one Remote Complex) are physically separated up to 1000 cable feet and optically connected.
- A second remoted arrangement, in which two Remote Complexes are optically connected to the Switch Complex. The port capacities of the DACS IV-2000 (512) are summarized in Table A-1.

Table A-1. **Port Capacity**

Item	Value
Maximum System Capacity	496 DS3-equivalent input and output interface ports
Maximum DS1 Port Capacity	13,888 input and output DS1 interface ports
Maximum DS3 Port Capacity	496 input and output DS3 interface ports
Maximum STS1 Port Capacity	480 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 Mbps 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	M13/C-bit parity; unframed (MUX3 only)
DS3 Line Rate	44.736 Mbps ±20 ppm
Line Code	B3ZS
Test Load Impedance	75Ω ±5% resistive, unbalanced

DS1 Signal

The DACS IV-2000 accepts incoming DS1 signals at the specified line rate of 1.544 Mbps 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 Mbps ±130 ppm
Line Code	AMI or B8ZS
Test Load Impedance	100Ω ±5% resistive, balanced

STS-1 Signal

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

Table A-4. **STS-1 Signal Characteristics**

Item	Value
STS-1 Signal Format	Conforms to TA-NWT-000253
STS-1 Line Rate	51.84 Mbps ±4.6 ppm
Line Code	B3ZS
Duty Cycle (measured at output cable terminals)	Nominal 50%, RZ pulse with 1.03V (±10%) peak output amplitude
Frame Synchronous Scrambling	Conforms to TA-NWT-000253
Wideband Power Level (measured at 450 ft)	-2.7 dBm to 4.7 dBm

Signal Impairments

The requirements related to signal impairments in electronic digital signal cross-connect equipment are specified in Bellcore TA-NWT-000233, *Wideband and Broadband Digital Cross-Connect Systems Generic Criteria* (Issue 1, November 1993) and TA-NWT-001339, *General Reliability Requirements for Digital Cross-Connect Systems* (Issue 1, November 1993). 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 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 4, Revision 1, April 1992). The DACS IV-2000 does not generate more than 0.01 unit interval (timeslots) of rms jitter with a high-pass measurement filter with 12-Hz cutoff frequency.

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 more 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 less than 25 μs for AMI-coded DS1 inputs and less than 29.5 μs for B8ZS-coded DS1 inputs. The DS3-to-DS3 nominal transmission delay (normal cross-connection) through the DACS IV-2000 is less than 23 μs.

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 shown in Table A-5 (MUX2 circuit pack) and Table A-6 (MUX3 circuit pack).

Table A-5. **DS3 Signal Impairment Specifications (MUX2 Circuit Pack)**

Item	Value
Jitter Accommodation	Conforms to TR-TSY-000009 (Figure 7) and TR-NWT-000499 (Figure 7-2)
Jitter Generation	< 0.01 UI
Signal-to-Noise 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)	< 25 μs (AMI), < 29.5 μs (B8ZS)
Transmission Signal Delay DS3 to DS3	< 23 μs
Bit Error Rate (BER/cross-connect path)	$< 1 \times 10^{-10}$

Table A-6. DS3 Signal Impairment Specifications (MUX3 Circuit Pack)

Item	Value
Jitter Accommodation	TR-NWT-000499, Issue 5 (Figure 7-1)
Jitter Generation	< 0.4 UI
Jitter Transfer	TA-NWT-000253, Issue 8 (Figure 5-13)
Bit-Error Rate	$< 1 \times 10^{-10}$
Transmission Signal Delay DS3 Clear-Channel	16 µs
Transmission Signal Delay DS3 Clear-Channel in DS1 Mode	27 µs
Transmission Signal Delay Enhanced DS3 Interface	27 µs

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) the signal accommodates versus the frequency of that jitter. 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 4, Revision 1, April 1992). The DACS IV-2000 does not generate more than 0.3 UI (timeslots) 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 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 frame is greater than 18 dB. (The cross-connection must be properly terminated when making this measurement.) The DACS IV-2000 provides more 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 less than 27.5 μs for AMI-coded DS1 inputs/outputs and less than 37 μs for B8ZS-coded DS1 inputs/outputs. The nominal DS1 line loopback transmission delay is less than 3 μs.

The DACS IV-2000 provides an operational BER of less than 10^{-10} per cross-connect path across the system regardless of the number of other cross-connections established.

The DS1 signal impairment specifications are shown in Table A-7.

Table A-7. **DS1 Signal Impairment Specifications**

Item	Value
Jitter Accommodation	Conforms 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
Signal-to-Noise 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)	< 27.5 μs (AMI), < 37 μs (B8ZS)
Transmission Signal Delay DS1 Line Loopback	< 3.0 μs
Bit Error Rate (BER/cross-connect path)	$< 1 \times 10^{-10}$

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-CORE, *SONET Transport Systems: Common Generic Criteria (A Module of TSGR, FR-NWT-000440)* (Issue 8, October 1993). The DACS IV-2000 does not generate more than 0.01 UI (timeslots) of rms jitter with a high-pass measurement filter with a 12-kHz cutoff frequency.

The STS-1 signal impairment specifications are shown in Table A-8.

Table A-8. **STS-1 Signal Impairment Specifications**

Item	Value
Jitter Accommodation	Conforms to TA-NWT-000253
Jitter Transfer (terminating DS1 signals on STS1 interfaces)	Conforms to TA-NWT-000253
Jitter Amplitude (terminating DS1 signals on STS1 interfaces)	< 5 UI peak-to-peak
Jitter Generation (rms)	< 0.01 UI

Cable Characteristics

Various cables and connectors are available for interconnecting the DACS IV-2000 to a DSX-1, DSX-3, or STSX-1, or directly to other network elements.

Optical Interface Cable and Connectors

All optical transmission cables are single-mode. All optical control cables are multi-mode. The maximum cable distance between the Switch Complex and a remoted interface bay is 1000 feet. All connectors are SC-type.

DS3 Interface Electrical Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor cable distribution. The DS3 interface cable and connector specifications are shown in Table A-9.

Table A-9. **DS3 Cable and Connector Specifications**

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	2x4
DS3 Connector Type (BNC) at the DACS IV-2000	connectorized

DS1 Interface Electrical Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor cable distribution. The DS1 interface cable and connector specifications are shown in Table A-10.

Table A-10. **DS1 Cable and Connector Specifications**

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- or 2249-type cable*)	900 ft
DS1 Connector Type (963P/T) or Wirewrap at the DACS IV-2000	2x14 (in) 1x28 (out)
DS1 Connector Type at DSX-1	wirewrap

* 1249 is preferred for overhead installation; 2249 is required for underfloor installation.

STS1 Interface Electrical Cable and Connectors

The DACS IV-2000 supports both overhead and underfloor cable distribution. The STS1 interface cable and connector characteristics are shown in Table A-11

Table A-11. STS1 Interface Cable and Connector Characteristics

Item	Value
Maximum Distance to STS1 NE (735-type cable or equivalent)	500 ft
Maximum Distance to STSX-1 (735-type cable or equivalent)	250 ft
Maximum Distance to STS1 NE (734-type cable or equivalent)	900 ft
Maximum Distance to STSX-1 (734-type cable or equivalent)	450 ft
STS1 Connector Type (982-type) at the DACS IV-2000	2x4
STS1 Connector Type (BNC) at the DACS IV-2000	connectorized

Alarm and Control Specifications

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

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 Visual. 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 (1.0 ampere), maximum voltage (48 volts), and maximum volt-amperage (20 volt-amperes).

