AT&T

TECHNICAL SPECIFICATION

Transmission Systems

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

General

This document provides the technical specifications for the AT&T Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect (DACS II ISX), Release 1.0. 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 Specification consists of a cover sheet and an attachment which contains the detailed information for the DACS II ISX Release 1.0 features and requirements.

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
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1. GENERAL DESCRIPTION

DACS II ISX is a software-controlled Digital Cross-Connect System which terminates T1 (1.544 Mbit/s) and E1 (2.048 Mbit/s) facilities. DACS II ISX provides cross-connect for 64 kbit/s and Nx64 kbit/s circuits, and provides 64 kbit/s test access. It also performs facility and equipment maintenance and provides interfaces for remote operations systems. DACS II ISX is a single, rack mountable shelf that, when fully equipped, supports 64 T1 or E1 terminations.

DACS II ISX system timing is derived from up to two traffic-carrying T1 or E1 signals that terminate on the DACS II ISX shelf. Assignment of these timing references is user programmable.

This document contains technical specifications for DACS II ISX features, performance information, external interfaces, environmental considerations, and system reliability. This information supplements the information contained in the AT&T DACS II ISX documentation listed in Table A on the next page.

Table A — AT&T DACS II ISX Documentation

Select Code	Document
AT&T 365-359-010	DACS II ISX Release 1.0, PDS Operation and Maintenance Manual
AT&T 365-359-011	DACS II ISX Release 1.0, PDS Command and Message Manual
AT&T 365-359-012	DACS II ISX Release 1.0, PDS Quick Reference Guide
AT&T 365-359-020	DACS II ISX Release 1.0, MML Operation and Maintenance Manual
AT&T 365-359-021	DACS II ISX Release 1.0, MML Command and Message Manual
AT&T 365-359-022	DACS II ISX Release 1.0, MML Quick Reference Guide
CIR 365-099-130TD	DACS II ISX Release 1.0 Technical Description
SD 99674-01	Application Schematic for DACS II ISX

2. SYNCHRONIZATION AND TIMING

This section provides system level specifications for DACS II ISX synchronization. DACS II ISX was designed according to the following synchronization standards.

- "Digital Cross-Connect System Generic Requirements and Objectives", TR-NWT-000170, Issue 2, January, 1993.
- "Clocks for the Synchronized Network: Common Generic Criteria", TR-NWT-001244, Issue 1, June 1993.
- Timing Requirements at the Outputs of Slave Clocks Suitable for Plesiochronous Operation of International Digital Links, CCITT Recommendation G.812, 1988.
- The Control of Jitter and Wander within Digital Networks which are Based on the 2048 kbit/s Hierarchy, CCITT Recommendation G.823, 1988.

2.1 Clock Mode Operation

The DACS II ISX supports the following modes of operation:

- Fast lock
- Normal
- Holdover.

The fast lock mode is used to quickly lock internal oscillators to an external reference frequency. The normal mode is active during typical operation, and the holdover mode is utilized when all external timing references are impaired. In the holdover mode, the DACS II ISX maintains the output frequency at the last known good value of the external reference and is subject to the stability of the DACS II ISX's internal oscillator.

2.2 Stratum 3/CEPT Local Clock

The DACS II ISX provides a fully duplicated clock which meets the following North American Stratum 3 and CEPT Local clock stability requirements.

Table B — Clock Specifications

Clock Stability	Minimum Accuracy	Minimum Stability	Minimum Pull-in Range
Stratum 3	+/- 4.6×10^{-6}	< 255 slips for the initial 24 hours of holdover, (+/- 0.37×10^{-6} average over first 24 hours)	Capable of synchronizing to clock with accuracy of +/- 4.6×10^{-6}
CEPT Local	Unspecified	+/- 2×10^{-8}/day	Unspecified

Minimum accuracy is the maximum long-term (20 years) deviation from nominal frequency with no external frequency reference (free run). Minimum stability is the maximum rate of change of clock frequency over time upon loss of all timing references (holdover). Pull-in range is the maximum input frequency difference from the nominal clock rate that can be overcome by a clock to pull itself into synchronization with a reference signal.

2.3 Dual Timing References

Each of the duplicated DACS II ISX Synchronizer Cross-connect (SXC) circuit packs receives two timing references, a primary and a secondary.

2.4 Timing Reference Types

DACS II ISX uses traffic-carrying T1 and/or E1 signals terminated on the Main Shelf's Enhanced Dual Digroup Circuit (EDDC) or Enhanced Dual Primary Circuit (EDPC) circuit packs as timing references. The two timing references are provisionable in any combination of the following sources:

- Traffic Carrying T1 - References selectable from any of the 64 line terminations on the system.
- Traffic Carrying E1 - References selectable from any of the 64 line terminations on the system.

The primary and secondary timing references must be provisioned on different EDDC/EDPC circuit packs.

2.5 Timing Reference Monitoring

A single timing reference is selected as active. Both the active and the non-active references are monitored for availability. For T1 and E1 timing references, the following signal impairments are detected:

- Loss of Signal
- Loss of Frame
- Alarm Indication Signal (AIS).

For E1 timing references, the following additional signal impairments are also detected:

- Excessive Error Rate
- TS0 Bit 5 Sync Failure Indication.

The DACS II ISX clock will not attempt to synchronize to a timing reference signal with any of the above impairments.

2.6 Automatic Reference Switching

When an impaired timing reference is recognized on the active input, the DACS II ISX switches to the alternate input if it is available. If the alternate timing reference is not available, the DACS II ISX enters holdover mode. The DACS II ISX automatically switches back from holdover to the primary or secondary timing reference when it becomes available.

Switching between timing references is non-revertive by default. However, revertive switching between timing references is provided as a user selectable option. Revertive switching means that a switch to the secondary will be followed by an automatic return to the primary when it becomes available.

2.7 Synchronization Alarms

The following synchronization alarms are provided by the DACS II ISX:

- Minor Alarms
  - — Loss of at least one but not all timing references.
  - — Active SXC in non-normal (fast or holdover) mode.
  - — Frequency control exceeding 75% of pull-in range.
- Major Alarms
  - — Loss of all timing references.
  - — Failure of one of the two SXCs.
- Critical Alarms
  - — Failure of both of the redundant SXCs.

2.8 Jitter Performance

2.8.1 Input Jitter Tolerance

DACS II ISX meets the requirements for susceptibility to jitter on the incoming T1 signal in accordance with the following Bellcore requirement:

- "Clocks for the Synchronized Network: Common Generic Criteria", TR-NWT-001244, Issue 1, June 1993.

Operation with larger jitter amplitudes may result in bit errors, reframes, and slips.

DACS II ISX is designed to operate error free when the E1 primary input signal contains jitter or wander within the bounds as specified in CCITT Recommendation G.823; paragraph 3.1.1, Table 1/G.823.

2.8.2 Jitter Transfer

The DACS II ISX synchronizer meets the following Bellcore and CCITT requirements for jitter transfer from the timing reference signal to any output signals:

- "Clocks for the Synchronized Network: Common Generic Criteria", TR-NWT-001244, Issue 1, June 1993.
- "Timing Requirements at the Outputs of Slave Clocks Suitable for Plesiochronous Operation of International Digital Links", CCITT Fascicle III.5, Recommendation G.812, 1988.
- "The Control of Jitter and Wander within Digital Networks which are based on the 2048 (&1544) kbit/s Hierarchy ", CCITT Fascicle III.5, Recommendations G.823 and G.824, 1988.

2.8.3 Output Jitter

When synchronized to a jitter-free timing reference, the maximum jitter at a DACS II ISX output port does not exceed 0.05 Unit Interval peak to peak measured over a bandwidth of 10 – 100 KHz.

3. TRANSMISSION CHARACTERISTICS

The DACS II ISX interfaces with digital transmission facilities at the T1 (1.544 Mbit/s) and E1 (2.048 Mbit/s) levels. For E1 facilities, DACS II ISX supports either 120 Ohm twisted pair cabling or 75 Ohm coaxial cabling.

