TECHNICAL DESCRIPTION

AT&T

Transmission Systems

DIGITAL ACCESS AND CROSS-CONNECT SYSTEM II - INTEGRAL SHELF CROSS-CONNECT (DACS II ISX) RELEASE 1.0

General

This document provides an overview of the AT&T DACS II ISX Release 1.0 benefits, features, and applications. DACS II ISX Release 1.0 supports up to 64 T1 or E1 facilities and provides 64 kbit/s cross connections, specific ranges of 64 kbit/s cross connections, 64 kbit/s test access, 1.544 Mbit/s ANSI/Bellcore compliant Performance Monitoring, and complies with the CCITT specifications applicable for 2.048 Mbit/s interfaces. The gateway feature supported by DACS II ISX provides one-way and two-way 64 kbit/s two-point cross-connections between T1 and E1 facilities along with 64 kbit/s test access. DACS II ISX is a single, rack mountable shelf that meets global standards for Electromagnetic Compatibility (EMC) and Electrostatic Discharge (ESD).

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Organization

This Customer Information Release (CIR) – Technical Description consists of a cover sheet and an attachment which contains the detailed information for the DACS II ISX Release 1.1 benefits, features, and applications.

DACS II ISX Documentation

Additional documentation on DACS II ISX may be ordered from the AT&T Customer Information Center by calling 1-800-432-6600 (1-800-432-8432 for CIRs).

Distribution

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ATTACHMENT
Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect (ISX)
Release 1.1 Technical Description

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ATTACHMENT
Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect (ISX)
Release 1.1 Technical Description

1. OVERVIEW

The Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect (DACS II ISX) Expansion Shelf is the latest addition to the AT&T Network Systems DACS II product line. The DACS II ISX Expansion Shelf increases the transmission line capacity of the DACS II ISX Main Shelf. The DACS II ISX system including the DACS II ISX Expansion Shelf joins the DACS II Enclosed Single Bay Frame (ESBF) and the DACS II Enclosed Capacity Expansion Frame (ECEF) as an economic alternative for low capacity 1/0 cross-connect applications.

The DACS II ISX Main Shelf is a single shelf, software-based, digital cross-connect system that terminates up to 64 T1 or E1 transmission lines and provides the same 64 kbit/s and Nx64 kbit/s circuit cross-connect features supported by DACS II ESBF and DACS II ECEF. An additional 64 T1 or E1 transmission lines can be terminated on the DACS II ISX Expansion Shelf increasing the total capacity of the system to 128 T1 or E1 transmission lines. The additional capacity provided by the Expansion Shelf does not require any hardware upgrades to the Main Shelf.

Note: Within this document, 1.544 Mbit/s signals are referred to as T1 signals. Likewise, 2.048 Mbit/s signals are referred to as E1 signals.

As in the other DACS II systems, the DACS II ISX system also supports a variety of maintenance functions such as 64 kbit/s test access, Nx64 kbit/s test access for E1 signals, and transmission line performance monitoring as specified in the ANSI, Bellcore, and CCITT standards. Both the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf meet stringent environmental, Electrostatic Discharge (ESD), and Electromagnetic Compatibility (EMC) standards for a variety of customer applications.

Centralized network control is provided by the I-2000 Controller, allowing the DACS II ISX system to be easily added to existing DACS II networks. The I-2000 Controller supports remote provisioning, centralized control and service monitoring of DACS II networks. The DACS II ISX Main Shelf supports one RS-232D compliant synchronous administrative link, running X.25 protocol and four RS-232D compliant asynchronous administrative links, running Snider protocol for connecting to local and remote operators, or operations systems such as the I-2000 Controller.

Operators or operations systems communicate with the DACS II ISX system by using one of two languages: PDS (Program Documentation Standard) or MML (HuMan to Machine Language). These languages are also used by DACS II ESBF and DACS II ECEF, providing a uniform user interface across all DACS II products.

2. DACS II ISX BENEFITS

The DACS II ISX Main Shelf uses proven DACS II technology to provide economic 1/0 cross-connect solutions to customers that require 64 or fewer T1 or E1 transmission line terminations. The system is easily expandable to accommodate an additional 64 T1 or E1 transmission lines via the DACS II ISX Expansion Shelf without any hardware upgrades to the Main Shelf.

For these low capacity applications, DACS II ISX offers most of the same benefits of DACS II ESBF and DACS II ECEF. Some of these benefits include:

- **Equipment Elimination.** DACS II replaces back-to-back channel banks used to provide consolidation for special services. Channel connections are completely digital, eliminating the need of digital-to-analog-to-digital signal conversions.
- **Centralized Operations.** A DACS II can be placed at centralized points in a network to monitor and control the network. A database is maintained by DACS II that consists of frame equipage and all of the cross-connections that have been established. This database can be queried from a central administrations center over one of the administrative links.
- **Fast Provisioning and Restoration.** A central Operations System can communicate with DACS II to establish new cross-connections. This capability reduces operational expenses and speeds up the provisioning procedure, reducing costly waiting time between order receipt and service cutover.
- **Circuit Testing.** DACS II can be used to both monitor and split DS0 channels thus providing a convenient test access point in the network.
- **Performance Monitoring.** DACS II monitors various transmission line performance parameters and reports the collected data either on demand or autonomously when alarm thresholds are reached.

In addition to these existing DACS II benefits, the DACS II ISX also offers the following new benefits.

- **Low Start Up Cost.** The DACS II ISX system proves economical for small capacity applications, allowing DACS II technology and operations to be used in applications once considered too small for DACS II.
- **Compact, Single Shelf Design.** Its compact design allows the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf to be mounted in racks along with other network equipment, accommodating various customer configurations and saving valuable office space. In addition, because the DACS II ISX Main Shelf is a single unitized shelf, installation, maintenance, and system growth are simple and straightforward.
- **Automatic Database Backup Process.** During normal operation, no manual maintenance operations are required. System database backups occur automatically after every transaction (for example, a cross-connect or disconnect). This feature enables the DACS II ISX system to be installed at operational sites.
- **Low Power Consumption.** The DACS II ISX system was designed to lead all vendors in power efficiency, requiring no more than 150 Watts for a fully equipped Main Shelf and no more than 75 Watts for a fully equipped Expansion Shelf for a total power consumption of less than 225 Watts for a fully equipped system consisting of a DACS II ISX Main Shelf and a DACS II ISX Expansion Shelf.
- **Easy Growth and Inventory.** Increasing capacity on the DACS II ISX Main Shelf is accomplished by simply adding T1 or E1 interface circuit packs. No additional common equipment is required. Its integrated design also reduces the number of required circuit packs and greatly simplifies equipment ordering and inventory. The same T1 and E1 interface circuit packs and power units that are used on the DACS II ISX Main Shelf are also used on the DACS II ISX Expansion Shelf.

- **Software-Based System Control.** The DACS II ISX system is a software-based cross-connect system. New features are placed into service by simply downloading new software into the DACS II ISX.
- **Common Interface Circuit Packs with DACS II.** To help reduce end user circuit pack inventory, the DACS II ISX system has been designed to use the same T1 and E1 interface circuit packs used in Release 6.1 of DACS II ESBF and DACS II ECEF.
- **Operational Transparency with DACS II.** The DACS II ISX system user interface (protocol and message languages) is based on that of DACS II ESBF and DACS II ECEF. Similar interfaces greatly simplify craft training and maintenance and allow a uniform operations flow in a network containing all members of the DACS II product line.
- **I-2000 Controller Support.** The AT&T I-2000 Controller supports provisioning, monitoring, and maintenance of the entire DACS II product line, including the DACS II ISX system.

3. DACS II ISX FEATURES

DACS II ISX has been designed to meet customer needs for providing DACS II features for small capacity 1/0 cross-connect applications. Its compact size, low startup cost, and low power consumption make DACS II ISX ideal for satisfying these customer needs. Operationally, DACS II ISX provides many of the same features and capabilities that DACS II currently offers. These features and capabilities are summarized below.

- **Transmission Line Terminations**
  - — Capacity: The DACS II ISX Main Shelf supports a mix of up to 64 T1 and E1 transmission lines. An additional 64 T1 or E1 transmission lines can be terminated on the DACS II ISX Expansion Shelf increasing the total capacity of the system to 128 T1 or E1 transmission lines.
  - — T1 interfaces: DACS II ISX supports standard D4, Extended Superframe (ESF) and T1DM DS1 framing formats. It provides ANSI T1.403 and Bellcore TR-TSY-000820 compliant T1 performance monitoring.
  - — E1 interfaces: The DACS II ISX E1 interface complies with CCITT recommendations G.703, G.704, G.706. It provides CCITT G.784 and G.826 compliant E1 performance monitoring.
  - — Optional Coaxial Adapter Panels are available for terminating 75 Ohm coaxial E1 cabling on both the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf.
- **Cross-Connection Features**

  DACS II ISX supports the following types of 64 kbit/s and Nx64 kbit/s connections:
  - — Two-way, two-point connections
  - — One-way, two-point connections
  - — Broadcast multipoint connections with switchable return path

— T1/E1 gateway connections (including A-law to μ-law conversion and ABCD signaling conversion).

In addition, DACS II ISX supports the following enhanced cross-connect features for E1 Time Slot 0 (TS0) and Time Slot 16 (TS16):

- E1 TS0 cross-connections (both TS0 to TS0 and TS0 to non-TS0) allow DACS II ISX to pass TS0 spare bit information between two network elements.
- E1 TS16 cross-connections allow DACS II ISX to pass TS16 spare bit information between two network elements.