The activation of the alarms is delayed to avoid calling the technician 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 office and telemetry alarm types and requirements for the DACS IV-2000 are shown in Table A-12.

Table A-12. **Office and Telemetry Alarms and Requirements**

Item	Value
Local Office Audible Alarms	Critical, Major, Minor
Local 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, 20 VA (max)
Alarm 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

The link characteristics for the communications and OS interfaces for the DACS IV-2000 are shown in Table A-13.

Table A-13. **Link Characteristics**

Interface	Physical	Baud	Electrical	Functional
CILINK 1-1 and 2-1	EIA-232-D	1200, 2400, 4800, 9600, and 19200 Default: 9600	EIA-232-D	Async. Snider
CILINK 1-2 and 2-2	EIA-449	1200, 2400, 4800, and 9600 Default: 2400	EIA-423	Async. Snider
CILINK 1-3 and 2-3	EIA-449	1200, 2400, 4800, 9600, and 19200 Default: 9600	EIA-423	Async. Snider
CILINK 1-4 and 2-4	EIA-449	1200, 2400, 4800, and 9600 Default: 2400	EIA-485	TABS point-to-point AS&C
CILINK 1-5, 1-6, 2-5, and 2-6	EIA-449	1200, 2400, 4800, and 9600 Default: 9600	EIA-423	Sync. X.25 or Async. Terminal Interface with external PAD
CILINK 1-7, 1-8, 2-7, and 2-8	EIA-232-D	1200, 2400, 4800, 9600, and 19200 Default: 9600	EIA-232-D	Async. Snider

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 ED-2C646,G7 adapter must be used and the baud rate is fixed at 9600. All baud rates can be used with an external timing source.

Protocols

The interface protocol for Links 1-1, 1-2, 1-3, 1-7, 1-8, 2-1, 2-2, 2-3, 2-7, and 2-8 is asynchronous Snider, which is defined in Bellcore TR-NWT-000064, *LATA Switching Systems Generic Requirements (LSSGR)*, 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) is specified in Compatibility Bulletin #149, *Maintenance Standards for Digital Transmission Systems* (Issue 4).

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).

TABS Link Specifications

The DACS IV-2000 has a TABS port as an electrical interface to a telemetry-based OS. 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 1200 to 9600 baud.

All alarm and status indications available over the communications interface link are also available over the TABS 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.

X.25 Link Specifications

The DACS IV-2000 has two synchronous EIA-449/EIA-423 ports for electrical interfaces to message-based OSs. The physical interface specifications are given in EIA Standard EIA-449 (November 1977). The synchronous links have the unbalanced 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.

Command and Message Specifications

NOTE:
In previous releases, the DACS IV-2000 supported Message Sets 1 and 2. The DACS IV-2000 (512) starting with Release 3.0 supports one message set, formerly Message Set 2.

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, commonly known as Transaction Language 1, Issue 4, is based on the Bellcore Special Reports, Technical Advisories, and Technical References listed in Table A-14.

Table A-14. **Command and Message Specifications**

Document Number	Specification
SR-STS-001665	*Network Monitoring and Analysis Generic Network Element Interface Support* (Issue 2, December 1992)
SR-STS-001578	*OPS/INE Generic Interface Support* (Issue 2, December 1992)
TA-NWT-000199	*Specification of Memory Administration Messages at the OS/NE Interface* (Issue 7, January 1993)
TA-NWT-000200	*Specification of System Maintenance Messages at the OS/NE Interface* (Issue 5, December 1990)
TR-NWT-000811	*OTGR: Operations Application Messages - TL1 Message Index* (Issue 2, May 1992)
TR-NWT-000818	*OTGR Section 6.1: Network Maintenance: Access and Testing - Generic Test Architecture* (Issue1, November 1992)
TR-NWT-000833	*OTGR: Operations Application Messages Network Maintenance: Generic Requirements for Network Element and Transport Surveillance Messages, Section 12.3* (Issue 5, Revision 2, April 1993)
TR-NWT-000835	*OTGR: Operations Application Messages - Network Element (NE) Security Parameter Administration Messages, Section 12.5* (Issue 3, Revision 1, May 1991)

System Performance Specifications

The system capabilities and performance specifications for the DACS IV-2000 cover switch types and capacity, cross-connection capabilities, boot time, fault tolerance and protection, and frame indicators and controls. Each of these areas is addressed in this section, and the particular specifications and requirements associated with each area are included.

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 that access to any or all of the free paths through the switch is never denied so that a connection from an input port to an output port can always be completed.

The capacity of the DACS IV-2000 is 14,336 input and output switch ports (512 equivalent DS3).

Cross-Connect Capability

The DACS IV-2000 supports four types of cross-connections:

- One-way
- Two-way
- Bridge
- 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-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.

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.

A tail-end switch occurs when an existing cross-connect path is disconnected and a new cross-connection is 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. 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).

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).

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).

The cross-connect capabilities of the DACS IV-2000 are shown in Table A-15.

Table A-15. **Cross-Connect Capabilities**

Cross-Connect Procedures	Value
One-way Cross-Connect Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (STS-1/DS3 clear-channel)
Two-way Cross-Connect Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (STS-1/DS3 clear-channel)
Bridge Setup Time	< 1 sec (DS1, VT1.5) < 3 sec (STS-1DS3 clear-channel)
Rolling (Signal Interruption Time)	< 2 ms (DS1, VT1.5) < 3 ms (STS-1/DS3 clear-channel)
One-way Signal Split (Signal Interruption Time)	< 2 ms (DS1, VT1.5) < 3 ms (STS-1/DS3 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 includes 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 shown in Table A-16. (Boot times for the collocated and remote systems do not differ significantly.)

Table A-16. **Boot Time Specifications (Collocated Systems)**

	Value
Procedure	**Collocated**
Cold Boot (from hard disk)	< 15 min
Cold Boot (from backup optical disk)	< 15 min
Restart (MC, ECI)	< 5 min
Memory Administration	Conforms 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 BER alarm thresholds for input signals. The high category shows failures at 10^{-3}, and the low category shows failures at 10^{-9}. If the facility connects to a MUX2 circuit pack (DS3), an SWIF2 circuit pack (DS1), or an SMUX circuit pack (STS1), 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. At the local office, the incoming signal failures are indicated at the threshold you have 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. Service is automatically restored to this new circuit pack from the protection circuit pack. 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 automatically supplies DS1 IDLE (unframed all ones), STS-1 AIS, and VT1.5 AIS signals 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 IDLE, STS-1 AIS, or VT1.5 AIS signal is substituted at the output port in less than 3 ms.

The fault tolerance and protection specifications for the DACS IV-2000 are shown in Table A-17.

Table A-17. **Fault Tolerance and Protection Specifications**

Item	Value
Cross-Connect Path Monitoring	Continuous
Input Signal Alarm, BER Threshold (DS1, DS3, and STS1 interfaces)	10^{-3}, 10^{-4}, 10^{-5},10^{-6},10^{-7},10^{-8},10^{-9}
Input Signal Failure Alarm	Major, Minor, or No Alarm
Input Signal Failure Visual Indication	ALM (flashes at 1-sec intervals)
DS1 AIS Substitution Time	< 3 ms
STS-1 AIS Substitution Time	< 3 ms
VT1.5 AIS Substitution Time	< 3 ms
Protection Switching Time	< 60 ms
Automatic Restoration Time	< 10 sec

Frame Indicators and Controls

Frame indicators and controls are provided in both the Switch Complex and the Remote Complexes.