The DACS II ISX Main shelf has two Network Processing Modules (NPMs) that contain the T1 and E1 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 facility 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 facilities.

In DACS II ISX, both T1 and E1 facility terminating circuit packs can be equipped in an NPM. However, to provide compact facility cabling into the DACS II ISX, each NPM is divided into two Network Processing Sub-Modules with eight circuit pack slots (16 facilities) 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. Adapter panels are connected to the standard Facility Interface Connectors for interfacing 75 Ohm E1 facilities.

3.1 Interface Characteristics

The DACS II ISX provides fully connectorized cable interfaces for both the T1 and E1 facility terminations.

3.1.1 T1 Interface

The DACS II ISX T1 interface has a nominal termination impedance of 100Ω. The T1 signal meets the requirements specified in AT&T Compatibility Bulletin 119 (CB 119) for signals interfacing at the DSX-1 cross-connect frame.

The cable and connector types recommended for the T1 facilities are:

— AT&T 255AS

  This cable type provides 20 twisted pairs (of which 16 are used) and meets the requirements with up to 450 feet between the DACS II ISX frame and the DSX-1.

— Connector type

  Cinch 223-10-50-047.

Transmit and receive signals of the T1 interface are carried in separate cables, with 16 active pairs per cable. Five programmable equalizer settings are provided to maintain the pulse shape and amplitude within the template specified in CB 119 over the full range of cabling distance.

3.1.2 E1 Interface

The DACS II ISX E1 interface has nominal termination impedances of either 120 Ohms or 75 Ohms. The E1 signal meets the pulse shape and amplitude requirements specified in CCITT Recommendation G.703, Interface at 2048 kbit/s.

The connector types recommended for E1 facilities are:

— 120 Ohm

Cinch 223-10-50-047

— 75 Ohm

BT43 or DIN/IEC 1.6/5.6.

3.2 Facility Framing Modes

- T1 Framing Modes

  DACS II ISX supports the following T1 framing modes:

  — D4 Superframe (SF): in accordance with PUB 43801, "Digital Channel Bank Requirements and Objectives."

  — Extended Superframe (ESF): in accordance with Bellcore Technical Reference TR-TSY-000194, Extended Superframe Format, Issue 1, December 1987 and AT&T Compatibility Bulletin 142 (CB 142), "Extended Framing Format Interface Specification."

  — DDS T1 Data Multiplexer (T1DM): in accordance with Bellcore Technical Advisory TA-TSY-000278, "Digital Data System (DDS) T1 Data Multiplexer (T1DM) Requirements," Issue 1, November 1985 and Bell System Technical Journal (BSTJ) Vol. 54 No. 5 May/June 1975, pages 893 – 918, "Digital Data System Digital Multiplexers."

  — "Carrier-to-Customer Installation - T1 Metallic Interface", American National Standards Institute T1.403-1989.

- E1 Framing Mode

  DACS II ISX supports the basic frame structure at 2048 kbit/s in accordance with the following:

  — "Synchronous Frame Structures Used at Primary and Secondary Hierarchical Levels", CCITT Recommendation G.704, 1991.

  — "Frame Alignment and CRC Procedures Relating to Basic Frame Structures Defined in Recommendation G.704", CCITT Recommendation G.706, 1991.

3.3 Reframe Time

Reframe times required by DACS II ISX for T1 and E1 signals are listed below. Note that these reframe time values are based upon the assumption that there are no false framing patterns.

- T1 Reframe Time

  DACS II ISX meets the 50 millisecond maximum average reframe time requirement for T1 facilities in either D4 SF or ESF framing formats specified in Bellcore TR-TSY-000170 and T1DM specifications in accordance with Bellcore Technical Advisory TA-TSY-000278.

The T1DM reframe time is in accordance with Bellcore Technical Advisory TA-TSY-000278, "Digital Data System (DDS) T1 Data Multiplexer (T1DM) Requirements," Issue 1, November 1985 and Bell System Technical Journal (BSTJ) Vol. 54 No. 5 May/June 1975, pages 893 – 918, "Digital Data System Digital Multiplexers."

- E1 Reframe Time

  The maximum average reframe time for E1 facilities is 3 milliseconds.

3.4 Internal Transmission Characteristics

3.4.1 Loss and Delay Distortion

The DACS II ISX equipment does not introduce any loss or delay distortion in the transmission path.

3.4.2 Blocking

DACS II ISX is a fully nonblocking cross-connect system. That is, it allows absolute connectivity through the system.

3.4.3 Transmission Delay

The nominal absolute delay introduced by DACS II ISX for a 64 kbit/s channel passing through a DACS II ISX system is 293 microseconds. The minimum delay is 43 microseconds.

3.4.4 DS0 (64 kbit/s) Errors

The DACS II ISX introduces no errors on signals cross-connected through it. The only exception is circuits using robbed bit signaling in which, due to the nature of the robbed bit signaling, the least significant bit is overwritten with signaling information every sixth frame.

3.5 False Framing Immunity and Rejection

- T1 False Framing

  The DACS II ISX provides T1 false framing protection. During a T1 out-of-frame condition, the framing circuitry will not lock onto an arbitrary candidate if more than one framing bit pattern is present. The T1 will remain in an out-of-frame condition until a unique framing bit pattern is identified. For the D4 framing mode, the DACS II ISX framing strategy uses both the terminal framing (Ft) and signaling framing (Fs) patterns. An in-frame condition is not declared unless both the Ft and Fs patterns are present. For the ESF mode, DACS II ISX uses both the ESF framing pattern and the Cyclic Redundancy Check (CRC6). An in-frame condition is not declared unless a good framing pattern is found with a good CRC6. For T1DM mode, the DACS II ISX framing strategy additionally uses the channel 24 framing pattern.

  DACS II ISX provides a signaling fixing capability, described in *Section 3.9.3*, to avoid false framing pattern simulation by signaling bits on outgoing T1 signals.

- E1 False Framing

  For E1 primary block facilities, the TS0 frame is used to maintain in-frame conditions in accordance with CCITT Recommendation G.704.

In addition, if the facility is also provisioned in the CRC-4 mode, an Out-of-Frame (OOF) condition is declared if CRC multiframe alignment cannot be achieved within 400 ms after the basic frame alignment has been achieved.

3.6 Out-of-Frame (OOF); Loss of Frame (LOF) Detection Limits

- T1 Facility

  The T1 facility OOF detection limits are mode dependent and are listed below:

  — D4 SF and T1DM framing modes: 2 out of 4 framing bits in error

  — ESF framing mode: 2 out of 4 framing bits in error or, if the facility is already out-of-frame, 32 out of 33 CRC-6 check bit errors.

- E1 Facility

  The E1 primary block (2.048 Mbit/s) LOF detection limits are three consecutive errored framing pattern errors (that is, the Frame Alignment Signal (FAS) in the TS0 frame word) or three consecutive errors of bit 2 of the Non Frame Word (NFW).

3.7 Line Coding

- T1 Line Coding

  DACS II ISX supports the following T1 line codes:

  — Zero Code Suppression (ZCS)

  — No Zero Code Suppression (NZCS)

  — Alternate Mark Inversion (AMI) Bipolar

  — Bipolar with 8 Zero Substitution (B8ZS).

- E1 Line Coding

  DACS II ISX supports the High Density Bipolar of order 3 (HDB3) E1 line code.

3.8 Channel Sequencing Formats

- T1 Channel Sequencing Formats

  DACS II ISX provides T1 transmission interfaces having the following channel numbering formats in accordance with AT&T PUB 43801:

  — D1D

  — D2

  — D4.

- E1 Channel Sequencing Formats

  DACS II ISX meets the telephone channel numbering and time slot channel numbering as specified in CCITT Recommendation G.704 for cross-connecting time slots from E1 signals.