- **64 kbit/s Test Access Features**
  - — DACS II ISX allows for the connection to external test equipment by providing 64 kbit/s circuit test access for nonintrusive circuit monitoring and for intrusive two-way circuit splitting. In addition, DACS II ISX can be used as a test access concentrator by hubbing test facilities from other DACS II systems to a single DACS II ISX and then connecting that DACS II ISX to an external test system.
  - — DACS II ISX provides up to eight software definable Test Access Digroups (TADs) which provide external test systems access to DACS II ISX circuits.
  - — Each TAD supports up to twelve two-way 64 kbit/s Test Ports (TPs). A TP provides external test systems with access to both directions of a 64 kbit/s circuit.
- **Nx64 kbit/s Test Access For E1 Signals**
  - — Some applications require more than one 64 kbits channel to carry data, e.g., video or high speed data communications. The Nx64 kbit/s Test Access feature allows for testing of Nx64 kbit/s services for 2 Mbit/s interfaces, where the value of N can range between 1 and 31.
- **Network Synchronization**
  - — The DACS II ISX Main Shelf's internal oscillator complies with North American Stratum 3 and CCITT Local Node standards.
  - — Redundant synchronization Timing References are provided by traffic carrying T1 or E1s. Selection of the Timing Reference signals is software programmable by the user.
  - — DACS II ISX automatically enters synchronization holdover if all redundant Timing References fail.
- **System Power**
  - — Both the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf operate on an input voltage range between –36 Volts DC and –75 Volts DC.
  - — For added reliability, both the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf support redundant input power feeds (Feeder A and Feeder B).
  - — Likewise, both the DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf provide 1+1 redundancy (load sharing) on its +5 Volt Power Units.

- **System Administration**
  - — To simplify operations within DACS II networks, DACS II ISX system administration (operations and commands) is based on that of DACS II ESBF and DACS II ECEF.
  - — Users can control a DACS II ISX system both locally and remotely via standard ASCII terminals or operations systems such as the I-2000 Controller.
  - — The DACS II ISX Main Shelf provides 1 synchronous (CCITT X.25) and 4 asynchronous (Snider) administrative interfaces for user access.
  - — PDS or MML message languages are available and are assigned on a per administrative link or per user basis.
  - — User logins are software definable and system security allows users to execute only those commands to which they are given access.
  - — The DACS II ISX Main Shelf uses redundant, non-volatile Memory Cards for backing up the system database and operating software.
  - — The DACS II ISX Main Shelf offers office alarm interfaces for reporting Critical, Major, and Minor alarms to local and remote alarm systems.

4. APPLICATIONS

The DACS II ISX system's compact design and low start up cost make it ideal for applications that were once considered too small for DACS II. When deployed in remote locations (for example, small end offices, cell sites, and customer premises), the DACS II ISX system offers a cost effective way to provide diverse circuit routing, disaster recovery resources, service monitoring, and remote digital test access. DACS II ISX systems in access networks can be integrated with DACS II ESBF/ECEF in larger hub offices to provide end-to-end service provisioning, testing, and maintenance. An entire DACS II network can be monitored and controlled from a central location by the AT&T I-2000 Controller.

Managing DACS II networks from centralized operations centers provides service providers with fast provisioning and centralized maintenance allowing them to offer their customers highly reliable services.

Some of the key DACS II ISX applications are identified below.

- **Circuit Grooming and Segregation.** DACS II ISX systems support 64 kbit/s and Nx64 kbit/s grooming and segregation in offices once considered too small for DACS II. This capability now allows service providers to optimize network utilization for even the smallest locations.
- **Back-To-Back Channel Bank Replacement.** DACS II ISX systems are more economical than back-to-back channel banks for ever smaller applications. DACS II ISX systems not only save on equipment costs, but also eliminates the manual activity previously required for circuit provisioning, circuit testing, and trouble sectionalization. This advantage can help service providers reduce service installation intervals and be more responsive to minimize service outage occurrences.

- **Network Restoration.** Because of its low startup costs, DACS II ISX systems can be deployed further and further into the access network. When utilizing the I-2000 Controller diverse access network routing capabilities, a DACS II ISX system and an I-2000 Controller can provide a quick and effective alternative for routing around network failures. The I-2000 Controller can be used to monitor DACS II networks and to initiate alternate configurations based on network failures reported by the DACS II systems. With DACS II ISX deployed in the access network, disaster recovery can be extended closer to the end user.
- **Hubbing Networks**. DACS II ISX systems can be used as an access vehicle for distributed networks. DACS II ISX systems can provide DACS II technology in small offices and can route service back to larger DACS II ESBF or DACS II ECEF hubs. Centralized network management via the I-2000 Controller can then be used to control all DACS II systems within the network.
- **International Gateway.** DACS II ISX systems support 64 kbit/s and Nx64 kbit/s gateway connections between T1 and E1 transmission lines. DACS II ISX not only provides the A-law to μ-law conversions and ABCD signaling conversions, but it also provides an efficient means for testing and monitoring international circuits.

5. DACS II ISX MAIN SHELF PHYSICAL DESCRIPTION

The DACS II ISX Main Shelf is 15.75" (400mm) high, 17.5" (445mm) wide, and 13.5" (343mm) deep and meets global (U.S. and international) standards for Electromagnetic Compatibility (EMC), Electrostatic Discharge (ESD), and environmental conditions. To accommodate various customer configurations, the DACS II ISX is rack-mountable on either a 19" ANSI/EIA standard frame, a 2' 2" Network Bay Frame (NBF), or a 600mm ETSI standard frame.

6. DACS II ISX MAIN SHELF SYSTEM LEVEL FUNCTIONS

The DACS II ISX Main Shelf is comprised of the following functional entities. Each of the items listed below is described in detail in the sections that follow.

- Two Network Processing Modules (NPMs)
- Two Synchronizer Cross-Connects (SXCs)
- One Main Controller (MC)
- One Status and Alarm Panel (SAP)
- Two Power Units (PUs).

Figure 1 shows the front view of the DACS II ISX Main Shelf's functional entities.

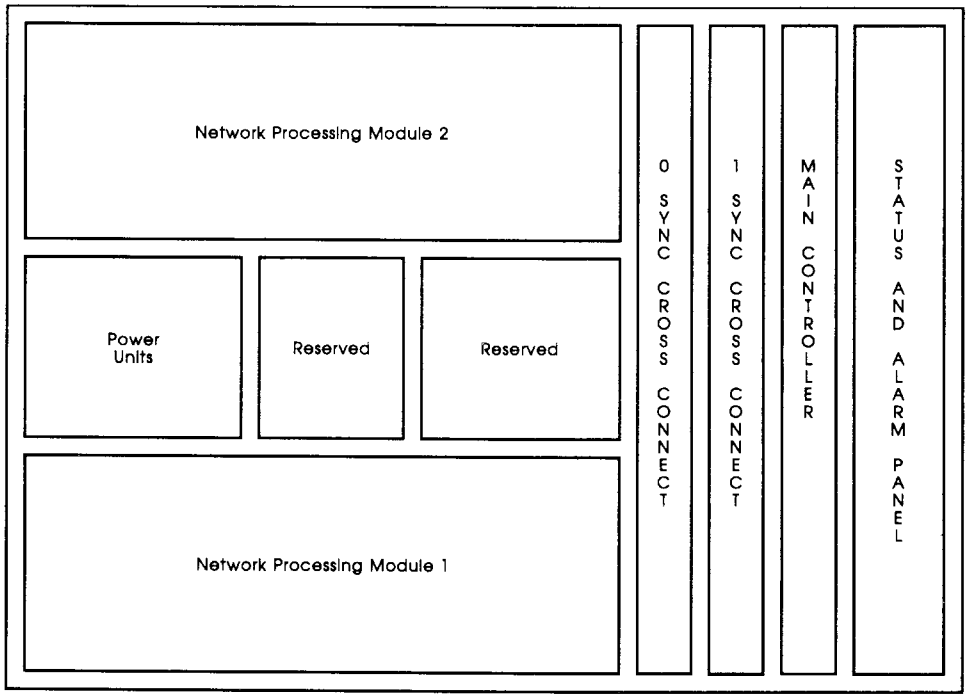

Figure 1 — DACS II ISX Main Shelf Functional Entities

Figure 2 shows the open-door front view physical layout of a DACS II ISX Main Shelf fully equipped with Enhanced Dual Digroup Circuit (EDDC) cards and a Bellcore compliant Status and Alarm Panel. The EDDC cards are described in the section that follows.