Seven visual equipment indicators are provided on the Switch Complex status panel (contained in the Main Controller Bay):

- CR (Critical) signals a critical alarm condition; red
- MJ (Major) signals a major alarm condition; red
- MN (Minor) signals a minor alarm condition; yellow
- ABN (Abnormal) is reserved for future use
- ACO (Alarm Cutoff) signals that the audible alarms have been turned off (ACO switch activated); green
- MC FAIL (Main Controller failure) is a processor major alarm that signals a failure in the High-Capacity Controller Module; red; (256) and (512) are not optically connected to a (512)
- FE (Far End) is reserved for future use.

Eight visual equipment indicators are provided on the Remote Complex status panel (contained in the OPEX Bay):

- CR (Critical) signals a critical alarm condition
- MJ (Major) signals a major alarm condition
- MN (Minor) signals a minor alarm condition
- ABN (Abnormal) is reserved for future use
- LOCAL ACO (Local Alarm Cutoff) shows that the audible alarms for the Remote Complex have been silenced (ACO switch activated)
- POWER ON signals that power is present at the status panel
- FAIL signals a failure in the Remote Unit Interface (RUI) Module
- FE (Far End) is reserved for future use.

All circuit packs, except those in the version one Synchronizer Module, have a red LED to aid in problem identification. (In addition, the ECI circuit packs have green LEDs to indicate the ECI is 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 and version two DS1TX circuit packs, 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 two 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 Switch Complex status panel:

- LED/LAMP TEST tests all LEDs
- RESET initiates the system reset function when operated simultaneously with the RESET ENABLE switch
- RESET ENABLE inhibits the reset function from being activated accidentally
- ACO turns off the office audible alarms.

Four controls (momentary-action, pushbutton, or toggle switches) are located on the Remote Complex status panel:

- LED/LAMP TEST tests all LEDs
- INTERRUPT initiates the interrupt function of the Remote Complex when operated simultaneously with the INTERRUPT ENABLE switch
- INTERRUPT ENABLE inhibits the reset function from being activated accidentally
- LOCAL ACO turns off the office audible alarms.

The alarm selection criteria for 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 in the DACS IV-2000 are summarized in Table A-18.

Table A-18. **Visual Indicators**

Indicator	Value or Specification
System Visual Indicators (Switch Complex)	CR, MJ, MN, ACO, MC FAIL
System Visual Indicators (Remote Complex)	CR, MJ, MN, LOCAL ACO, POWER ON, FAIL
Circuit Pack Failure Visual Indicator	ALM (2-sec minimum duration); red LED lit
Protection Bus Active Visual Indicator	Green LED lit on MUXPS or DS1RY
Primary and Secondary Disk Active Visual Indicator (when disk is spinning)	Green LED lit
Power Feed Status Visual Indicator	Green LED lit
System Controls (Switch Complex)	LED TEST, RESET/RESET ENABLE, and ACO
System Controls (Remote Complex)	LED TEST, INTERRUPT, INTERRUPT ENABLE, and LOCAL ACO
Power Bus Failure Indicator	BUS AA, AB, AC, AD, BA, BB, BC, BD
Power Unit Failure Visual Indicator	ALM; red LED lit
Alarm Selection Criteria	Conforms to TR-TSY-000191
CPU (Control Complex) Active Visual Indicator	Green LED lit
Active CLKGN Visual Indicator	Green LED lit
Version Two Synchronizer Active Visual Indicator	Green LED lit

Power Specifications

Two sets of power requirements for the DACS IV-2000 are addressed in this section, one for the DACS IV-2000 (512) Switch Module and collocated interface bays and one for the Remote Complexes [converted to DACS IV-2000 (256) frames]. For complete power information, see the *Floor Plan Data* (FPD 801-500-168-15 for collocated arrangements, FPD 801-500-168-8 for Remote Complexes with the standard power configuration, or FPD 801-500-168-21 for Remote Complexes with the duplex power configuration).

Switch Complex and Collocated Interface Bays

The DACS IV-2000 (512) operates with one or two Lineage® 2000 (or equivalent) battery plants (-48 Vdc nominal) in a central office environment, which supply power to one or two battery distribution feeder boards (BDFBs). BDFB-A supplies power buses AA through AD, and BDBF-B supplies power buses BA though BD to the Switch Complex and collocated interface bays. All feeders have four connections to the fuse and alarm panels.

The two BDFBs enable duplication of the power supply to the system to operate in the event one battery plant fails (except where there is only one battery plant).

Remote Complex

The DACS IV-2000 Remote Complexes are configured to accept two power supply arrangements: standard or duplex. The standard configuration consists of one BDFB powered from a single Lineage 2000 (or equivalent) battery plant. The standard configuration was the only configuration available for (256) systems up to Release 4.0. The Release 4.0 and 5.0 (256) systems include an option for duplex power. The duplex configuration allows the Remote Complex to be powered from one or two Lineage 2000 (or equivalent) battery plants.

Standard Power Configuration

In the standard configuration, the Remote Complexes operate 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 OPEX Bay and provide power for the entire Remote Complex. 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 OPEX PWR Module, and the fan assemblies.
- Feeders F and G (connected directly to the RUI PWR Module) supply power to the RUI 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.)

Twelve power feeders (A1 through F1, A2 through F2) and twelve returns are terminated at the OPEX Bay and provide power for the entire Remote Complex. The red battery plant supplies power buses A, B, and E; the blue battery plant supplies power buses C, D, and F. All power feeders are connected to the Fuse and Alarm Panel.

When the Remote Complex is powered using two battery plants, the following requirements apply:

- Power feeders to the Remote Complex must be placed in two groups to allow connection to two separate BDFBs.
- Two battery plants are required (red and blue).
- Feeders A, B, and E are fed from the red battery plant; feeders C, D, and F are fed from the blue battery plant.

Loss of one battery plant or one group of feeders connected to that plant does not cause any loss of service (except where there is only one battery plant supplying power).

Power Dissipation

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).

The power specification requirements for fully equipped bays with an input voltage range of -40.5V to -60V are shown in Table A-19.

Table A-19. **Power Dissipation**

Bay	Value	
	Collocated System	System with Remote Complex
Switch Complex (Main Controller, two Switch Bays)	4909 watts	5400 watts
OPEX Bay	—	1000 watts
Enhanced DS1 Interface Bay	685 watts	685 watts
DS3 Interface Bay	597 watts	597 watts
Enhanced STS1/DS3 Interface Bay	1144 watts	1144 watts
Enhanced STS1/DS3/DS1 Interface Bay	911 watts	911 watts

Notes:

1. This table shows the specifications for the enhanced bay types only; for nonenhanced bays, see AT&T 365-340-900, *DACS IV-2000 (512) Release 5.0 Reference Manual.*
2. These values conform to TR-NWT-000063, *Network Equipment-Building Systems (NEBS) Generic Equipment Requirements* (Issue 5, September 1993).

Physical Specifications

The physical specifications for the DACS IV-2000 are shown in Table A-20. The floor load from the frames (excluding cable distribution system) averaged across the associated floor area does not exceed 115 lb/ft^2.