3.9 Signaling Characteristics

DACS II ISX channel-associated signaling has the following characteristics for T1 and E1 facilities.

3.9.1 Signaling Modes

- Per Channel Signaling Modes for T1 Facilities

  DACS II ISX supports the following per channel signaling modes for T1 facilities:

  — Robbed bit: The signaling bits are transmitted in the least significant bit of the data channel every sixth frame. The signaling frames and bits are identified by a superframe sequence (12 frames for the D4 mode; 24 frames for the ESF mode) in the 193rd bit.

  — Digital Multiplexed Interface-Bit Oriented Signaling (DMI-BOS): It provides a signaling channel (in channel 24) without robbing bits from the data channel. The signaling bits are identified by a superframe sequence in channel 24.

  — Transparent: No signaling bits are associated with the channel.

- Per Channel Signaling Modes for E1 Facilities

  DACS II ISX supports two multiframe and signaling formats for E1 primary block facilities:

  — Non-signaling Associated (NSA) format

  With this format, DACS II ISX does not process signaling; that is, it is transparent to signaling, but can carry signaling formats such as Common Channel Signaling (CCS), in-band signaling, or data channels with no signaling.

  — Channel Associated Signaling (CAS)

  With this format, Time Slot 16 (TS16) of the E1 primary block facility is used to carry channel associated signaling information as specified in CCITT Recommendation G.704.

3.9.2 Signaling Formats

DACS II ISX supports the following DS0 (64 kbit/s) signaling formats:

- 2-state signaling
- 4-state signaling
- 16-state signaling
- Transparent Signaling.

The application of the signaling formats is framing mode dependent, as follows:

- The 2-state and 4-state signaling and transparency are applicable for either the D4 SF or ESF framing mode.
- The 16-state signaling is only applicable for the ESF framing mode and the E1 signals.

3.9.3 Signaling Fixing

For DS0 (64 kbit/s) channels provisioned with the robbed bit signaling mode, DACS II ISX performs the following signaling fixing features:

- For 4-state signaling, if both A and B signaling bits are not equal to 0 (that is, 01,10,11), on a cross-connection with signaling, DACS II ISX forces the least significant bit of the outgoing channel to 1 in a nonsignaling frame when the incoming channel was in a signaling frame.
- For 16-state signaling, the least significant bit is forced to 1 if A,B,C, and D signaling bits are not equal to 0 (that is, 0001,0010,.....,1110,1111).

This algorithm prevents generation of false framing patterns when a circuit traverses multiple DACS II ISX systems.

3.9.4 Signaling Freezing

DACS II ISX enters the signaling freezing state when one of the following conditions occurs:

- An out of frame (OOF)
- A single framing bit error, or
- In the D4 with DMI-BOS mode when 2 frames contain Remote Frame Alarm (RFA) - yellow alarm.

The signaling freezing is done by maintaining the signaling state that existed before the detection of the failure condition. The signaling freezing state is released when the above conditions are removed and two superframes have passed or when a Carrier Failure Alarm (CFA) is entered.

3.9.5 Signal Distortion

DACS II ISX does not insert any envelope distortion in the line signal. The only noise contribution is associated with robbed bit signaling and the lack of superframe alignment.

3.9.6 Programmable Signaling Insertion Modes

DACS II ISX supports the following programmable signaling output insertion word modes for T1 and E1 primary block facilities:

- T1 Facilities

  DACS II ISX supports the following per channel signaling output insertion modes for T1 facilities:

  — Pass-through (transparent)

  — Robbed bit signaling

  — Alternate Message Store (AMS): A predefined (per-channel programmable) 8-bit word is inserted when the circuit is not provisioned or, in the event of a facility or equipment failure, when the circuit is provisioned.

  — T1 level alarm code outputs (yellow alarm and AIS).

- E1 Facilities

  DACS II ISX supports the following per channel signaling output insertion modes for E1 primary block facilities:

  — AMS: A predefined (per-channel programmable) 8-bit word is inserted when the circuit is not provisioned or, in the event of a facility or equipment failure, when the circuit is provisioned.

  — E1 alarm code outputs [Remote Alarm Indication (RAI)].

3.10 64 kbit/s Channel Capability

The DACS II ISX supports 64 kbit/s channel capability for the following modes:

- B8ZS provides a 64 kbit/s clear data channel. If signaling is required, it can be either robbed bit or DMI-BOS.
- No Zero Code Suppression (NZCS) prevents the normal overwriting of the second least significant bit (bit 7) of an all-zero word. This requires the source of the 64 kbit/s or T1 signal to ensure that T1 pulse density requirements are met. This option is normally used when DACS II ISX provides cross-connection of T1 (24 channel) services such as digitally encoded video signals for teleconferencing. If signaling is required, it can be either robbed bit or DMI-BOS.

  These two options are selected on a per-T1 basis as part of the DACS II ISX equipment provisioning commands.
- HDB3 supports 64 kbit/s clear channel connections for E1 applications.

4. OFFICE ALARMS

The DACS II ISX provides relay contact closures for interfacing with the central office alarm grid. The DACS II ISX Status and Alarm Panel is equipped with alarm indicators and an alarm cutoff (ACO) switch. The ACO switch is provided to silence local audible alarms. The ACO function can also be activated/deactivated from a local or remote terminal by entering the ACO command.

The classification (levels) and types of alarms are described in the sections below.

4.1 Alarm Classification

DACS II ISX provides four classifications (levels) of visual alarms. These have the following general definitions:

- Minor Alarm in T1 Applications; Deferred Maintenance Alarm (DMA) in E1 applications

  Minor alarms are generated for the following non-service-affecting failures: All E1 facility alarms or administrative link failures programmed by the user to generate minor alarms, failure of at least one but not all timing references, active synchronizer in non-normal (fast or holdover) mode, synchronizer frequency control exceeding 75% of pull-in range, failure or manual removal of one but not both Memory Cards when the Main Controller is In Service, system date or time not set.

- Major Alarm in T1 Applications; Prompt Maintenance Alarm (PMA) in E1 applications

  Major alarms are generated for all service-affecting failures which affect five or fewer facilities or the non-service affecting failure of a redundant Synchronizer Cross Connect (SXC). Specifically, major alarms are generated for the following failures: protected failures of power feeders, primary fuses or power units, at least one but not more than five facility and/or facility equipment failures, non-service affecting failure of one of the duplicated SXC circuit packs, failure of the Main Controller, failure of the last In Service Memory Card, failure of all timing references, administrative link failures programmed by the user to generate major alarms.

- Main Controller Failure Alarm

  Any Main Controller failure

- Critical Alarm (PMA Critical in E1 application)

  Critical alarms are generated from all service affecting failures which affect more than five facilities. Specifically, critical alarms are generated for the following failures: unprotected failures of power feeders, primary fuses or power units causing a total loss of Main Shelf power, more than five facility and/or facility equipment failures, failure of both of the duplicated SXC circuit packs.

DACS II ISX also provides Maintenance Information notifications to report non-alarmed changes in the system state (such as facility performance threshold crossing alerts) and changes brought about by manual maintenance actions. Maintenance Information notifications are not displayed on the Status and Alarm Panel.

4.2 Alarm Types

DACS II ISX provides contact closures for the following alarm groups:

- Local Visual alarms: critical, major, MC failure - major, and minor
- Local Audible alarms: critical, major, and minor
- Remote Alarms: critical, major, MC failure - major, and minor.

The remote frame identification code (remote ID) is activated when any remote alarm is invoked. A "remote only" alarm mode can be set by software command which results in the generation of only remote alarms (local visual and audible alarms are suppressed) until the "remote only" mode is released by entry of another software command.

4.3 Alarm Interface Parameters

All central office alarm relay contact closures are rated as follows:

- Maximum instantaneous current: 2.5 ampere for 1 second
- Maximum steady state current: 2.0 ampere
- Maximum voltage: 30 V
- Maximum volt-ampere rating: 60 VA
- Transient noise suppression devices (diodes, networks, or other devices) must be used to protect terminations from inductive load transients.