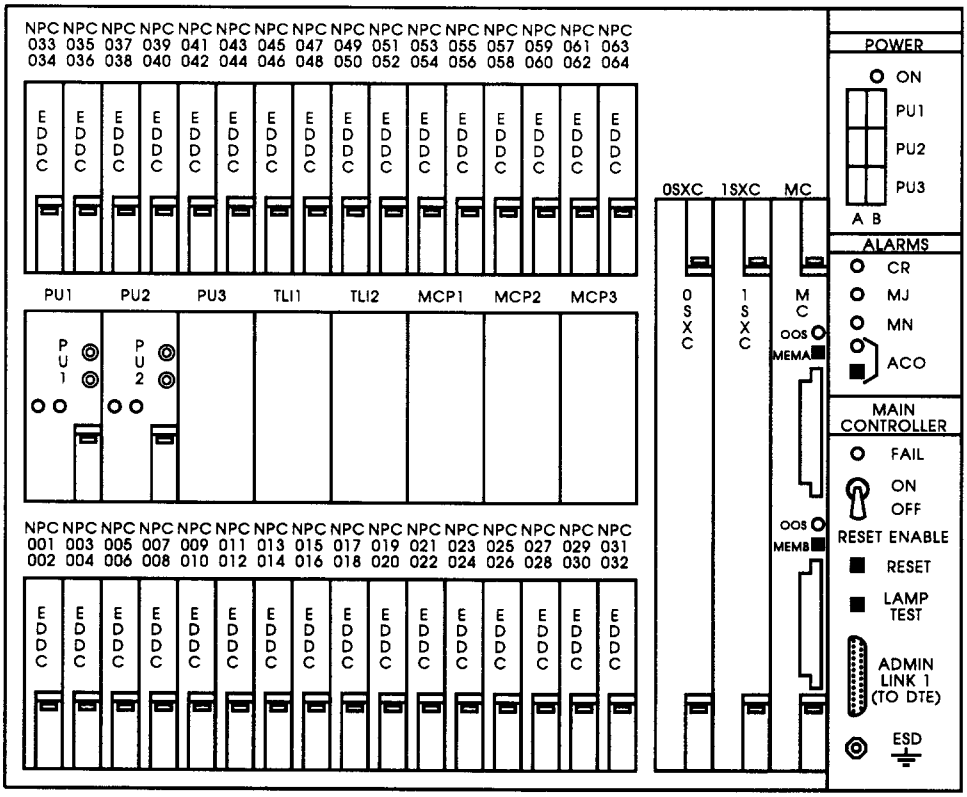

Figure 2 — Fully Equipped DACS II ISX Main Shelf (T1 Interface)

Note: The circuit pack slots labeled PU3, TLI1, TLI2, MCP1, MCP2, and MCP3 are not populated in Release 1.1.

Figure 3 shows the open-door front view physical layout of a DACS II ISX Main Shelf fully equipped with Enhanced Dual Primary Circuit (EDPC) cards and a CCITT compliant Status and Alarm Panel. The EDPC cards are described in the section that follows.

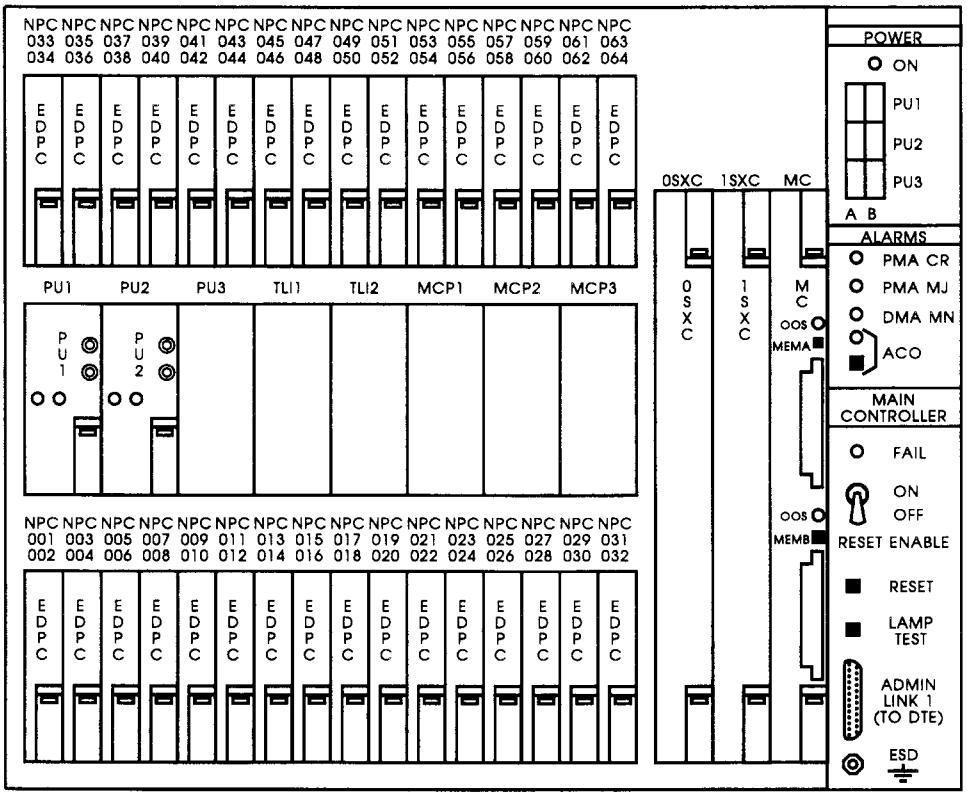

Figure 3 — Fully Equipped DACS II ISX Main Shelf (E1 Interface)

Note: The circuit pack slots labeled PU3, TLI1, TLI2, MCP1, MCP2, and MCP3 are not populated in Release 1.1.

6.1 Network Processing Modules (NPMs)

The DACS II ISX has two Network Processing Modules (NPMs) that contain the T1 and E1 line terminating circuit packs. Each NPM contains 16 circuit pack slots which can be populated with Enhanced Dual Digroup Circuits (EDDCs) for T1 terminations or with Enhanced Dual Primary Circuits (EDPCs) for E1 terminations. Each EDDC or EDPC pack terminates and processes two transmission line interfaces, referred to as Network Processing Circuits (NPCs). Therefore, a total of 32 NPCs can be supported in each NPM. For E1 interfaces, the EDPC pack is software programmable to support either 120 Ohm or 75 Ohm transmission lines.

In DACS II ISX, both T1 and E1 line terminating circuit packs can be equipped in an NPM. However, to provide compact transmission line cabling into the DACS II ISX Main Shelf, each NPM is divided into two Network Processing Sub-Modules with eight circuit pack slots (16 transmission lines) per Sub-Module. Each Network Processing Sub-

Module can be software provisioned to support T1 interfaces, 75 Ohm E1 interfaces or 120 Ohm E1 interfaces. This capability allows customers to tailor DACS II ISX to support their particular mix of T1 and E1 signals.

Separate transmit and receive transmission line connectors are provided at the rear of the DACS II ISX Main Shelf to connect transmission line cabling to each Network Processing Sub-Module. Coaxial Adapter Panels are available that are installed onto the Network Processing Sub-Module (NPSM) line interface connectors to convert from the connectors used for 100 Ohm and 120 Ohm twisted pair cables to 75 ohm coaxial connectors.

Two types of Coaxial Adapter Panels are available. One type converts the two 50-pin transmit/receive line interface connectors to 32 BT43 type coaxial connectors (ED9C199-30,G1). The other type converts the two 50-pin transmit/receive connectors to 32 DIN 1.6/5.6 coaxial connectors (ED9C199-30,G2).

Selection of capacitive or direct connector grounding is user switchable for each group of 8 terminations or sub-module. The Coaxial Adapter Panels are equipped on a NPSM basis; therefore, up to four Coaxial Adapter Panels can be installed on the Main Shelf.

Figure 4 shows the rear view of the DACS II ISX Main Shelf with a Coaxial Adapter Panel connected to one of the Sub-Modules.

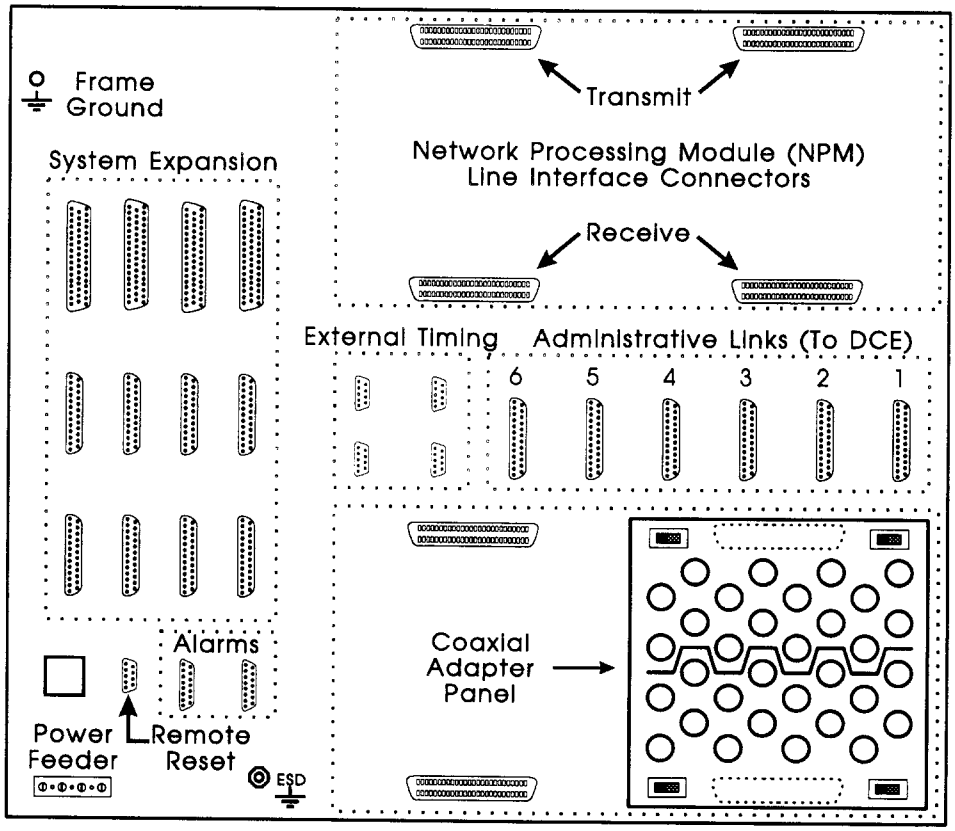

Figure 4 — Coaxial Adapter Panel (Shown Connected to a Sub-Module on the Main Shelf)

The following dual T1 or E1 line terminating circuit packs can be equipped in DACS II ISX Network Processing Modules on both the Main Shelf and on the Expansion Shelf.