Table A-20. **Physical Characteristics**

Item	Value
Framework Type	Network Bay
Physical Dimensions (Collocated Systems)	Up to 23 bay positions, or 21 standard bays: 26 in. (W) x 84 in. (H) x 12 in. (D)
Physical Dimensions (Remote Complexes)	Up to 9 standard bay positions: 26 in. (W) x 84 in. (H) x 12 in. (D)
Fuse and Alarm Bay	13 in. (W) x 84 in. (H) x 12 in. (D); 200 lb.
Switch Complex (Main Controller, two Switch Bays)	2090 lb.
OPEX Bay	450 lb.
Enhanced DS1 Interface Bay	450 lb.
DS3 Interface Bay	450 lb.
Enhanced STS1/DS3 Interface Bay	450 lb.
Enhanced STS1/DS3/DS1 Interface Bay	450 lb.
Floor Load (excluding cable distribution)	Conforms to TR-NWT-000063
Maintenance Aisle, Front (minimum width)	30 in.
Wiring Aisle, Rear (minimum width)	24 in.
Maximum Shipping Size (packaged)	90 in. (W) x 100 in. (H) x 46 in. (D)

Environmental Specifications

The environmental specifications for the DACS IV-2000 include the thermal characteristics; handling and transportation requirements; and earthquake, acoustical noise, electromagnetic compatibility (EMC), and electrostatic discharge (ESD) specifications. These environmental specifications conform to Bellcore TR-NWT-000063 *Network Equipment-Building System (NEBS) Generic Equipment Requirements (Issue 5, September 1993)* and TR-NWT-001089, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 2, June 1993).

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. 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. Relative humidity must be less than 68 percent for ambient temperatures above 95°F. At the short-term emergency condition of 120°F, the relative humidity must be below 20 percent.

The DACS IV-2000 remains operational when installed in central offices 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-21.

Table A-21. **Environmental Characteristics**

Item	Value
Normal Operating Temperature Range	+40° to +100°F (4.4° to 37.8°C)
Minimum Short-Term Temperature	+35°F (1.6°C)
Maximum Short-Term Temperature	+120°F (48.8°C)
Maximum Rate of Temperature Change	15°F (8.4°C) per hour
Operating Relative Humidity	20 to 55%
Minimum Short-Term Relative Humidity	10%
Maximum Short-Term Relative Humidity	80% and < 0.024 lb of water/lb of dry air

Table continued on next page.

Table A-21. **Environmental Characteristics (Continued)**

Item	Value
Operational Altitude	From 200 ft below to 13,000 ft above sea level
Equipment Cooling	Forced Convection
Fire Resistance and Dust	Conforms to TR-NWT-000063
Standard Heat Dissipation	Conforms to TR-NWT-000063

Handling and Transportation

The DACS IV-2000 meets the shock, vibration, temperature, and relative humidity requirements specified in TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993) for handling and transportation. (See Table A-22.)

Table A-22. **Handling and Transportation Specifications**

Item	Value
Vibration and Shock Design Criteria	Conforms to TR-NWT-000063
Temperature for Transportation/ Storage	Conforms to TR-NWT-000063
Relative Humidity for Transportation/ Storage	Conforms to TR-NWT-000063
Altitude for Storage/Shipment	Up to 40,000 ft, conforming to TR-NWT-000063

Earthquake, Acoustical Noise, EMI, and ESD

The DACS IV-2000 meets the earthquake and office vibration criteria for zone 4 earthquake protection specified in TR-NWT-000063, Issue 5. It meets the acoustical noise limits specified for CO indoor telephone equipment in TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993).

The design techniques for the DACS IV-2000 minimize emissions for an open frame design. The objective is to conform to the emission and immunity EMC limits as outlined in Part 15, Subpart J, of the FCC rules for Class A Computing Devices; see TR-NWT-000063, *Network Equipment-Building System (NEBS) Generic Equipment Requirements* (Issue 5, September 1993) and TR-NWT-

001089, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 2, June 1993).

The DACS IV-2000 is designed to meet the ESD requirements specified in TR-NWT-001089, *Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment* (Issue 2, June 1993).

ESD grounding connections are provided on the front and rear of each bay, and the use of wrist straps is required. EMI 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-23.

Table A-23. **Earthquake, Acoustical Noise, EMC, and ESD Specifications**

Item	Value
Earthquake and Office Vibration	Conforms to TR-NWT-000063
Acoustical Noise Limits under Normal Operating Temperatures	< 60 dBA Conforms to TR-NWT-000063
Electromagnetic Compatibility (EMC) with EMI Enclosures	Conforms to TR-NWT-001089, Part 15, Subpart J, *Class A Computing Devices*
Electrostatic Discharge (ESD) with EMI Enclosures	Conforms to TR-NWT-001089

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. The specifications are greater than 9000 years per DS3/STS1 and greater than 17,000 years per DS1. The outage time is less than 0.013 minute per year per DS3/STS1, and less than 0.007 minute per year per DS1, as specified in Bellcore TA-NWT-000233, *Wideband and Broadband Digital Cross-Connect Systems Generic Criteria* (Issue 1, November 1993) and TA-NWT-001339, *General Reliability Requirements for Digital Cross-Connect Systems* (Issue 1, November 1993).

Mean Time Between Maintenance Activities

Reliability is specified in terms of Mean Time Between Maintenance Activities (MTBMA), which 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-24 is for fully equipped standard bays and depends on bay type. The MTBMA, MTBF, and outage time are based on 2 hours Mean Time To Repair (MTTR) as specified in Bellcore TA-NWT-000233, *Wideband and Broadband Digital Cross-Connect Systems Generic Criteria* (Issue 1, November 1993) and TA-NWT-001339, *General Reliability Requirements for Digital Cross-Connect Systems* (Issue 1, November 1993).

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 TA-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, December 1992).

Table A-24. **Availability and Reliability Specifications**

Item	Value	
	Collocated System	System with One Remote Complex
MTBF (per DS1)	17,000 years	17,000 years
MTBF (per DS3/STS1)	9000 years	9000 years
Outage Time (per DS1)	0.0107 min/year; better than TA-NWT-001339	0.0339 min/year; better than TA-NWT-001339
Outage Time (per DS3)	0.0167 min/year; better than TA-NWT-001339	0.0397 min/year; better than TA-NWT-001339
Outage Time (per DS3/STS1 to DS3/STS1)	0.0173 min/year; better than TA-NWT-001339	0.0405 min/year; better than TA-NWT-001339
Outage Time (per STS1)	0.0167 min/year; better than TA-NWT-001339	0.0399 min/year; better than TA-NWT-001339
MTBMA Switch Bay (fully equipped)	5840 hours	5840 hours
MTBMA STS1/DS3 Interface Bay (fully equipped)	4112 hours	4112 hours
MTBMA STS1/DS3/DS1 Interface Bay (fully equipped)	3793 hours	3793 hours
MTBMA DS1 Interface Bay (fully equipped)	5211 hours	5211 hours
MTBMA STS1/DS3 Interface Bay (fully equipped)	4112 hours	4112 hours
MTTR	2 hours	2 hours
Reliability Prediction Procedure	Conforms to TR-NWT-000332	Conforms to TR-NWT-000332

ROADS Standard Product Configurations

B

Contents

Contents

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 (512) platform, ROADS *only* supports Release 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," in the *DACS IV-2000 (256) Applications, Planning, and Ordering Guide* 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.