A remote reset capability for DACS II ISX is provided.

The DACS II ISX interface to all alarm and remote reset leads is connectorized and is accessed at the rear of the DACS II ISX Main Shelf.

5. FACILITY ALARMS AND PERFORMANCE MONITORING

DACS II ISX collects and reports T1 and E1 facility alarms and performance data and supports programmable thresholds. E1 performance monitoring allows for quality of service measurement as specified in CCITT Recommendations G.826 and G.784. T1 performance monitoring is compliant with ANSI T1.403 and Bellcore TR-TSY-000820.

DACS II ISX reports whenever any of these facility degradations exceeds the user programmable maintenance and service limits. DACS II ISX also provides a 24-hour alarm summary report and autonomous daily audits.

5.1 T1 Facility Alarms and Performance Monitoring

5.1.1 T1 Facility Alarms

DACS II ISX continuously monitors T1 facilities, and detects and reports the occurrence and retirement of Carrier Group Alarms (CGAs). The CGA is the combination of a Carrier Failure Alarm (CFA) plus suitable Trunk Conditioning (TC).

- Loss of Signal (LOS) Alarm

  The LOS alarm indicates that DACS II ISX is detecting no pulses of either positive or negative polarity at the T1 line interface. The LOS alarm is generated independently of any additional Red CGA alarm that may result from an accompanying failure of the T1 path. When a LOS alarm is declared, trunk conditioning is applied on a per-channel basis and a yellow alarm signal is transmitted back in the upstream direction. For the duration of a T1 LOS condition, the accumulation of all T1 line performance parameters is inhibited. A T1 LOS condition is cleared when a T1 signal containing an average pulse density of at least 12.5% is persistently detected. When a T1 LOS condition clears, the yellow alarm signal is removed, trunk conditioning is removed and line performance monitoring is resumed.

- Red CGA Alarm

  The Red CGA alarm indicates that the DACS II ISX is detecting a continuous out-of-frame condition on an incoming T1. It can also be generated by the integration of intermittent short out-of-frame conditions. A Red CGA may supersede either an Alarm Indication Signal (AIS) or a Yellow CGA. When a Red CGA is declared, trunk conditioning is applied on a per-channel basis and a yellow alarm signal is transmitted back in the upstream direction. For the duration of a Red CGA, the accumulation of all T1 path performance parameters except Path Unavailable Seconds is inhibited. A Red CGA condition is cleared when a continuous in-frame condition with no slips is detected. When a Red CGA condition clears, the yellow alarm signal is removed, trunk conditioning is removed and normal path performance monitoring is resumed.

- Yellow CGA Alarm

  The Yellow CGA alarm indicates that the remote terminal is detecting an out-of-frame condition on a T1 signal transmitted by the DACS II ISX. A Yellow CGA may supersede either an Alarm Indication Signal (AIS) or a Red CGA. When a Yellow

CGA is declared, trunk conditioning is applied on a per-channel basis. The accumulation of near-end T1 performance parameters is unaffected by a Yellow CGA. A Yellow CGA is cleared when a received yellow alarm signal is no longer detected, causing trunk conditioning to be removed.

- Alarm Indication Signal (AIS) CGA Alarm

  The AIS CGA alarm indicates that the DACS II ISX is detecting an AIS signal on an incoming T1. An AIS is a signal associated with a maintenance alarm that is transmitted in the direction of a failure as a substitute for the normal signal. AIS CGAs may be programmed to generate either a major alarm or simply an informational message on a per facility basis. An AIS CGA may supersede either an Red or a Yellow CGA. When an AIS CGA is declared, trunk conditioning is applied on a per-channel basis and a yellow alarm signal is transmitted back in the upstream direction. For the duration of an AIS CGA, the accumulation of all T1 path performance parameters except Path Unavailable Seconds is inhibited. When an AIS CGA condition clears, the yellow alarm signal is removed, trunk conditioning is removed and normal path performance monitoring is resumed.

- Loss of Multiframe Alarm (LMA)

  The LMA is valid only in DMI-BOS signaling modes and indicates that DACS II ISX cannot frame on the word 24 multiframe pattern of the T1 signal.

- Remote Multiframe Alarm (RMA)

  The RMA is valid only in DMI-BOS signaling modes and indicates that the far end facility cannot frame on the word 24 multiframe pattern of the T1 signal transmitted by the DACS II ISX.

Table C summarizes the declaration, retirement, and action performed by DACS II ISX for the T1 facility alarms.

Table C — DACS II ISX T1 Carrier Group Alarms

Alarm	Mode	Detection		Retirement	
		Algorithm	Action	Algorithm	Action
RED (voice)	D4, ESF	OOF active for 2.5 seconds or hit integration 5/1	Transmit YELLOW upstream and Trunk Conditioning downstream	OOF inactive for 12.5 seconds	Remove YELLOW and Trunk Conditioning
RED (data)	ESF, T1DM	OOF active for 500 ms or hit integration 5/1	Same as above	OOF inactive for 2.5 ms	Same as above
LMA (voice)	D4 (DMI), ESF (DMI)	LMA active for 7.5 seconds or hit integration 5/1	Transmit RMA	LMA inactive for 17.5 seconds	Remove RMA
LMA (data)	ESF (DMI)	LMA active for 500 ms or hit integration 5/1	Same as above	LMA inactive for 100 ms	Same as above
YELLOW (voice)	D4, ESF	RFA active for 500 ms or hit integration 5/1 (facility is in-frame)	Transmit Trunk Conditioning downstream	RFA Inactive for 100 ms	Remove Trunk Conditioning
YELLOW (data)	ESF, T1DM	RFA active for 50 ms (facility is in-frame)	Same as above	RFA inactive for 50 ms	Same as above
RMA (voice)	D4 (DMI), ESF (DMI)	RMA active for 500 ms or hit integration 5/1 (facility is in-frame)	Transmit Trunk Conditioning downstream	RMA inactive for 100 ms	Remove Trunk Conditioning
RMA (data)	ESF (DMI)	RMA active for 50 ms (facility is in-frame)	Same as above	RMA inactive for 50 ms	Same as above
AIS (voice)	D4, ESF	OOF active to declare RED and AIS active for 1 second or hit integration 6/1	Transmit YELLOW upstream and Trunk Conditioning downstream	OOF inactive and AIS inactive for 200 ms, if OOF active and AIS inactive hold AIS and restart RED algorithm	Remove YELLOW and Trunk Conditioning

Table C — DACS II ISX T1 Carrier Group Alarms (Cont'd.)

Alarm	Mode	Detection		Retirement	
		Algorithm	Action	Algorithm	Action
AIS (data)	ESF, T1DM	OOF active to declare RED and AIS active for 300 ms or hit integration 3/1	Same as above	OOF inactive and AIS inactive for 100 milliseconds, if OOF active and AIS inactive hold AIS and restart RED algorithm	Same as above
LOS	D4, ESI, T1DM	LOS active for 2.5 seconds or hit integration 5/1	Same as above	LOS inactive for 12.5 seconds	Same as above

5.1.2 T1 Performance Monitoring

Performance monitoring, data storage and retrieval on DACS II ISX is compliant with Bellcore TR-TSY-000820. This specification identifies the Near End and Far End T1 PM parameters to be monitored as well as the data collection intervals for these PM data. DACS II ISX also complies with ANSI T1.403, which defines the requirements for broadcast and receipt of PM data as well as the initiation of loopbacks.

DACS II ISX support of ANSI T1.403 includes:

- Generating/Terminating the ANSI T1.403 ESF data link T1 performance reports
- Calculation and storage of Far End performance data
- Initiation of ANSI T1.403 compliant Far End loopbacks.

DACS II ISX provides full time line and path performance monitoring on T1 facilities. The performance data are stored in 15 minute and 24 hour intervals, and may be retrieved for analysis by an external user or operations system.