- Enhanced Dual Digroup Circuit (EDDC) - TG191

  This circuit pack terminates two T1 signals that have D4 SuperFrame, Extended SuperFrame (ESF), or T1 Data Multiplexer (T1DM) framing format. The EDDC packs provide DS1 Performance Monitoring compliant with ANSI T1.403 and Bellcore TR-TSY-000820 standards.

  DACS II ISX Release 1.1 allows DACS II ISX to terminate transmission lines in cellular networks that carry signals between Ericsson cellular switches and cell sites. DACS II ISX Release 1.1 supports Ericsson Cellular Framing by providing a new user-provisionable framing format, which is a variation of the D4 Superframe format. This new framing format applies only to T1 NPCs.

- Enhanced Dual Primary Circuit (EDPC) - TG192

  This circuit pack terminates two E1 signals. The EDPC has a software programmable termination impedance, so it terminates both 75 ohm and 120 ohm E1 transmission lines. The EDPC packs provide Time Slot 0 processing and E1 Performance Monitoring compliant with CCITT Recommendations.

6.2 Synchronizer Cross-Connects (SXCs)

The DACS II ISX Main Shelf uses duplicated Synchronizer Cross-connect (SXC) circuit packs to perform the clock synchronization function and the circuit cross-connect function. These duplicated circuit packs are referred to as the Side 0 SXC (0SXC) and the Side 1 SXC (1SXC). Both SXC circuit packs maintain identical cross-connect maps; however, only one SXC circuit pack is active (in other words, carries service). Should the service carrying SXC pack (for example, 0SXC) fail, DACS II ISX will automatically switch to the other SXC pack (for example, 1SXC) for clock synchronization and circuit cross-connections.

Both SXC circuit packs receive Timing References (TREFs) in the form of extracted line timing signals from traffic carrying facilities that terminate on the DACS II ISX. The system administrator may specify two of these facilities for use as the primary and secondary Timing References. The synchronization function generates system timing signals that are phase locked to the selected Timing Reference and are used for internal synchronization. The system timing signals comply with both North American Stratum 3 and CCITT Local Node Clock standards.

Under normal operation, the DACS II ISX uses the primary Timing Reference to derive synchronization from the network. Should this Timing Reference fail, DACS II ISX will automatically switch to the secondary Timing Reference, without affecting customer service. If both Timing References fail, DACS II ISX will operate in holdover mode until the Timing References return or until new Timing References are established.

The cross-connect function on the duplicated SXC circuit packs uses a single stage time slot interchange to provide fully non-blocking 64 kbit/s and Nx64 kbit/s cross-connections for all time slots (up to 2048 64 kbit/s channels) terminating on the DACS II ISX Main Shelf. The SXC and the backplane were designed to support non-blocking cross-connects for an additional 2048 64 kbit/s time slots (total of 4096 time slots) via the DACS II ISX Expansion Shelf. This design allows existing DACS II ISX

systems to be expanded via the DACS II ISX Expansion Shelf without having to replace the SXC circuit packs on the DACS II ISX Main Shelf.

In addition to providing cross-connects for establishing customer service, the SXC circuit packs also provide the cross-connects for 64 kbit/s test access.

DACS II ISX administrative software supports the following test access modes:

- Non-intrusive monitor access
- Intrusive two-way split access
- Terminate and leave activate/release access.

Up to eight T1 or E1 facilities can be designated as Test Access Digroups (TADs). Each TAD supports up to 12 simultaneous two-way 64 kbit/s test sessions. DACS II ISX TADs are connected to external test equipment which tests the service channels by accessing them via the TADs. When a test session is completed, DACS II ISX returns the circuit under test to its original state.

6.2.1 Nx64 kbit/s Test Access For E1 Interfaces

The DACS II ISX Release 1.1 Nx64 kbit/s Test Access feature for E1 interfaces allows customers to designate up to 32 Network Processing Circuits (NPCs) for use as NPCTGs and grow and reconfigure up to 100 Nx64 kbit/s Test Groups (TGs) on DACS II ISX. A TG is composed of two separate bundles of N 64 kbit/s channels. These bundles are referred to as the East bundle and the West bundle of the TG and allow an Nx64 kbit/s circuit to be tested simultaneously in both directions of transmission. Once the TGs are grown, Test Access sessions will operate in a manner similar to current 64 kbit/s Test Access on DACS II ISX (i.e., circuit monitor, split, etc. will operate as with current 64 kbit/s Test Access). Customers will be able to gain Nx64 kbit/s Test Access regardless of the service channel arrangement within the port (i.e., the service channels may be contiguous, alternate, or random).

The Nx64 kbit/s Test Access feature will allow customers to test Nx64 kbit/s services with value of N ranging between 1 and 31 for 2 Mbit/s interfaces.

In addition to the maximum of 100 TGs, DACS II ISX Release 1.1 will continue to support creation of Test Ports (TPs) and Test Access Digroups (TADs or NPCTPs).

6.3 Timing Link Interfaces (TLIs)

The two Timing Link Interface (TLI) circuit pack slots (TLI1 and TLI2) are not equipped in Release 1.1 but have been designed to provide a future means of synchronizing DACS II ISX to non-traffic carrying signals. Each TLI circuit pack would terminate two Timing References and then pass the timing to the duplicated SXC circuit packs for synchronization. Each TLI circuit pack will also provide two timing distribution signals that will be available via connectors located on the backplane.

6.4 Main Controller (MC)

The MC circuit pack is a single board controller which oversees the DACS II ISX system operation.

The MC communicates to all DACS II ISX entities and performs the following system functions:

- Provides administrative communication interfaces
- Controls office alarms and status indications
- Performs system provisioning and maintenance
- Controls the selection of the active SXC circuit pack
- Maintains system executables and database in non-volatile Memory Cards.

6.4.1 Communication Interfaces

The MC supports four RS-232D compliant asynchronous Administrative Links (Link 1—Link 4) running the Snider protocol, one RS-232D compliant synchronous Administrative Link (Link 5) running the CCITT X.25 protocol, and one additional link (Link 6) for future expansion. The asynchronous links operate at rates up to 9600 baud and the synchronous link operates at rates up to 20k baud. The synchronous X.25 link supports sixteen Virtual Circuits (VCs) with any combination of Switched Virtual Circuits (SVCs) and Permanent Virtual Circuits (PVCs). Therefore, a total of 20 users can access DACS II ISX at any given time. Standard 25-pin Administrative Link Connectors (Link 1—Link 6) for the six links are mounted on the rear of the DACS II ISX Main Shelf.

Figure 5 shows the connectors on the back of the DACS II ISX Main Shelf.

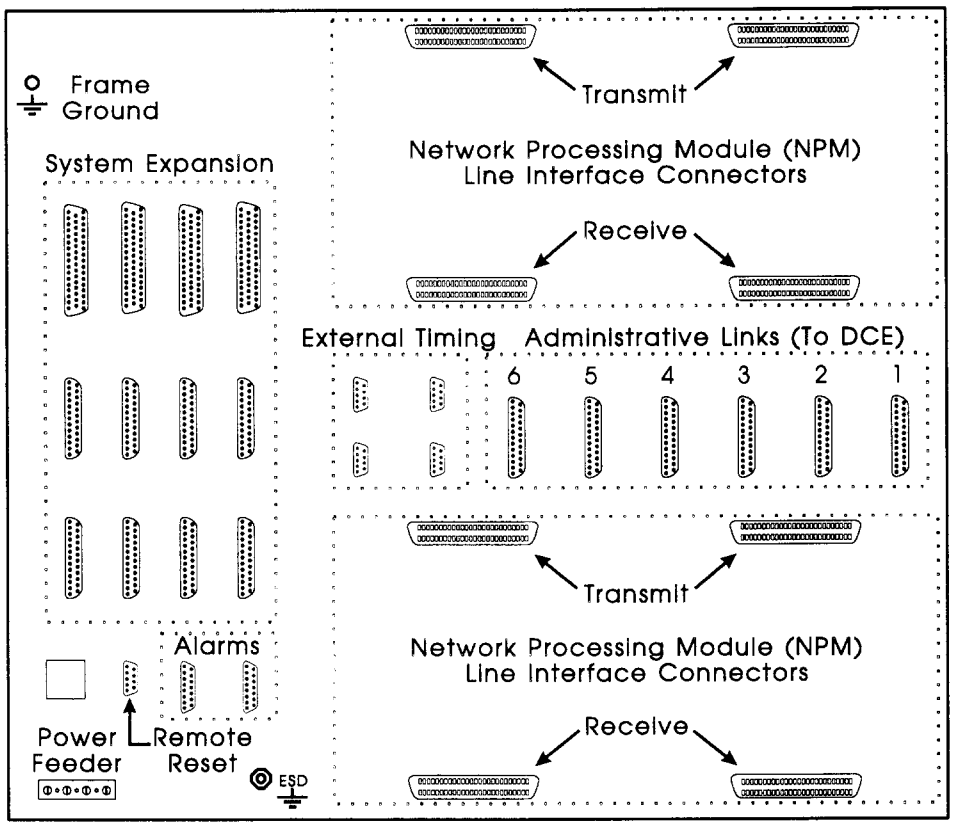

Figure 5 — DACS II ISX Main Shelf Connectors (Rear View)

User login provisioning on DACS II ISX is software programmable on a per-user basis. That is, when a DACS II ISX user is created, the user is assigned access to various functional operations. These operations can consist of circuit provisioning, equipment provisioning, maintenance, test access, system monitoring, and system administration. A user is only allowed to execute those commands which have been assigned to that particular user.