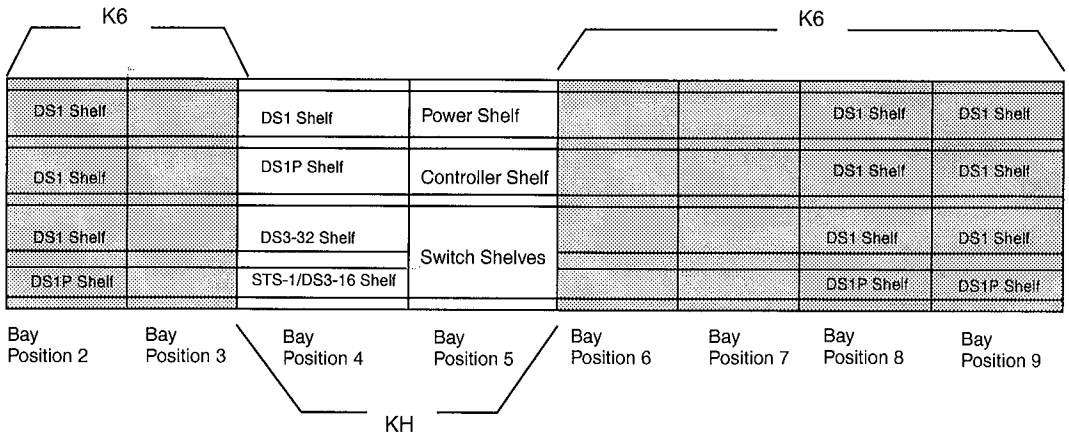


Figure B-1. **Sample Application Code KH**

Figure B-2 illustrates the (256) New System configuration with an STS-1/DS3 Bay.

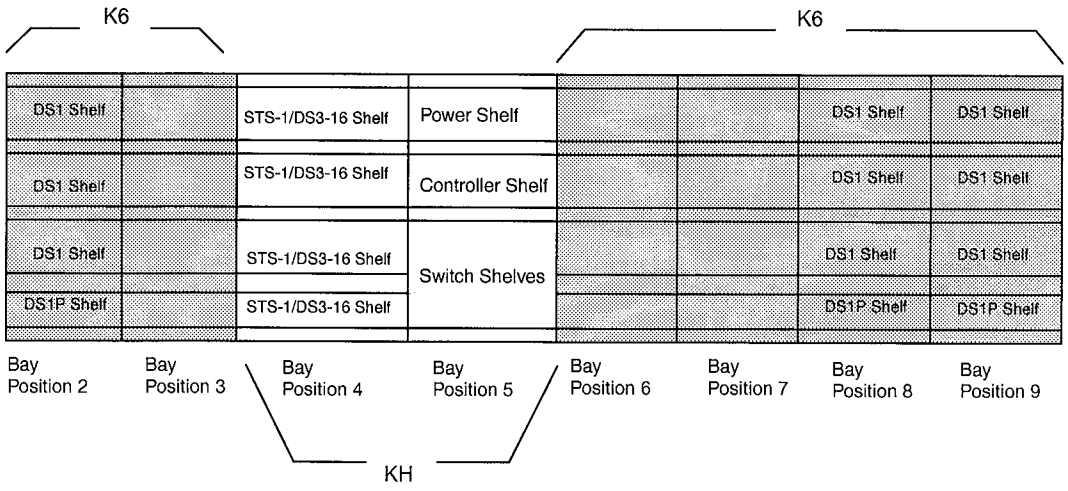


Figure B-2. **Sample Application Code KH with an STS-1/DS3 Bay**

(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," in the *DACS IV-2000 (256) Applications, Planning, and Ordering Guide* 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)**

<table>
<tr><th colspan="2">DS1/DS3/STS-1</th><th>DS1</th><th colspan="2">STS-1/DS3</th></tr>
<tr><td>DS1</td><td>0 to 868</td><td rowspan="6">0 to 868</td><td>DS3</td><td>0 to 60</td></tr>
<tr><td>DS3</td><td>0 to 46</td><td>STS-1</td><td>0 to 60</td></tr>
<tr><td colspan="2">OR</td><td rowspan="4">DS3 & STS-1</td><td rowspan="4">0 to 60</td></tr>
<tr><td>DS1</td><td>0 to 868</td></tr>
<tr><td>DS3</td><td>0 to 30</td></tr>
<tr><td>STS-1</td><td>0 to 16</td></tr>
</table>

System Dimensions/Floor Plan Requirements

Each bay for this configuration has a minimum dimension of 7ft. H x 26in. W x13in. 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 x13ft. W x 13in D.

Figure B-3 illustrates the growth bays that can be ordered with this configuration.

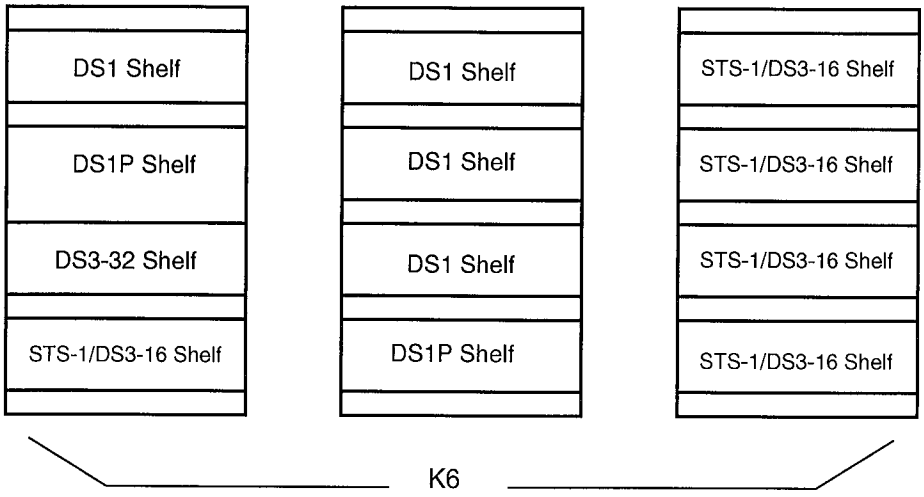


Figure B-3. **Application Code K6 Growth Bays**

(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," in the *DACS IV-2000 (256) Applications, Planning, and Ordering Guide* 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," 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.