DACS II ISX monitors and stores the following performance parameters for each terminating T1 facility:

- Near End T1 Line Performance Parameters
  - — Coding Violations (CV)
    This parameter is a count of the line coding violations (e.g., bipolar violation).
  - — Errored Seconds (ES)
    This parameter is a count of seconds during which at least one line CV has occurred.
  - — Severely Errored Seconds (SES)
    This parameter is a count of seconds during which 1544 or more line CVs have occurred. This number corresponds to an approximate BER of 10^{-3}.

- Far End T1 Line Performance Parameters[1]

  — Errored Seconds (ES)
  This parameter is a count of seconds during which at least one far end line CV has occurred. The far end CV data are communicated to the near end via the Extended Superframe data link.

- Near End T1 Path Performance Parameters

  — Coding (CRC-6) Violations (CV)
  This parameter is a count of detected CRC-6 CVs (or a count of detected framing errors for non-Extended Superframe formats).

  — Errored Seconds (ES)
  This parameter is a count of seconds during which at least one of the following has occurred: a path CV, a controlled slip, or a severely errored framing event.

  — Severely Errored Seconds (SES)
  This parameter is a count of seconds during which at least one of the following has occurred: 320 or more CRC-6 CVs or a severely errored framing event. For non-Extended Superframe formats, the occurrence of 8 or more framing errors may be substituted for the 320 CRC-6 CVs.

  — Severely Errored Framing Seconds (SEFS)
  This parameter is a count of seconds during which at least one severely errored framing event has occurred. A severely errored framing event is defined as: 2 or more framing bit errors within a 3 millisecond period (often referred to as an out of frame condition).

  — Controlled Slip Seconds (CSS)
  This parameter is a count of seconds during which a controlled slip has occurred.

  — Unavailable Seconds (UAS)
  This parameter is a count of seconds during which the 1.544 Mbit/s signal is deemed unavailable (e.g., during a loss of frame condition).

- Far End T1 Path Performance Parameters

  The far end path performance parameters are based on far end CRC-6 CV, SEF, and slip counts that are communicated to the near end via the Extended Superframe data link. The CVs are not communicated as exact counts but rather as a range of counts in compliance with ANSI T1.403. For example, if 40 far end CRC-6 errors were detected in a one second interval, the far end would indicate (via the data link) that between 11 and 100 CRC-6 errors were detected. The near end would, therefore, always have the worst case assessment of the far end performance (e.g., DACS II ISX would assume 100 CRC-6 errors in the above example). The following far end path performance parameters are monitored and stored by DACS II ISX.

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1. The far end performance parameters are communicated to the near end via the Extended Superframe data link as defined in ANSI T1.403.

— Coding Violations (CV)
This parameter is a count of detected far-end CRC-6 coding violations.

— Errored Seconds (ES)
This parameter is a count of seconds during which a far end path CV is reported.

— Severely Errored Seconds (SES)
This parameter is a count of seconds during which the far end reports 320 or more CRC-6 CVs.

— Severely Errored Framing Seconds (SEFS)
This parameter is a count of seconds during which at least one far end severely errored framing event is reported.

— Controlled Slip Seconds (CSS)
This parameter is a count of seconds during which a far end controlled slip is reported.

— Unavailable Seconds (UAS)
This parameter is a count of seconds during which the far end T1 signal is deemed unavailable.

Table D — DA Type NPCs Parameter Register Threshold Range and Default Values

Parameter	Threshold Value Range	Default Threshold Value
Daily Near-end Path Coding Violations	000000000–134217727	132960*
Daily Near-end Path Errored Seconds	00000–86400	648
Daily Near-end Path Severely Errored Seconds	00000–86400	100
Daily Near-end Severely Errored Framing Seconds	00000–86400	17
Daily Near-end Path Controlled Slip Seconds	00000–86400	4
Daily Near-end Path Unavailable Seconds	00000–86400	10
Daily Near-end Line Coding Violations	000000000–134217727	133400
Daily Near-end Line Errored Seconds	00000–86400	648
Daily Near-end Line Severely Errored Seconds	00000–86400	100
Daily Far-end Path Coding Violations	000000000–134217727	132960
Daily Far-end Path Errored Seconds	00000–86400	648
Daily Far-end Path Severely Errored Seconds	00000–86400	100
Daily Far-end Severely Errored Framing Seconds	00000–86400	17
Daily Far-end Path Controlled Slip Seconds	00000–86400	4
Daily Far-end Path Unavailable Seconds	00000–86400	10
Daily Far-end Line Errored Seconds	00000–86400	648
15-Minute Near-end Path Coding Violations	0000000–2097151	13296†
15-Minute Near-end Path Errored Seconds	000–900	65
15-Minute Near-end Path Severely Errored Seconds	000–900	10
15-Minute Near-end Severely Errored Framing Seconds	000–900	2
15-Minute Near-end Path Controlled Slip Seconds	000–900	1
15-Minute Near-end Path Unavailable Seconds	000–900	10
15-Minute Near-end Line Coding Violations	0000000–2097151	13340
15-Minute Near-end Line Errored Seconds	000–900	65
15-Minute Near-end Line Severely Errored Seconds	000–900	10
15-Minute Far-end Path Coding Violations	0000000–2097151	13296
15-Minute Far-end Path Errored Seconds	000–900	65
15-Minute Far-end Path Severely Errored Seconds	000–900	10
15-Minute Far-end Severely Errored Framing Seconds	000–900	2
15-Minute Far-end Path Controlled Slip Seconds	000–900	1
15-Minute Far-end Path Unavailable Seconds	000–900	10
15-Minute Far-end Line Errored Seconds	000–900	65

* The value shown applies to ESF framing and is a count of CRC errors. When the T1 has D4 or T1DM framing, framing errors are counted and the default Daily value is 691.

† The value shown applies to ESF framing and is a count of CRC errors. When the T1 has D4 or T1DM framing, framing errors are counted and the default 15-Minute value is 72.

5.1.3 T1 Performance Data Storage

DACS II ISX monitors the above performance parameters and stores their counts for future retrieval as required by Bellcore TR-TSY-000820. These data storage intervals are listed below.

- 15 minute intervals:
  - — Current 15 minute interval
  - — Previous 15 minute interval
  - — Additional 95 most recent 15 minute intervals.
- 24 hour intervals:
  - — Current 24 hour interval
  - — Previous 24 hour interval
  - — Additional 6 most recent 24 hour intervals.

Each of the performance parameters has thresholds for the current 15 minute interval and the current 24 hour interval. When a threshold is exceeded, an autonomous message is broadcast over the DACS II ISX administrative link. Each performance parameter may be assigned one of four software settable threshold values for generating the autonomous message. When provisioning a T1 interface, the user can select one of the four threshold options for each performance parameter on that particular T1 interface.

5.1.4 T1 Loop Back

In compliance with ANSI T1.403, DACS II ISX provides the ability to initiate and terminate the following far end T1 loop backs:

- Line Loop Back (LLB)
- Network Loop Back (NLB)
- Payload Loop Back (PLB).

The far end loop back commands are initiated and terminated via the standard DACS II ISX administrative interface (i.e., PDS or MML commands). Upon receiving a request to initiate a far end loop back, DACS II ISX uses the Extended Superframe data link and/or inband signaling to direct the identified far end equipment to execute/terminate the loopback.

In addition to requesting far end loop backs, DACS II ISX can also perform a near end payload loop back in compliance with ANSI T1.403. That is, upon receiving a data link payload loop back command from the far end equipment or via a local administrative command, DACS II ISX will loop the received payload back onto the facility. When the loop back is terminated, DACS II ISX automatically returns the existing connections to their previous states.

5.1.5 T1 Test Signal Injection

The DACS II ISX EDDC circuit pack provides the ability to inject T1 test signals onto existing, provisioned T1 facilities. The test signals may be used in conjunction with the far end loop back features to perform single ended facility maintenance.