6.4.2 Alarms

The MC continuously monitors for signal failures, circuit pack failures, and power failures, and reports the failures via administrative link alarm messages and by operating contact closures for Local Audible, Local Visible and Remote Office alarms. In addition, the MC operates a remote ID contact closure used to identify the shelf as the source of a remote alarm. Connections for both the Local Audible and Local Visible Alarms are made at the Local Office Alarm Connector. Connections for the Remote Alarms are made at the Remote Office Alarm Connector. The MC can also be remotely reset via reset control leads accessible at the Remote Reset Connector. These connectors are all located on the back of the DACS II ISX Main Shelf as shown in Figure 5.

6.4.3 Memory Cards

The MC maintains redundant copies of the system software and database on non-volatile memory. This storage space is provided via two removable plug-in PCMCIA Memory Cards (PCMCIA is an acronym for Personal Computer Memory Card International Association). The system maintains fully duplicated database and system software backups on both Memory Cards. The two Memory Cards supported are referred to as Memory A (MEMA) and Memory B (MEMB). To ensure database synchronization between working and backup memories, both Memory Cards are automatically updated after each DACS II ISX transaction (for example, a cross-connect or disconnect). If one of the Memory Cards is removed from service or fails, DACS II ISX will continue using the remaining Memory Card and will operate in a simplex backup mode.

The Memory Cards are also used to install new software releases onto the DACS II ISX. This is accomplished by simply installing a Memory Card containing the new software and then executing the DACS II ISX software upgrade procedure. The software upgrade procedure is non-service affecting.

6.5 Main Controller Peripherals (MCPs)

Three Main Controller Peripheral slots (MCP1, MCP2, MCP3) are directly connected to and controlled by the MC to support future modular growth of additional system components. In Release 1.1, MCP1, MCP2, and MCP3 are not used.

6.6 Power Units (PUs)

Office power is delivered to the DACS II ISX Main Shelf over redundant power feeders (Primary Feeder A and Primary Feeder B). If one of these feeders fails, DACS II ISX will continue to operate as normal, drawing sufficient power from the remaining feeder. The power feeders are connected to the DACS II ISX Main Shelf at the Power Terminal Block mounted at the rear of the DACS II ISX. The feeders are fused with AT&T WP-90247L313 5 Ampere type fuses that provide a visual indication when blown. Office alarms and administrative messages are automatically activated whenever a fuse blows.

Two Power Units (PU1 and PU2) produce the +5 Volts for powering all DACS II ISX circuit packs. A green LED on each of the power units, when lit, indicates that power is being supplied to the power unit from one of the primary feeders. The red alarm LED on each of the PUs lights when the unit is receiving input power but is not generating output power. If either one of the +5 Volt Power Units fails, DACS II ISX will continue to operate normally and will activate office alarms and administrative messages indicating the failure.

Note: The circuit pack slot labeled "PU3" is provided for an additional Power Unit to support future system expansion.

6.7 Status and Alarm Panel (SAP)

The Status and Alarm Panel displays system alarm and status indications, and provides manual system controls, a wrist strap ground jack, and a front panel RS-232D DCE 25-pin Administrative Link Connector for Administrative Link 1. To accommodate different customer environments, DACS II ISX offers two versions of the Status and Alarm Panel: a Bellcore compliant version and a CCITT compliant version. The difference between these two Status and Alarm Panels is the labeling and color of the Alarm LEDs. The Bellcore and CCITT compliant Status and Alarm Panels are shown in Figure 6.

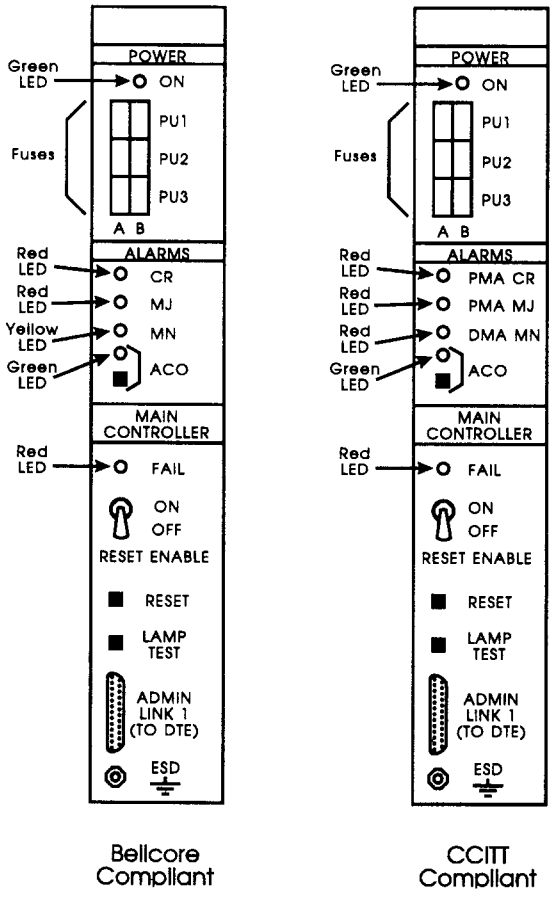

Figure 6 — Bellcore and CCITT Compliant Status and Alarm Panels

The Status and Alarm Panel is partitioned into the following three sections:

- Power
- Alarms
- Main Controller.

Each item listed above is described in the sections that follow.

6.7.1 Status and Alarm Panel Power Section

The power section contains a Light Emitting Diode (LED) labeled "ON" which, when lit, indicates that the DACS II ISX is powered on. In addition, there are six indicating fuses for the redundant office power supply feeders. There is one fuse between Feeder A and each of the three Power Units, and one fuse between Feeder B and each of the three Power Units. The fuse configuration is shown in Figure 7.

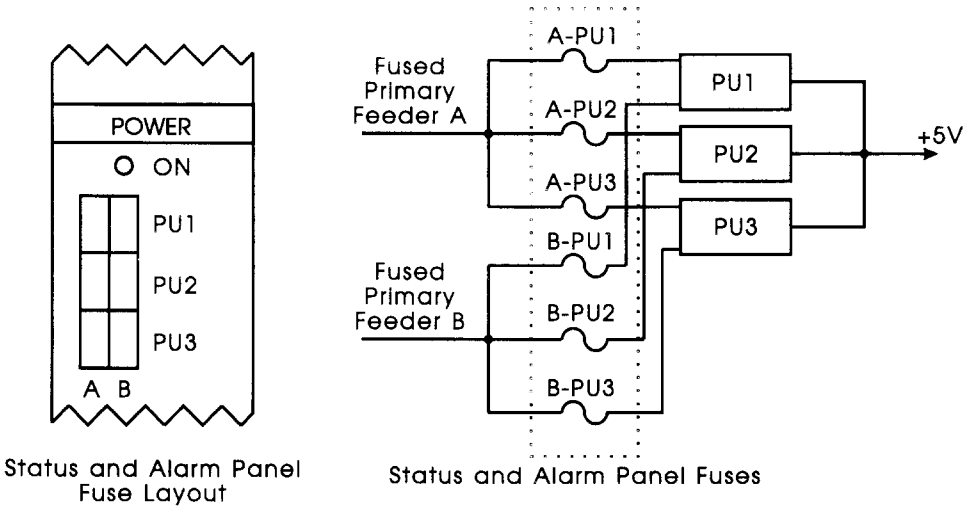

Figure 7 — DACS II ISX Main Shelf Fuse Configuration

6.7.2 Status and Alarm Panel Alarm Section

There are three LEDs on the alarm section of the Status and Alarm Panel which indicate the alarm status of the system. There is also an audible alarm cutoff push-button labeled "ACO". Depressing the ACO push-button silences all currently active local audible alarms. A corresponding LED is lit when the ACO is active indicating that all audible alarms have been disabled.

6.7.3 Status and Alarm Panel Main Controller Section

The Main Controller (MC) section contains an LED labeled "FAIL" that, when lit, indicates a MC failure.

A reset enable switch is provided to protect against accidentally reseting the MC by inadvertently depressing the MC Reset push-button. Unless the Reset Enable switch is in the ON position, pressing the MC Reset push-button has no effect.

If the Reset push-button is pressed when the Reset Enable switch is in the ON position, the MC is reset. Whenever the MC is reset, all of the shelf alarms are cleared.

A push-button labeled "LAMP TEST", when pressed, lights all of the LEDs on both the Status and Alarm Panel and on the Power Units. Any LED that does not light on the Status and Alarm Panel when the button is pressed should be replaced. A Power Unit is faulty and should be replaced if any LED on the Power Unit does not light when the push-button is pressed. The MC must be installed in the shelf for the lamp test to function properly.

An RS-232D DCE 25-pin connector labeled "ADMIN LINK 1 (TO DTE)" provides a front panel interface connector for a user terminal. The connector is electrically bridged using a null modem in series to the rear panel administrative link 1 interface connector. In addition, an Electro-static Discharge (ESD) wrist strap ground jack is provided.