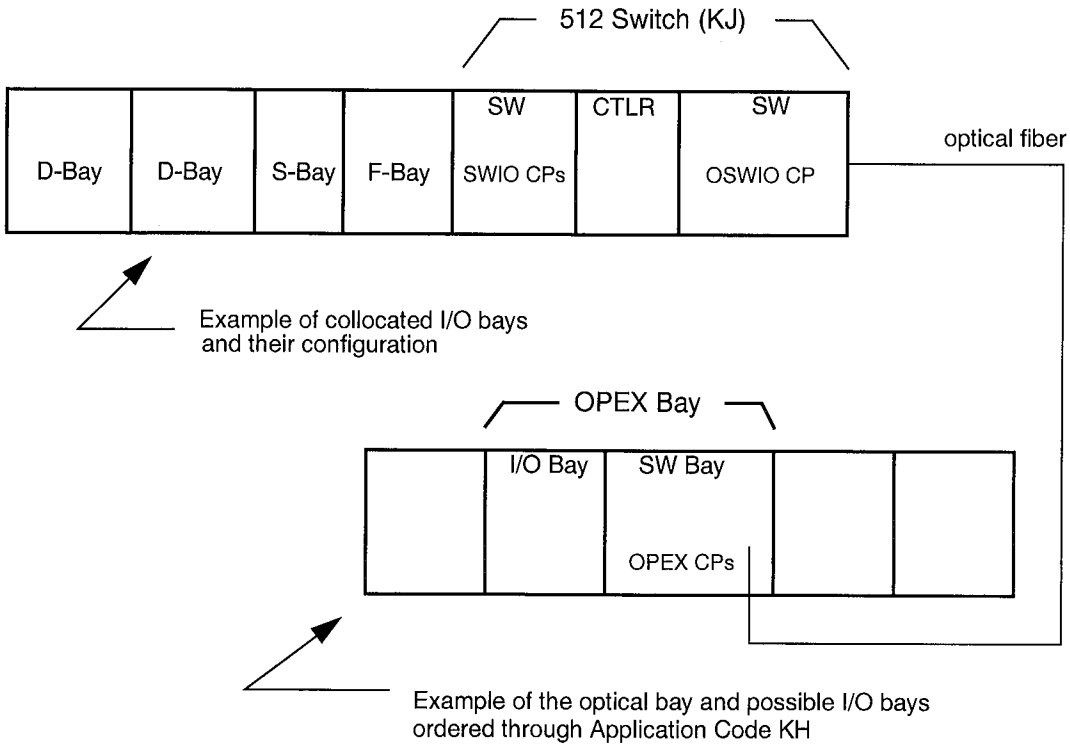


Figure B-4. **Sample Application Code KJ with Collocated and Optically Remoted Bays**

(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," 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 B ay	
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 x13in. 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.

Figure B-5 illustrates the bay types in Application Code K8.

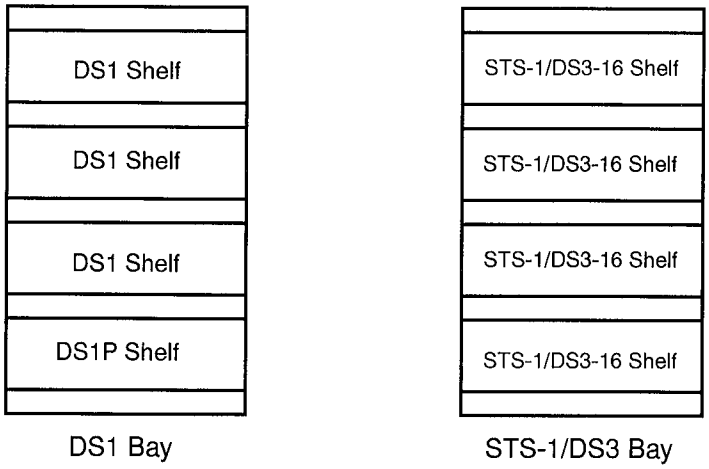


Figure B-5. **Sample Application Code K8**

(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, 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.

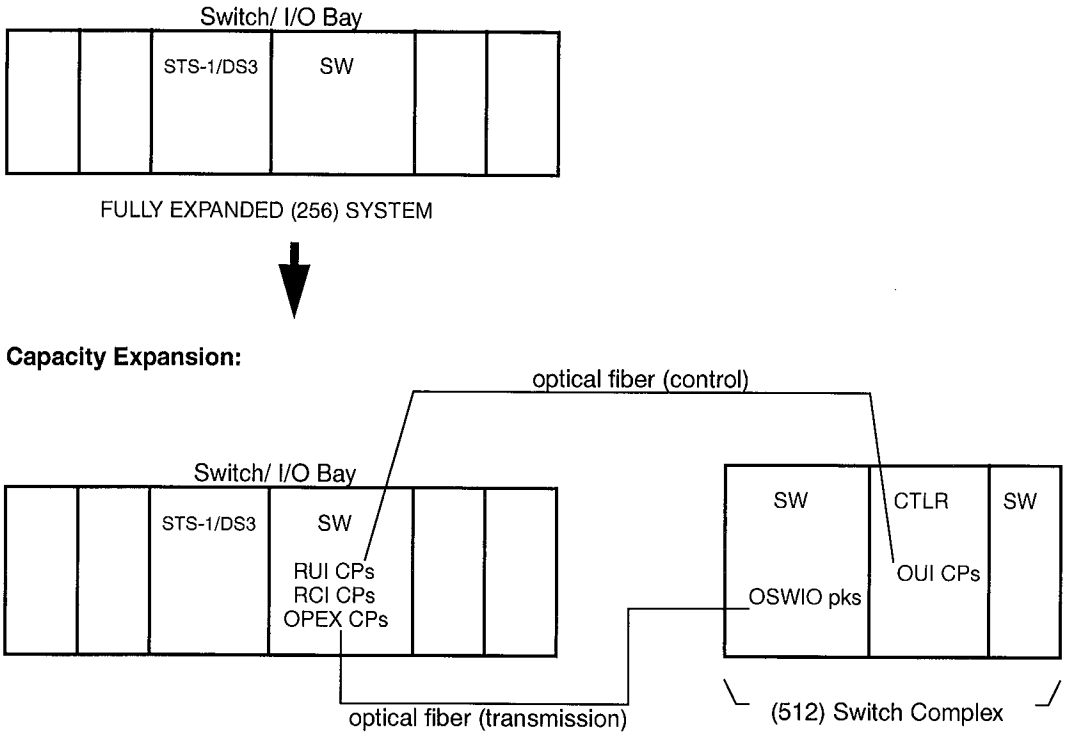


Figure B-6. **Sample Application Code K9**

Glossary

A

Absent (ABS)
The circuit pack or a blank circuit pack is not in the associated slot.

Active (ACT)
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
An indication that a failure has occurred within a piece of equipment and/or a transmission facility.

Alarm Cutoff (ACO)
A button on the Status Panel used to silence audible alarms. Audible alarms can also be silenced using the `OPR-ACO-ALL` command.

Alarm Delay
Specifies the alarm delay (in seconds) for software-detected alarm conditions. Initial value is 10 seconds.

Alarm Indication Signal (AIS)
A signal transmitted downstream if the incoming signal is defective.

Alarm, Scan, and Control (AS&C) Points
Interface between the DACS IV-2000 and telemetry operations systems (OSs).

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 (AMI)
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.

Available (AVAIL)
Circuit pack or interface module is not provisioned and not assigned in the database. The circuit pack or interface module is not monitored 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.

Battery Distribution Feeder Board (BDFB)
Lineage 2000 (or equivalent) battery plant (-48 Vdc nominal) used to supply power to the DACS IV-2000. New Release 4.0 frame orders use two BDFBs (red and blue power feeds), while existing frames software upgraded to Release 4.0 use one BDFB

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 (BER) Threshold
Point at which an alarm is issued for bit errors.

Blank (BLK)
Circuit pack slot containing a bus extender (blank) circuit pack.

Blue Code
Same as alarm indication signal (AIS).

Boot
To transfer contents of backup memory into the system's working memory.

Bridge
To take a signal from a single input port and connect it to multiple output ports.

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

Call Redirect
Autonomous action taken when the ECI circuit pack that an X.25 network is connected to fails. A call redirect takes up to 2 minutes to complete and switches the X.25 network to the working ECI circuit pack.

Capacity Expansion
Feature that allows customers to minimize the number of DACS IV-2000 frames needed in larger offices by absorbing up to two DACS IV-2000 (256) systems into the Switch Complex of a DACS IV-2000 (512) system.

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.

Collocated
A standalone system in which the interface bays are electrically and physically connected to the Switch Complex.

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.

Communication Interface Link (CILINK)
Access port that allows users or operations systems (OSs) to communicate with the DACS IV-2000.

Condition
The type of alarm failure, such as internal and loss of signal..