The four T1 test signals that DACS II ISX can inject are:

- Yellow Signal:
  Since this signal is transmitted in the Extended Superframe data link, it may be used in conjunction with the remaining test signals. However, when using the Superframe or T1DM framing formats, the yellow signal is actually passed via the data channels. Consequently, users may not use other T1 test signals with the Superframe or T1DM yellow signal.
- High Ones Density Test Signal:
  This signal consists of all ones in the payload bits with valid T1 framing.
- Low Ones Density Test Signal:
  This signal consists of a repeating eight bit pattern of (00000001) with valid T1 framing.
- Quasi-Random Test Signal:
  A 1,048,575 bit sequence generated by a 20 stage shift register as defined in ANSI T1.403, with valid T1 framing.

In addition to the test signals, the EDDC circuit pack enables DACS II ISX to send the following in-band signals to control far end loopbacks:

- In-band Loop Back Activate Signal:
  This signal consists of a repeating bit pattern of (00001) lasting for 5 to 8 seconds with valid T1 framing.
- In-band Loop Back Deactivate Signal:
  This signal consists of a repeating bit pattern of (001) lasting for 5 to 8 seconds with valid T1 framing.

Once the test signal activation command is received and executed by DACS II ISX, the test signal remains on the line until it is deactivated by a subsequent user command.

DACS II ISX always applies downstream trunk conditioning before it begins transmitting the requested test signal.

5.2 E1 Primary Block Facility Alarms and Performance Monitoring

DACS II ISX continuously monitors the E1 primary block facilities for both Primary Block Alarms (PBAs) and facility performance parameters.

5.2.1 E1 Primary Block Facility Alarms

E1 facilities terminating on DACS II ISX are monitored for three types of E1 alarms: signal alarms, Time Slot 0 (TS0) detected alarms and Time Slot 16 (TS16) detected alarms.

5.2.1.1 Signal Alarms

- Loss of Signal (LOS)
  The LOS condition is declared when more than 10 consecutive zeros are detected.
- Alarm Indication Signal (AIS) Alarm
  The AIS alarm is declared when the Alarm Indication Signal is received in all 32 time slots.

- Loss of Frame (LOF)
  The LOF condition is declared when three consecutive Frame Alignment Signals (FASs) have been received with an error or when TS0 bit 2 of the Non Frame Word (NFW) have been received with an error on 3 consecutive occasions. In addition, DACS II ISX will declare a LOF when 915 or more CRC-4 block errors are detected in a one second interval.
- Excessive Error Rate (EER)
  The EER alarm is declared when 8192 or more coding violations are detected in a four second interval, which is equivalent to a Bit Error Rate (BER) of $1X10^{-3}$. The EER alarm is also declared when four consecutive 1-second intervals each have 19 or more FAS+[2] errors.
- Bit Error Rate (BER)
  The BER alarm is declared when 1228 or more coding violations are detected in a 1 minute interval, which is equivalent to a BER of $1X10^{-5}$. The BER is also declared when 3 consecutive 2-second intervals each contain 2 or more CRC block errors (for facility provisioned with CRC-4), or 2 or more FAS+ block errors (for facility provisioned without CRC-4).
- Loss of CRC-4 Multiframe Alignment (LCMA)
  The LCMA alarm is declared when basic frame alignment is valid but CRC-4 multiframing is lost on the facility which is provisioned with automatic CRC mode.
- Far End LCMA (FLCMA)
  The FLCMA alarm is declared when more than 990 CRC-4 block errors are reported from the far end equipment (via E-Bits) in each second for five consecutive seconds.

5.2.1.2 TS0 Detected Alarms

- Remote Alarm Indication (RAI)
  The RAI alarm is declared when the remote alarm indication is received in TS0 Bit 3 of the NFW.
- Remote AIS (RAIS)
  The RAIS alarm is declared when the RAIS indication is detected in TS0 Bit 4 of the NFW on the facility which is provisioned with RAIS alarming capability enabled.
- Remote Bit Error Rate (RBER)
  The RBER alarm is declared when the RBER indication is detected in TS0 Bit 4 of the NFW on the facility which is provisioned with RBER alarming capability enabled.
- Synchronization Failure Indication (SFI)
  The SFI alarm is declared when SFI indication is detected in TSO Bit 5 of the NFW. Detection of this alarm is software programmable on a per E1 basis.
- Pseudo Frame Word Out-of-Frame (PFWOOF)
  For timeslot zero to non-timeslot zero cross-connections using the Pseudo Frame Word (PFW) mode, the PFWOOF alarm will be declared if the PFW cannot be recognized.

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2. FAS+ is defined as the 8-bit total consisting of the Frame Alignment Signal (FAS) (0011011 pattern in the even frame of Time Slot 0) and bit 2 contained in the odd framing word of TS0.

5.2.1.3 TS16 Detected Alarms

- A16
  The A16 alarm is declared when "ALL-Ones" is received in TS16 of a facility using CAS.
- Loss of Multiframe Alignment (LMA)
  The LMA alarm is declared when LMA or loss of incoming signal is detected on TS16 of a facility using CAS.
- R16
  The R16 alarm is declared when the remote alarm indication is received in bit 6 of TS16 of Frame 0.

5.2.1.4 Alarm Maintenance Classification and Consequent Action

The alarm levels that can be raised include the following:

- PMA - Prompt Maintenance Alarm
- DMA - Deferred Maintenance Alarm
- MI - Maintenance Information.

Table E shows the alarm levels that are declared for each type of 2.048 Mbit/s failure, TS0 or TS16 failure indication.

Table E — 2 Mbit/s Failures and Alarm Levels

Failure	Alarm Level
LOS	PMA
LOF	PMA
EER	PMA
LMA	PMA
AIS	PMA, DMA, MI
BER	DMA
SFI	MI
LCMA	MI
RAI	MI
RAIS	MI
RBER	MI
FLCMA	MI
R16	MI
A16	MI
PFWOOF	MI

Figure 1 shows the alarm reporting priority and coexistence scheme in a tree type format. An offspring alarm on the tree has a lower priority than its root alarm and is not reported if there is an existing root alarm. Two alarms can coexist if they are not in each other's root path.

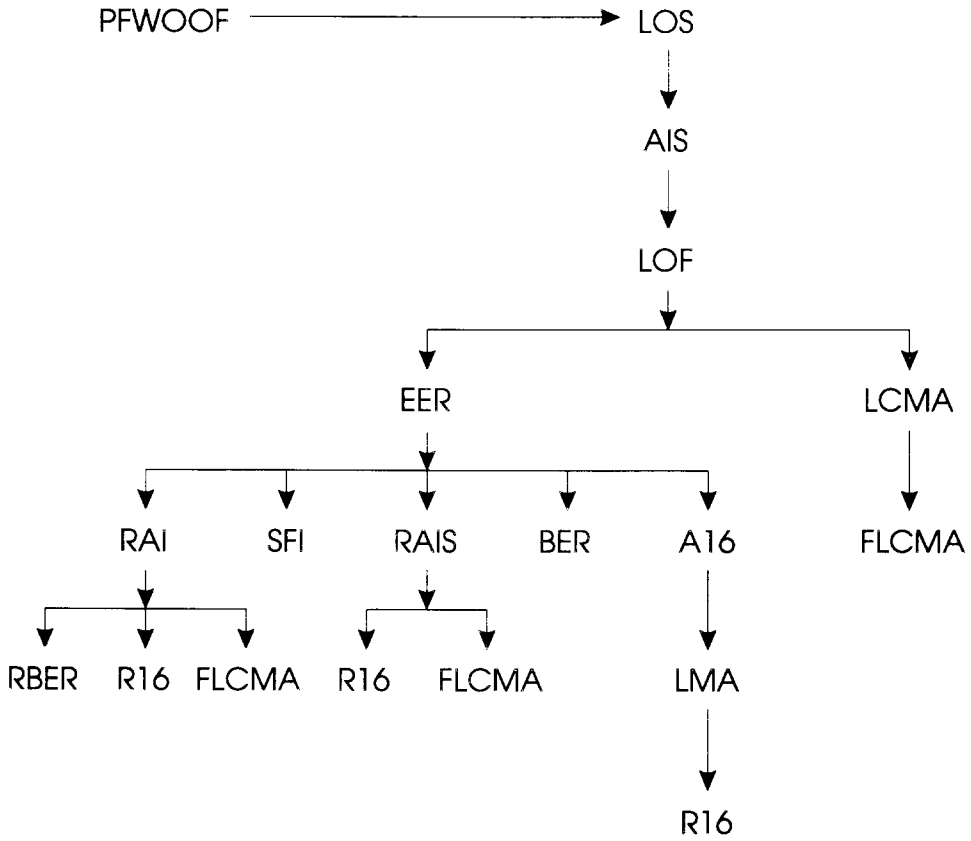

Figure 1 — DACS II ISX Facility Alarm Priority and Coexistence

Table F summarizes the consequent actions for detected alarms.