7. NPC ADDRESSING SCHEME

The DACS II ISX Main Shelf and the DACS II ISX Expansion Shelf support a 3-digit NPC addressing scheme. With this scheme, NPCs are numbered by counting sequentially from the first NPC (left most on the Main Shelf) in the first Network Processing Module to the last NPC in the last Network Processing Module. Each Network Processing Module contains 32 NPCs.

With this scheme, the NPCs in NPM1 on the Main Shelf are addressed as NPC 001 through NPC 032. The NPCs in NPM2 on the Main Shelf are addressed as NPC 033 through NPC 064. On the Expansion Shelf, the NPCs in NPM3 are addressed as NPC 065 through NPC 096 and the NPCs in NPM4 are addressed as NPC 097 through NPC 128.

8. SHELF ALARMS

DACS II ISX performs equipment and transmission line error detection and alarming. The DACS II ISX evaluates the cause of hardware errors and isolates them to a single circuit pack. The results of the evaluation are displayed in an error recovery message. DACS II ISX performs both transmission line failure and performance monitoring for all NPCs. Details concerning circuit pack and transmission line alarms are described in the following sections.

8.1 System Alarm Hierarchy

There are three types of system alarms: Critical, Major, and Minor. The Local Visible and Remote Critical contact closures and the Remote ID contact closure are activated for Critical, Major, and Minor alarms. The Local Visible and Remote Critical, Major, Processor Failure, as well as the Remote ID contact closures are activated even if the Main Shelf looses all power (the MC must be plugged in).

Critical Alarms

Critical Alarms indicate service affecting failures that affect more than five facilities (either T1 or E1 transmission lines). This type of alarm is raised for the following failures:

- Unprotected power feeder, primary fuse, or power unit failures causing a total loss of power to the main shelf. The Local Visible and Remote Critical contact closures and the Remote ID contact closure are activated by total system power loss.

- Failure of both SXCs
- More than five facility failures (hardware, line failures, or performance monitoring Major alarms).

Major Alarms

Major alarms indicate service affecting failures that affect five or less facilities or the failure of redundant circuit packs. This type of alarm is raised for the following failures:

- Single protected power failures including a protected power feeder failure, primary fuse failure, or a power supply failure
- At least one but no more than five facility failures (hardware, line failures, or performance monitoring Major alarms)
- Failure of one SXC
- Main Controller failure except if the MC is intentionally taken out of service by user command
- Failure of both Memory Cards
- Failure of any administrative link provisioned in the Major alarm class
- Failure of all timing references.

Minor Alarms

Minor alarms are generated for non-service affecting failures. This type of alarm is raised for the following failures:

- All facility performance Minor alarms
- Failure of any administrative link provisioned in the Minor alarm class
- Failure of one but not both timing references
- Failure or removal (including manual) of one but not both Memory Cards
- System date or time is not set.

Non-alarmed notifications are provided to indicate changes in the state of the system that occur due to manual maintenance activity.

8.2 Circuit Pack Failure Alarms

Circuit pack communications and operations are continuously monitored by the Main Controller (MC). If errors are detected, the MC executes an error recovery routine which confirms the error and then runs diagnostic tests on the suspect circuit pack. A failed circuit pack is removed from service and automatic protection switching, if available, is performed. Automatic protection switching causes service to be transferred to a backup or redundant piece of equipment. The failure of a circuit pack always triggers an office alarm.

8.3 Transmission line Failure Alarms

Transmission Line failure alarms are raised when DACS II ISX detects transmission failures on transmission lines coming into the DACS II ISX. Whenever DACS II ISX detects a transmission line failure, it sends 64 kbit/s trunk conditioning and trouble

insertion words out on the channels to alert downstream equipment. The codes for the trunk conditioning or insertion words are software programmable and are entered as part of the cross-connect commands. In addition to notifying downstream equipment, a remote alarm signal is sent in the upstream direction on the failed transmission line. Transmission line failures are reported by an autonomous output message and a corresponding frame alarm.

For T1 transmission lines, the following transmission line failures are detected:

- Red Carrier Group Alarm (CGA), also called Loss of Frame (LOF)
- Yellow CGA
- Alarm Indication Signal (AIS) CGA
- Loss of Signal (LOS)
- Local Multiframe Alarm (LMA), for DMI-BOS signaling only
- Remote Multiframe Alarm (RMA), for DMI-BOS signaling only.

AIS is an all ones digital signal that is transmitted downstream from a failure as a substitute for the normal signal. It is recognized by the network elements as a condition that is different from loss of framing. It notifies downstream equipment that a service affecting failure has occurred and has been detected upstream. The AIS alarm is programmable as either a Major alarm, Minor alarm, or an informational message to allow the user to select how the alarm will be reported.

During a T1 failure, trunk conditioning and trouble insertion words are transmitted downstream on the failed transmission line's channels. Trouble insertion words are substituted for lost data to indicate a transmission failure to the terminating equipment. The trunk conditioning and insertion word are programmed by the user as part of the cross-connect commands.

For E1 transmission lines, the following transmission line failures are detected:

- Loss of Signal (LOS)
- Loss of Frame (LOF)
- Remote Alarm Indication (RAI) received in TS0 bit 3
- Remote Multiframe Alarm (RMA) received in TS16
- Alarm Indication Signal (AIS) received in all 32 time slots
- AIS received in TS16
- Loss of CRC4 multiframe alignment in TS0
- Loss of multiframe alignment in TS16
- Synchronization Failure Indication (SFI) in TS0 bit 5
- Excessive Error Rate (EER).

Other E1 transmission line failures are supported by DACS II ISX on a user-provisionable basis. Refer to the *DACS II ISX Command and Message Manual* for details. DACS II ISX performs consequent actions resulting from an E1 failure. These actions are compliant with the CCITT recommendations.

9. TRANSMISSION LINE PERFORMANCE MONITORING

DACS II ISX continuously monitors the performance of the T1 and E1 signals that terminate on it. T1 performance monitoring on DACS II ISX is compliant with ANSI T1.403 and Bellcore TR-TSY-000820 standards. E1 performance monitoring is compliant with CCITT Rec. G.784 and G.826. These standards define the line errors and faults that should be monitored and describe means for storing and retrieving the performance data. DACS II ISX stores counts of T1 and E1 errored conditions (for example, Errored Seconds, Severely Errored Seconds, etc.) according to the above standards and allows users or operations systems to retrieve the data in either real time or by scheduling performance monitoring reports. DACS II ISX maintains performance data counts for 15 minute and 24 hour intervals and stores up to 7 days worth of performance data.

The monitored parameters vary depending on the type of NPC. T1 performance monitoring parameters are collected for both the near-end and far-end terminal according to ANSI and Bellcore standards. The following parameters are collected for T1 transmission lines:

- Line Coding Violations
- Line Errored Seconds
- Line Severely Errored Seconds
- Path Coding Violations
- Path Errored Seconds
- Path Severely Errored Seconds
- Path Severely Errored Framing Seconds
- Path Controlled Slip Seconds
- Path Unavailable Seconds.

The E1 performance monitoring parameter set complies with the latest CCITT recommendations. The following parameters are collected for E1 transmission lines:

- CRC Block Errors
- Framing Errors
- Out of Frame Seconds
- Errored Seconds
- Severely Errored Seconds
- Controlled Slip Seconds
- Coding Violations
- Unavailable Seconds
- Unavailable Time Count
- Multiframe Errors

- Far End Block Errors
- Far End Errored Seconds
- Far End Severely Errored Seconds
- Far End Unavailable Seconds.

The performance monitoring thresholds for the facility parameters are programmed when the NPC is provisioned for service. Default threshold values will be applied if the user does not enter any specific thresholds. For E1 transmission lines, the alarm level associated with the threshold crossings is also programmed when the NPC is provisioned for service. Each threshold crossing can be programmed to trigger either a Major alarm, a Minor alarm, or an informational message.

10. DACS II ISX EXPANSION SHELF

10.1 DACS II ISX Expansion Shelf Overview

The Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect (DACS II ISX) Expansion Shelf is the latest addition to the AT&T Network Systems DACS II product line. The DACS II ISX Expansion Shelf increases the transmission line capacity of the DACS II ISX. The DACS II ISX Main Shelf terminates up to 64 T1 or E1 transmission lines. An additional 64 T1 or E1 transmission lines can be terminated on the DACS II ISX Expansion Shelf increasing the total capacity of the system to 128 T1 or E1 transmission lines. The additional capacity provided by the Expansion Shelf does not require any hardware upgrades to the Main Shelf.

10.2 DACS II ISX Expansion Shelf Physical Description

The DACS II ISX Expansion Shelf is 12.5" (318mm) high, 17.5" (445mm) wide, and 13.5" (343mm) deep and meets global (U.S. and international) standards for Electromagnetic Compatibility (EMC), Electrostatic Discharge (ESD), and environmental conditions. To accommodate various customer configurations, the DACS II ISX Expansion Shelf is rack-mountable on either a 19" ANSI/EIA standard frame, a 2' 2" Network Bay Frame (NBF), or a 600mm ETSI standard frame. The Expansion Shelf was designed to mount above the DACS II ISX Main Shelf.

10.3 DACS II ISX Expansion Shelf System Level Functions

The DACS II ISX Expansion Shelf is comprised of the following functional entities. Each of the items listed below is described in detail in the sections that follow.

- Two Network Processing Modules (NPMs)
- Two Power Units (PUs)
- One Status Panel (SP).

Figure 8 shows the front view of the DACS II ISX Expansion Shelf functional entities.