Control Cable ID
Specifies the controller cable (J cable) identification associated with an interface module or a DS3 performance monitor (DS3PM) circuit pack.

Control Complex (CC)
A set of circuit packs (CPU/MTC/SSC/SCI/UI) that provide all control functions for the DACS IV-2000. For the redundant controller, two control complexes are provided for increased reliability of the main controller.

Critical (CR)
Alarm that indicates a severe, service-affecting condition.

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.

Display Number
Specifies a TABS display number.

Double Ampersand (&&)
Specifies multiple addressed ranges of equipment, links, or ports. For example, 1&&-6 means equipment/link/port locations 1 through 6.

Driven
A condition in which an interface with a connection is being monitored.

DS1GRP
A group of 28 DS1 ports in an 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 Mbps (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.

DS2 Signal
A logical signal with a data rate of 6.312 Mbps (ANSI T1.107). A DS2 signal is produced by combining seven DS1 signals.

DS3 Clear-Channel Interface-16 Module
A DS3 Interface-16 Module that contains one to fifteen MUX3 circuit packs, one MUXP3 circuit pack, and no MUX2 circuit packs.

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 Mbps (ANSI T1.107). For the DACS IV-2000, a traffic-carrying DS3 signal is either framed or unframed (MUX3 only). A framed 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 µs 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. An unframed DS3 is any DS3 conformant to electrical specifications in ANSI T1.102-1994.

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).

Duplicate Control Complex
A set of circuit packs (CPU/MTC/SSC/SCI/UI) that provides all control functions for the DACS IV-2000. For the high capacity-controller, the main controller functions are duplicated by the two Control Complexes.

E

Echo
To display an input at a terminal. (A user ID is echoed, but a password is not.)

Electrical Carrier 1 (EC-1)
The industry standard nomenclature for an electrical STS-1 signal.

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 Bay
An interface bay containing seismic bay framework.

Enhanced DS3 Interface-16 Module
A DS3 Interface-16 Module that contains at least one MUX3 circuit pack and one MUXP3 circuit pack in addition to one or more MUX2 circuit packs.

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 (EQPT)
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).

Far-end
Equipment not associated with the DACS IV-2000 frame currently being communicated with over the CILINKs.

Fault
The circuit pack has a hard (not temporary) fault and can not provide its normal function.

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.

Group Numbering Method
The numbering method using the combination of the VT1.5 group and the VT1.5 port for DS1 and VT1.5 signals within STS1 interface modules.

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.

Input Status
The input signal status of a DS1, DS3, VT1.5, or STS1 interface port, which can be:

- DRVN (driven) — indicates that a valid signal is expected at the Port, the Port is being monitored for incoming failures, and no incoming failures are currently detected.
- NDRVN (not driven) — indicates that no valid signal is expected at the Port, and the port is not monitored for failures. If the port is formatted, Performance Monitoring data is accumulated.
- INIT (initialized) — is used for an initialized (unset) value (in this case, the port is considered not driven until a valid signal is detected, at which time it becomes DRVN).
- QRSS (quasi-random signal source) — is used to indicate that the DS1 signal is provisioned as the QRSS source for the system. Only one Input Port can be designated as the QRSS Port at any given time. Attempting to specify QRSS for more than one port is denied.

In-Service
A state in which the circuit pack is performing normal service functions, in either active or standby mode.

Intertie
A facility interface between two DACS IV-2000 systems.

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 (LPBK)
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.

Major (MJ)
Indicates a service-affecting failure, main or unit controller failure, or power supply failure.

Maintenance Condition (MCOND)
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 can not 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.

Minor (MN)
Indicates a non-service-affecting equipment or facility failure.

Multiplexer
An electronic device that allows two or more signals to pass over one communications circuit.

Multipoint Address
Specifies the Layer 2 (multipoint) address used on a TABS link.

N

Near-end
Equipment associated with the DACS IV-2000 frame that is currently being communicated with over the CILINKs.

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.

N-Rate Cable
A cable that carries an N-rate signal (27.648 Mbps), which includes 14 DS1 signals, half of an STS-1(cc-SPE) signal, or 14 STS-1(VT1.5) signals and timing information. There are four N-rate cable groups:

- R1 — from SWIF, MUX, or SMUX to SWIO
- X1 — from SWIO to SWCS
- Y1 — from SWCS to SWIO
- T1 — from SWIO to SWIF, MUX, or SMUX.

O

Optical Extension (OPEX)
Circuit pack, module, and bay that allow one or two DACS IV-2000 (256) systems to be optically connected to a DACS IV-2000 (512) Switch Complex.

.Optical Remoting
The optional feature in which optical fibers and circuit packs connect interface bays. Optical Remoting is used to accomplish capacity expansion.

Optical Unit Interface (OUI)
A circuit pack in the High-Capacity Controller that extends the LAN distribution and error summary functions to the Unit Controller and power circuit packs in the interface modules of a Remote Complex.

Outage
A disruption of service that lasts for more than 1 second.

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.

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).

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 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.

Port Numbering Method
The numbering method using the sequence of 1 to 28 VT1.5 or VT1.5(DS1) signals within an STS-1 signal.

Primary Line
The second line in an output message.

Program
The software that directs the operation of the main controller and other frame elements.

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 (PROV)
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

Red-lined
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.

Remote Complex
A system in which the interface bays are optically connected but not physically connected to the Switch Complex.

Remote Unit Interface (RUI)
The Remote Unit Interface Module is located in a shelf in the OPEX bay. This module replaces the 256 Redundant Controller Module in capacity-expansion applications. The RUI supports the Remote Complex fiber interface to the Optical Unit Interface in the Switch Complex Main Controller.

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.

Rollover
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.

Sequential Numbering Method
The numbering method using the sequence of 1 to 28 VT1.5 or VT1.5(DS1) signals within an STS-1 signal.

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.

Single Ampersand (&)
Specifies multiple addressed equipment, links, or ports. For example, 1&-5 means equipment/link/port locations 1 and 5.

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 point release
- a 3-digit number that indicates the issue of the point release
- one letter that indicates the load of the software 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 (STBY)
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).

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 μs 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 Synchronous Payload Envelope (STS SPE)
A 125-μs 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.

STS-1 Signal
The basic building block signal in the SONET standard. An STS-1 signal has a data rate of 51.84 Mbps. 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 μs. 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.

Subrate
In the Digital Data System, a data bit rate that is either 2.4, 4.8, or 9.6 kbps

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

T1
Transmission carrier system at the rate of 1.544 Mbps (same as DS1 signal).

T2
Transmission carrier system at the rate of 6.312 Mbps (same as DS2 signal).

T3
Transmission carrier system at the rate of 44.736 Mbps (same as DS3 signal).

Terminated
Output mode in which idle code is transmitted downstream.

Test Access
Allows the DACS IV-2000 the ability to apply and monitor test signals in accordance with Bellcore TA-TSY-000203.

Test Mode
Specifies the test access mode.

Test Signal Identification (TSID)
Unique name given to a DS1 test signal

Tributary
One of the 28 DS1 (1.544 Mbps) channels in a DS3 (44.736 Mbps) signal or one of 28 VT1.5 (1.728 Mbps) channels in an STS-1 (51.84 Mbps) 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
- 16EDS3 — for Enhanced DS3 Interface-16 Module
- 16DS3CC — for DS3 Clear-Channel (DS3CC) Interface-16 Module
- 16STS1 — for STS1 Interface-16 Module
- DS1 — for DS1 Interface Module
- DS1P — for DS1 Interface-Protection 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 Mbps. 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 µs 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-µs superframe structure overlaid on, and aligned to, a 125-µs STS1 SPE. Contained within this structure is the VT payload pointer and the VT SPE.