Table F — Consequent Actions for Detected Alarms

Detected Alarm	Consequent Action			
	Remote Alarm Indication Transmitted in TS0 Bits	**Remote Alarm Indication Transmitted in TS16, Bit 6, Frame 0**	**AIS Applied to All Received Timeslots**	**AIS Applied to Received Signaling Channels in TS16**
LOS/LOF	RAI	—	yes	yes
AIS	RAI,RAIS*	—	yes	yes
EER	RAI	—	yes	yes
BER	RBER*	—	—	—
RAI	—	—	—	yes*
RAIS	—	—	—	yes*
A16	—	R16	—	yes
LMA	—	R16	—	yes
R16	—	—	—	yes*
FLCMA	—	—	—	—
LCMA	Set E bits	—	yes†	yes†
SFI‡	—	—	—	—

* Dependent on the E1 NPC type provisioned.

† No consequent action if Automatic CRC-4 is enabled.

‡ Extracted line clock to synchronizer is squelched.

5.2.2 E1 Performance Monitoring

DACS II ISX provides enhanced E1 performance monitoring similar to the T1 performance monitoring enhancements. DACS II ISX performance monitoring is based on CCITT Recommendations G.784 and G.826. The following parameters are accumulated/calculated per E1 facility.

5.2.2.1 Error Count Parameters

- Code violations (CV)
  The CV count is incremented every time a code violation is detected. DACS II ISX monitors and accumulates the CV in addition to converting it into an error rate estimate for alarm reporting.
- Framing error count (FRER)
  The FRER count is incremented every time a framing error is detected. The FRER is also used to provide an error rate estimate for alarm reports.
- Unavailable time count (UATC)
  A period of unavailable time (UAT) begins when the bit error ratio in each second is worse than 10^{-3} for a period of ten consecutive seconds. These ten seconds are considered unavailable time. A new period of available time begins at the first second of a period of ten consecutive seconds each having an error rate better than 10^{-3}. The UATC count is incremented every time a period of unavailable time is entered.

- CRC4 block error count (CRC)
  The CRC count is incremented every time a CRC block error is detected.
- Multiframe alignment Error count (MER)
  The MER count is incremented when an error is detected in the Multiframe Alignment Signals (MASs).

5.2.2.2 Errored Interval Parameters

- Controlled slip seconds (CSS)
  The CSS is incremented for every 1-second interval with one or more slip defects.
- Out of frame seconds (OFS)
  The OFS is incremented for every 1-second interval with one or more Loss of frame defect. Continuous Loss of frame defects are counted as one defect.
- Errored seconds (ES)
  The ES is incremented for every 1-second interval with one or more of the following conditions: CV, slip, LOS, LOF, framing error, or CRC4 block error.
- Severely errored seconds (SES)
  The SES is incremented for every 1-second interval with one or more of the following conditions: slip, LOS, LOF, a percentage of FAS or CRC blocks received in error - programmable from 1% to 91% (default 81%), or 4 contiguous FAS or CRC-4 block errors.
- Unavailable seconds (UAS)
  The UAS count is incremented for every 1 second interval in an UAT period.

5.2.2.3 Remote (Far end) Performance Parameters

It is also possible to accumulate some far-end E1 performance parameters by using the received E-bits (or international bits) in the CRC-4 multiframe word as defined in CCITT Recommendation G.706. The following parameters are stored.

- Far end block error count (FEBE)
  FEBE is equivalent to the local error count parameter.
- Far end errored seconds (FES)
  The FES count is incremented every time one or more FEBE occur in a one second interval.
- Far end severely errored seconds (FSES)
  The FSES count is incremented every time a percentage of far end blocks are in error in a one second interval, programmable from 1% to 91% (default 81%).
- Far end unavailable seconds (FUAS)
  FUAS is similar to UAS but it is calculated using FSES rather than SES.

5.2.3 E1 Performance Data Management

DACS II ISX collects and stores the performance parameters in 15 minute and daily intervals as required per CCITT Recommendation G.784. For each collection interval, current and previous registers are kept to provide a history of the parameter. As an example, the following registers are kept for coding violations:

Current 15 minute interval, previous 15 minute interval, 95 most recent 15 minute intervals, current day and previous day.

All current parameters have associated thresholds that, when exceeded, result in an autonomous messages. These messages are user programmable as either informational (MI), minor alarms (DMA), or major alarms (PMA). The associated thresholds can be specified on a per-parameter per-E1 link basis from one of four values, either locally or remotely over the administrative links. One of the four values is the system default value while the remaining three values are programmable by the user. The daily counts and alarm state of all transmission links are also displayed automatically as part of a daily report. By default the daily report is issued at midnight. The user can define any time of day for the daily report and the facility performance parameters to be included in the report.

Table G shows the E1 performance parameters, the threshold ranges, and the default thresholds.

Table G — E1 Performance Parameters Threshold Range and Default Values

Parameter	Interval	Threshold Value Range	Default Threshold Value
CRC Block Errors	Daily	1–79056000	176947
Framing Errors	Daily	1–345600000	176947
Out of Frame Seconds	Daily	1–86400	4
Errored Seconds	Daily	1–86400	4320
Severely Errored Seconds	Daily	1–86400	90
Controlled Slip Seconds	Daily	1–86400	4
Coding Violations	Daily	1–176947200	176947
Unavailable Seconds	Daily	1–86400	90
Unavailable Time Count	Daily	1–4320	9
Multiframe Errors	Daily	1–86400	4095
Far End Block Errors	Daily	1–79056000	176947
Far End Errored Seconds	Daily	1–86400	4320
Far End Severely Errored Seconds	Daily	1–86400	90
Far End Unavailable Seconds	Daily	1–86400	90
CRC Block Errors	15 Min.	1–823500	18432
Framing Errors	15 Min.	1–3600000	18432
Out of Frame Seconds	15 Min.	1–900	4
Errored Seconds	15 Min.	1–900	300
Severely Errored Seconds	15 Min.	1–900	30
Controlled Slip Seconds	15 Min.	1–900	1
Coding Violations	15 Min.	1–1843200	18432
Unavailable Seconds	15 Min.	1–900	30
Unavailable Time Count	15 Min.	1–45	3
Multiframe Errors	15 Min.	1–900	255
Far End Block Errors	15 Min.	1–823500	18432
Far End Errored Seconds	15 Min.	1–900	300
Far End Severely Errored Seconds	15 Min.	1–900	30
Far End Unavailable Seconds	15 Min.	1–900	30

The alarm state of a threshold crossing message is user programmable on a per parameter and per E1 basis as one of the following:

- Maintenance Information (MI)
- Deferred Maintenance Alarm (DMA)
- Prompt Maintenance Alarm (PMA).