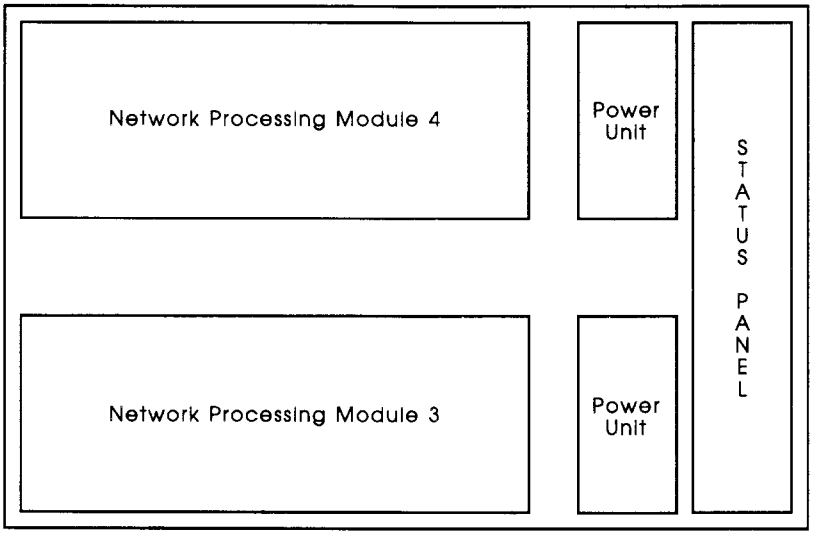

Figure 8 — DACS II ISX Expansion Shelf Functional Entities

Figure 9 shows the open-door front view physical layout of a DACS II ISX Expansion Shelf fully equipped with Enhanced Dual Digroup Circuit (EDDC) cards.

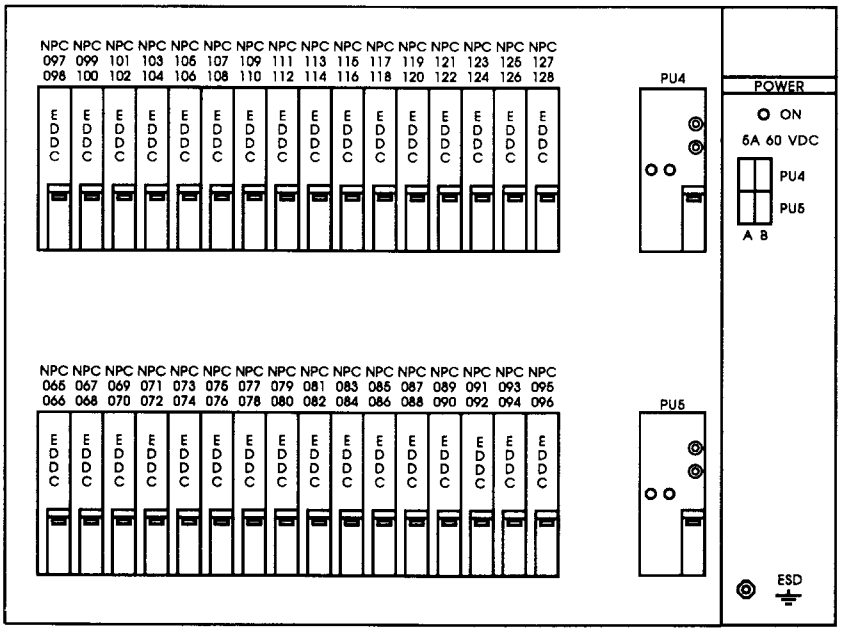

Figure 9 — Fully Equipped DACS II ISX Expansion Shelf (T1 Interfaces)

10.3.1 Network Processing Modules (NPMs)

The DACS II ISX Expansion Shelf has two Network Processing Modules (NPMs) that contain the T1 and E1 terminating circuit packs. Each NPM contains 16 circuit pack slots that can be populated with Enhanced Dual Digroup Circuits (EDDCs) for T1 terminations or with Enhanced Dual Primary Circuits (EDPCs) for E1 terminations. Each EDDC or EDPC pack terminates and processes two transmission line interfaces, referred to as Network Processing Circuits (NPCs). Therefore, a total of 32 NPCs can be supported in each NPM. For E1 interfaces, the EDPC pack is software programmable to support either 120 ohm or 75 ohm transmission lines.

In each system, both T1 and E1 transmission line terminating circuit packs can be equipped in an NPM. However, to provide compact transmission line cabling into the DACS II ISX Expansion Shelf, each NPM is divided into two Network Processing Sub-Modules with eight circuit pack slots (16 transmission lines) per Sub-Module. Each Network Processing Sub-Module can be software provisioned to support T1 interfaces, 75 ohm E1 interfaces or 120 ohm E1 interfaces. This capability allows customers to tailor DACS II ISX to support their particular mix of T1 and E1 signals.

Figure 10 shows the rear view of the DACS II ISX Expansion Shelf with a Coaxial Adapter Panel connected to one of the Network Processing Sub-Modules.

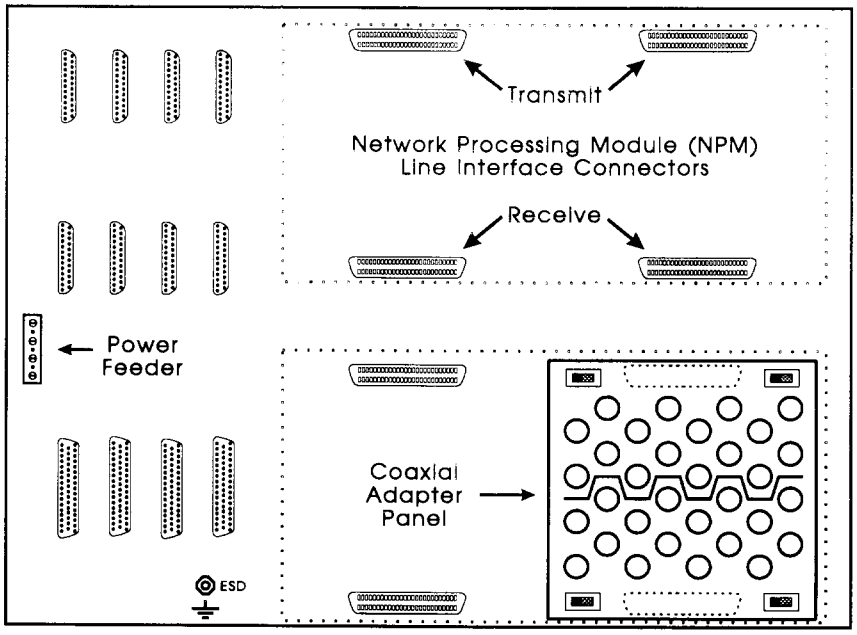

Figure 10 — Coaxial Adapter Panel (Shown Connected to a Sub-Module)

The transmission line terminating circuit packs used to equip the DACS II ISX Main Shelf can also be used to equip the DACS II ISX Expansion Shelf Network Processing Modules. Specifically, the Enhanced Dual Digroup Circuit (EDDC) circuit packs can be used to terminate T1 transmission lines and the Enhanced Dual Primary Circuit (EDPC) circuit packs can be used to terminate E1 transmission lines.

10.3.2 Power Units (PUs)

The DACS II ISX Expansion Shelf operates on an input voltage range between –36 Volts DC and –75 Volts DC.

Office power is delivered to the DACS II ISX Expansion Shelf over redundant power feeders (Primary Feeder A and Primary Feeder B). If one of these feeders fails, the DACS II ISX Expansion Shelf will continue to operate as normal, drawing sufficient power from the remaining feeder. The power feeders are connected to the DACS II ISX Expansion Shelf at the Power Terminal Block mounted at the rear of the Expansion Shelf behind the Status Panel. The feeders are fused with AT&T WP-90247L313 5 Ampere type fuses that provide a visual indication when blown. Office alarms and administrative messages are automatically activated whenever a fuse blows.

Two Power Units (PU4 and PU5) produce the +5 Volts for powering all DACS II ISX Expansion Shelf circuit packs. A green LED on each of the power units, when lit, indicates that power is being supplied to the power unit from one of the primary feeders. The red alarm LED on each of the PUs lights when the unit is receiving input power but is not generating output power. The system will continue to operate normally if either one of the +5 Volt Power Units fails on the DACS II ISX Expansion Shelf. In addition, office alarms will be activated and administrative messages will be generated by the system indicating the failure.

The same type of Power Unit used to power the DACS II ISX Main Shelf can also be installed on the DACS II ISX Expansion Shelf.

10.3.3 Status Panel (SP)

The Status Panel contains a Light Emitting Diode (LED) labeled "ON" which, when lit, indicates that the DACS II ISX Expansion Shelf is powered on. In addition, there are four indicating fuses for the redundant office power supply feeders. There is one fuse between Feeder A and each of the two Power Units, and one fuse between Feeder B and each of the two Power Units. In addition, an Electro-static Discharge (ESD) wrist strap ground jack is provided.

The Expansion Shelf's fuse configuration is shown in Figure 11.