VT Synchronous Payload Envelope (VT SPE)
A 500-μs 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 STS-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

ABN	Abnormal
ABS	Absent
ACO	Alarm Cutoff
ACT	Active
AIS	Alarm Indication Signal
ALS	Alarm Indication Signal/Loss of Pointer Second
AMI	Alternate Mark Inversion
AS&C	Alarm, Scan, and Control
ASCII	American Standard Code for Information Interchange
AUX PWR	Auxiliary Power
AVAIL	Available

B

B8ZS	Bipolar with 8-Zero Substitution
BDFB	Battery Distribution Feeder Board
BEC	Block Error Count
Bellcore	Bell Communications Research
BER	Bit Error Rate
BESP	Path Bursty Errored Seconds
BIP	Bit Interleaved Parity
BLK	Blank
BPV	Bipolar Violation
BRT-2000	Business Remote Terminal-2000
BX	Bus Extender

C

CB	AT&T Compatibility Bulletin
CC	Control Complex
CE	Capacity Expansion
CE&T	AT&T Network Systems Customer Education and Training
CIC	Customer Information Center
CILINK	Communication Interface Link
CL	Clear
CLFI	Common Language Facility Identifier
CLKDR	Clock Distributor
CLKGN	Clock Generator
CLLI	Common Language Location Identifier
CP-BITS	Copy of Parity Bits
CPU	Central Processing Unit
CR	Critical
CRC	Cyclic Redundancy Code
CSS	Controlled Slip Second
CTS	Clear-to-Send
CV	Coding Violation
CVL	Line Code Violation

D

DA	Discontinued Availability
DACS	Digital Access and Cross-Connect System
DL	Data Link
DM	Degraded Minute
DPLL	Digital Phase Lock Loop
DPLL2	Digital Phase Lock Loop 2
DRVN	Driven
DS1TX	DS1 Timing Extractor
DS3CC	DS3 Clear-Channel
DSAB	Digital Systems Access Bay

E

EC-1	Electrical Carrier-1
ECI	Enhanced Communications Interface
EDSX-1	Electronic DSX-1
EEE	ESF Error Event path
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ENH DS1 INTFC	Enhanced DS1 Interface
ENH DS3 INTFC-16	Enhanced DS3 Interface-16
ENH DS1 INTFC	Enhanced DS1 Interface
EQPT	Equipped
ES	Errored Second

ESD	Electrostatic Discharge
ESF	Extended Superframe
ESL	Line Errored Second
ESP	Path Errored Second

F

F&A	Fuse and Alarm
FB	Fuse Board
FC	Failure Count
FE	Far End
FEBE	Far-End Block Errors
FEPS	Facility and Equipment Planning System
FMA-BITS	F and M Bits Adjusted
FMN-BITS	F and M Bits Nonadjusted
FPD	Floor Plan Data
FS & ALM	Fuse and Alarm
Fuse 1-15	

G

GTP	General Telemetry Processor

H

HCC	High Capacity Controller
HDA	Header Designation Assembly

I

IEC	Inter-Exchange Carrier
INIT	Initialized
Inter-LATA	Inter-Local Access and Transport Area
INTFC	Interface
INTFC-P	Interface-Protection
IS	In Service

L

LATA	Local Access and Transport Area
LBO	Line Buildout
LED	Light Emitting Diode
LOF	Loss-of-Frame
LOS	Loss of Pointer
LOP	Loss-of-Signal
LOSS	Loss of Signal Second
LPBKI	Internal Loopback
LPBKL	Line Loopback
LPBKM	DS1 Tributary Loopback Tributary Loopback
LPBKT	Terminal Loopback
LSSGR	LATA Switching Systems Generic Requirements

M

MC	Main Controller
MC FAIL	Main Controller Failure
MCOND	Maintenance Condition
MEM	Memory Storage
MJ	Major
MN	Minor
MTBF	Mean Time Between Failures
MTBMA	Mean Time Between Maintenance Activities
MTC	Maintenance Interface
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
NMA	Network Monitoring Analysis
NORM	Normal
NOVAL	No Value

O

OC Optical Carrier
OCS Operations Communications System
OOF Out of Frame
OOFS Path Out-of-Frame Second
OPEX Optical Extension
OPEX PWR Optical Extension Power
OPS/INE Operations System/Intelligent Network Element
OR Optical Remoting
OS Operations System
OSWIO Optical SWIO Optical Switch Input/Output
OUI Optical Unit Interface

P

PAD Packet Assembler/Disassembler
PCM Pulse Code Modulation
PCV Path Code Violation
PM Performance Monitoring
PMGR Performance Monitoring Generator and Receiver
POH Path Overhead
POS Provisioned Out-of-Service
PRI Primary
PRI-1,-2 Primary Storage1,-2
PRM Performance Report Message
PSET Parameter Set
PTY Parity
PWR Power

Q

QRSS Quasi-Random Signal Source

R

RCI Remote Communications Interface
REPT Report
RL Retry Later
RMS-DS1/SARTS Remote Measuring System - DS1 Switched Access Remote Testing System
RT Remote Terminal
RTAC Regional Technical Assistance Center
RUI Remote Unit Interface
RUI FAIL Remote Unit Interface Failure
RUI PWR Remote Unit Interface Power
RX Remote Complex
RY Relay

S

S/N Signal-to-Noise
SARTS Switched Access Remote Testing System
S-Bit Stuff Bit
SCCS Switching Control Center System
SCI Switch Communications Interface
SEC Secondary Secondary Storage
SEFS Severely Errored Frame Second
SES Severely Errored Second
SESL Line Severely Errored Second
SESP Path Severely Errored Second
SF Superframe
SHORTINT Short Interval
SLMF Signal Label Match Failure
SLS Slip Second
SMUX SONET Multiplexer
SMUXP SONET Multiplexer Protection
SONET Synchronous Optical Network
SPCS Stored Program Control Systems
SPE Synchronous Payload Envelope
SQPGR Software Quality Program Generic Requirements
SRD Software Release Description
SRQAC Software Reliability and Quality Acceptance Criteria

SSC	Secondary Storage Controller
SSS	Secondary Storage Subsystem
STBY	Standby
STPNL	Status Panel
SW	Switch
SW PWR	Switch Power
SWCS	Switch Center Stage
SWIF	Switch Interface
SWIO	Switch Input/Output
SWSLMF	Switch Signal Label Match Failure
SYNC	Synchronizer

T

TA	Technical Advisory
TABS	Telemetry Asynchronous Block Serial
TACC	Test Access
TBS	Time Base
TBS32	Stratum 3 Time Base Oscillator 2
TCA	Threshold Crossing Alert
TERM	Terminated
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
TR	Technical Reference
TRANSID	AT&T Transport Self-Identification Plan
TSGR	Test Signal Generator and Receiver Transport Systems Generic Requirements
TSID	Test Signal Identification
TX	Timing Extractor

U

UAS	Unavailable Second
UC	Unit Controller
UCAL	User Community Authorization Level
UI	Unit Interface
UNF	Unframed

V

VF	Voice Frequency
VT	Virtual Tributary

W

WDCS	Wideband Digital Cross-Connect System
WKG	Working

Index

Numerics

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W

X