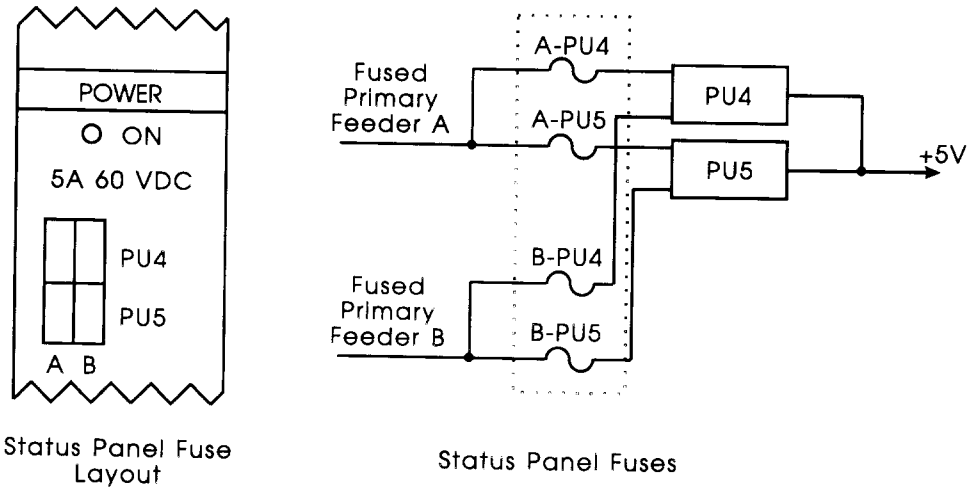

Figure 11 — DACS II ISX Expansion Shelf Fuse Configuration

11. I-2000 CONTROLLER FOR DACS II ISX

The I-2000 Controller for DACS II ISX is a software-based computer system that provides element management capabilities for DACS II ISX networks. The I-2000 Controller for DACS II ISX reduces network operating costs by providing remote, centralized provisioning, control, and monitoring of DACS II ISX networks. When fully configured, the I-2000 Controller for DACS II ISX supports up to six simultaneous users, enabling access and remote control of any of the DACS II ISX systems, while monitoring and recording software and hardware attributes. The I-2000 Controller for DACS II ISX is shown in Figure 12.

The I-2000 Controller for DACS II ISX supports up to twenty DACS II ISX systems. The I-2000 Controller interfaces with individual DACS II ISX systems through either an X.25 direct connection, an X.25 packet network, or an asynchronous interface (Snider protocol).

Note: The I-2000 Controller is available for use on a *SUN** Sparc 10 Workstation with I-2000/DACS II Release 3.3. In addition to the improved speed, expandability, and worldwide recognition of *SUN* Workstations, this new platform supports up to 30 DACS II ISX systems from a single I-2000 Controller.

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* *SUN*® Workstation is a registered trademark of Sun Microsystems, Inc.

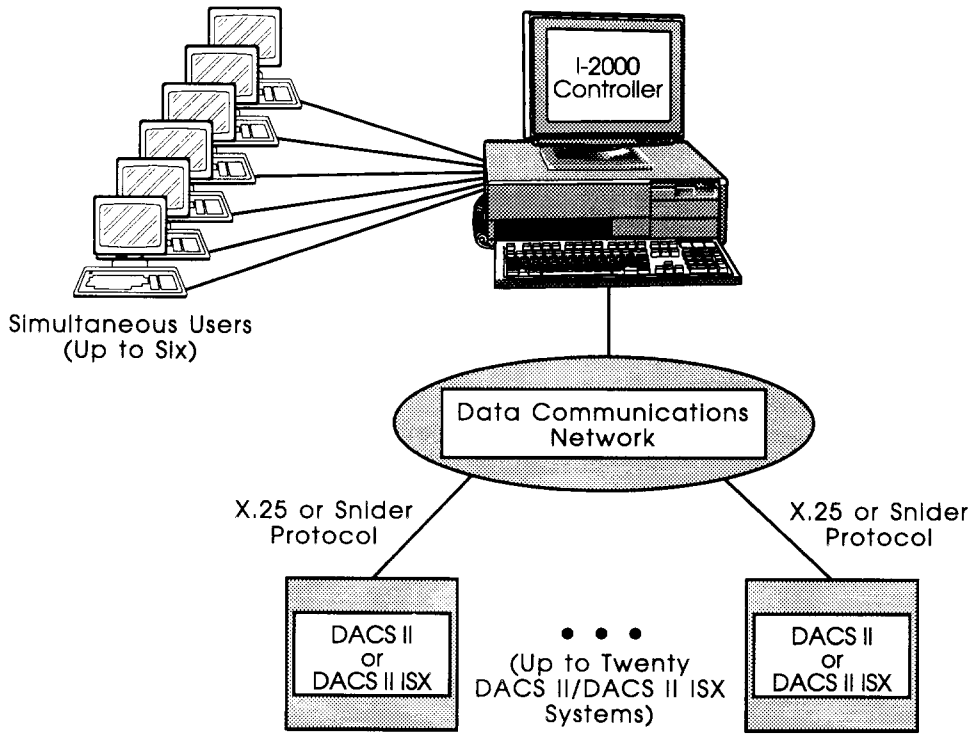

Figure 12 — I-2000 Controller for DACS II ISX

The I-2000 Controller for DACS II ISX provides the following features for monitoring and controlling DACS II ISX networks.

- **Cross-connect provisioning.** Provides circuit provisioning activities such as activating, deactivating, alternate routing, normalizing, deleting, pending, and modifying the state of a circuit.
- **Data base query access and forms.** Offers users the ability to query different information such as provisioning information, restoration plans, test ports, and history files (for example, alarm log, restoration conflicts, and verification results).
- **Data base verification and reconciliation.** Offers users the ability to compare the I-2000 Controller and the DACS II ISX for database discrepancies. Discrepancies can be resolved by optionally updating either the I-2000 database or the DACS II ISX cross-connect map.
- **Pass through mode.** Allows the I-2000 Controller for DACS II ISX to be used as a virtual terminal to access DACS II ISX systems directly.
- **Data base backup/recovery to/from floppy disk.** Allows the I-2000 database to be backed up or restored via floppy disks.
- **User-friendly form and menu interface.** Allows users to select and execute features via user-friendly menus and/or filling out forms.

- **User-defined names for facilities and cross-connects.** Enables users to define their own sets of names for transmission line terminations and customer circuits.
- **Equipment and cross-connect database.** Maintains updated database of DACS II ISX equipment provisioning information and cross-connect status.
- **Help function.** Provides users with on line help to assist in operations of the I-2000 Controller for DACS II ISX.

12. ACRONYMS

This section contains a list of acronyms and their meanings that are used throughout this document.

Acronym	Meaning
ACO	Alarm Cutoff
AIS	Alarm Indication Signal (Also known as all 1s signal)
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
BER	Bit Error Rate
CCITT	International Telephone and Telegraph Consultative Committee
CEPT	Conference Europeene des Postes et Telecommunications
CGA	Carrier Group Alarm
CRC	Cyclic Redundancy Check
DACS	Digital Access and Cross-Connect System
DACS II ISX	Digital Access and Cross-Connect System II Integral Shelf Cross-Connect
DC	Direct Current
DCE	Data Communications Equipment
DIN	Deutsche Industrie Normenausschuss
DMA	Deferred Maintenance Alarm
DS0	Digital Signal Level 0 (64 kbit/s)
DS1	Digital Signal Level 1 (1.544 Mbit/s)
DTE	Data Terminal Equipment
D4	A Type of Channel Bank
ECEF	Enclosed Capacity Expansion Frame
EDDC	Enhanced Dual Digroup Circuit
EDPC	Enhanced Dual Primary Circuit
EER	Excessive error rate
EIA	Electronic Industries Association
EMC	Electromagnetic Compatibility
ESBF	Enclosed Single Bay Frame
ESD	Electrostatic Discharge
ESF	Extended Superframe
ETSI	European Telecommunication Standardization Institute
E1	CEPT Primary Rate (2.048 Mbit/s)
IEC	International Electrotechnical Commission
ISX	Integral Shelf Cross-Connect
kbit	Kilobit
kbit/s	Kilobit Per-Second
LAN	Local Area Network

Acronym	Meaning
LED	Light-Emitting Diode
LMA	Loss of Multiframe Alignment
LOF	Loss of Frame
LOS	Loss of Signal
Mbit	Megabit
Mbit/s	Megabits Per-Second
MBER	Minor Bit Error Rate
MC	Main Controller
MCP	Main Controller Peripheral
MEMA	Memory Card Slot A
MEMB	Memory Card Slot B
MML	HuMan-Machine Language
NBF	Network Bay Frame
NPC	Network Processing Circuit
NPCTG	Network Processing Circuit Test Group
NPCTP	Network Processing Circuit Test Port
NPM	Network Processing Module
NPSM	Network Processing Sub-Module
OOF	Out-Of-Frame
OS	Operations System
PCMCIA	Personal Computer Memory Card International Association
PDS	Program Documentation Standards (Language)
PMA	Prompt Maintenance Alarm
PU	Power Unit
PVC	Permanent Virtual Circuit
RAI	Remote Alarm Indication
RAIS	Remote Alarm Indication Signal
RAM	Random Access Memory
RMA	Remote Multiframe Alarm
SAP	Status and Alarm Panel
SFI	Synchronization Failure Indication
SP	Status Panel
SVC	Switched Virtual Circuit
SXC	Synchronizer Cross-Connect
TAD	Test Access Digroup
TC	Trunk Conditioning
TG	Test Group
TLI	Timing Link Interface
TP	Test Port
TS	Time Slot
TSI	Time Slot Interchange
T1	Digital Signal Level 1 (DS1, 1.544 Mbit/s)
T1DM	T1 Data Multiplexer
VC	Virtual Circuit
TAD	Test Access Digroup
TG	Test Group
TLI	Timing Link Interface
TP	Test Port

Acronym	Meaning
TREF	Timing Reference
TS0	Time Slot 0
TS16	Time Slot 16
VC	Virtual Circuit