5.2.4 E1 Loopback

The DACS II ISX Enhanced Dual Primary Circuit (EDPC) packs support the following E1 loop backs:

- Facility Loop Back
- Equipment Loop Back.

The E1 loop backs are initiated and terminated by user commands entered via the DACS II ISX administrative links. The facility loop back loops the received E1 signal from the incoming facility back onto the facility. The received signal line coding and line timing are both preserved during the facility loop back.

The equipment loop back loops the transmitted E1 signal from the EDPC pack back into the EDPC pack. (i.e., the EDPC receives its own transmitted E1). This loop back includes the line coding and line timing produced by the EDPC.

For both loop backs, the user specifies whether the direction being looped should be transmitted through DACS II ISX (for facility loop back), transmitted onto the E1 facility (for equipment loop back) or be terminated, with AIS transmitted downstream (for both loop backs). Users also specify whether DACS II ISX is to provide E1 performance monitoring on the received signal.

6. EQUIPMENT AND FACILITY PROTECTION

6.1 Hardware Protection

The DACS II ISX architecture provides complete redundancy to equipment which carries or affects service for more than two T1/E1 facilities.

6.1.1 Duplicated Equipment and Protection Switching Performance

The duplicated equipment redundancy consists of two independent but fully duplicated sides (Side 0 and Side 1) for signal and clock distribution paths. This duplication is provided via the redundant SXC packs.

The protection switching of the duplicated SXC can be initiated autonomously or manually. The autonomous protection switching is performed when an entity on the active side fails, provided that the inactive side is in service. The manually initiated switching is performed when a valid protection switching command is entered while the inactive side is in service.

Table H specifies DACS II ISX autonomous protection switching performance data including the failure detection time. The manually initiated side switching is hitless.

Table H — DACS II ISX Release 1.0 Protection Switching Performance

Circuit Pack Failed	Nominal Switching Time (in ms)
SXC	40

6.2 Software Protection and Data Transfer Performance

DACS II ISX provides protection for the executable software code and database by using hardware parity bits and software checksums. In addition, all data is duplicated in the system nonvolatile memory. The nonvolatile backup is on redundant Personal Computer Memory Card International Association (PCMCIA) memory cards (MEMA and MEMB). In the event of loss of data in the operating memories (RAM), the system is rebooted from the nonvolatile backup.

Table I shows DACS II ISX data transfer and system reset performance. When the specifications were obtained, the DACS II ISX system was equipped as follows: one NPSM was fully equipped with TG191 circuit packs and three NPSMs were fully equipped with TG192 circuit packs. The timing specified is for a fully provisioned and cross-connected system with 64 facilities.

Table I — DACS II ISX Data Transfer and System Reset Performance

Operation	Nominal Execution Time
MEMA to MEMB Database Transfer	1 Minute
MEMA to MEMB System Software Transfer	Less than 2 Minutes
MC RAM to MEMA/MEMB Database Transfer	Less Than 2 Minutes
MEMA/MEMB to MC RAM Database Transfer	Less Than 20 Seconds
Restore MC	Less Than 2 Minutes
System Reset	Less Than 2 Minutes
Boot Frame	Less Than 2 Minutes

When the MC is restored to service, an attempt is made to duplicate and restore both Memory Cards to service. System executables and database are transferred from the Memory Cards to the MC's Random Access Memory (RAM). In addition, the system hardware is configured with the information transferred from the Memory Cards.

If the MC can access the cross-connect hardware, it performs a timeslot by timeslot comparison of the hardware configuration with the database. If no mismatches exist, the boot will proceed. Otherwise, if the MC determines that booting the hardware with the database will disconnect existing circuits, a warning message is generated. The number of channels that will be disconnected is displayed in the message and the user is then asked if the boot should proceed.

When the MC is restored to service, existing test access sessions are terminated and all of the test ports are released. All alarms that exist on the system are cleared. Any facility alarms that still exist on the system will return once the MC is restored to service.

System reset, also known as cold boot, is defined as a manual reset of the DACS II ISX, which results in the Main Controller being reset, downloading of the system database and software executables from backup memory, and a rewrite of the hardware with the database information. Boot frame, also known as warm boot, is invoked by user command and involves only the database and does not require code downloading.

7. CROSS-CONNECT CAPABILITY AND PERFORMANCE

DACS II ISX provides its cross-connect capability via the duplicated SXC. The SXC has a 4096×4096 switch matrix. The SXC is fully duplicated for reliability and is fully nonblocking for any equipment configuration or cross-connect type. The SXC and the digital signal terminating and processing circuitry maintain frame integrity for all 64 kbit/s signals cross-connected. That is, each 64 kbit/s signal experiences the same number of frame delays. DACS II ISX is compliant with the cross-connect standards specified in ETS 300-010-01 and CCITT Recommendation G.796.

7.1 Supported Cross-Connect Types

DACS II ISX performs several types of 64 kbit/s and N×64kbit/s cross-connections. The circuit types include:

- 2-way, 2-point cross-connections
- 1-way, 2-point cross-connections

- Multipoint broadcasts with selectable return path
- Multipoint, 1-way broadcast
- Timeslot zero to non-timeslot zero cross-connections.

7.2 Cross-Connect Execution Time

Table J specifies DACS II ISX cross-connect and disconnect performance with the following assumptions:

- All required equipment is in-service.
- There are no conflicting cross-connections.
- DACS II ISX is not currently executing any other command.
- There are no other input messages in queue.
- DACS II ISX MML command and message language is used.

The cross-connect execution times specified do not include input/output times for the cross-connect command on the administrative link. They are defined as from the time at which the DACS II ISX detects a carriage return to the time at which the DACS II ISX begins to send out the first output character. The completion of the cross-connection/disconnection occurs earlier.

Table J — Two-point 64 kbit/s Cross-Connect/Disconnect Execution Time

Number of Channels	Cross-Connect Type	Nominal Execution Time (in ms)
1	2-way, 2-point Cross-Connect	832
	2-way, 2-point Disconnect	773
	1-way, 2-point Cross-Connect	790
	1-way, 2-point Disconnect	768
24	2-way, 2-point Cross-Connect	994
	2-way, 2-point Disconnect	990
	1-way, 2-point Cross-Connect	903
	1-way, 2-point Disconnect	893
30	2-way, 2-point Cross-Connect	1000
	2-way, 2-point Disconnect	1000
	1-way, 2-point Cross-Connect	910
	1-way, 2-point Disconnect	924

8. TEST ACCESS CAPABILITY AND PERFORMANCE

DACS II ISX provides test access for 64 kbit/s circuits passing through the system. This access is provided via the Test Access Digroups (TADs) called NPCs for Test Ports (NPCTPs). An NPCTP has 12 64 kbit/s Test Ports (TPs), each consisting of a pair of 64 kbit/s channels. DACS II ISX supports up to eight NPCTPs for a total of 96 TPs. NPCTPs and TPs are predesignated via user commands.

8.1 Test Access Types

DACS II ISX provides the following test access modes:

- Monitor
- Split
- Hub
- Terminated
- Looped TP.

For details and allowed options, refer to the *AT&T DACS II ISX Command and Message Manuals*.

8.2 Test Access Execution Time

The test access execution times shown in Table K apply to access of existing 2-way, 2-point 64 kbit/s cross connections with the following assumptions:

- All required equipment is in-service.
- There are no conflicting test connections.
- DACS II ISX is not currently executing any other command.
- There are no other input messages in queue.
- DACS II ISX MML command and message language is used.

The execution times shown do not include input/output times for the Test Access command on the administrative link. They are defined as from the receipt of the input command termination character to the the outputs of the first character in the command completion message. Completion of the test access connection occurs earlier.

Table K — DACS II ISX 64 kbit/s Test Access Execution Time

Access Type	Action	Nominal Execution Time (ms)
Monitor	Activate	789
	Release	761
Split	Activate	752
	Release	766
Looped	Activate	764
	Release	750
Hub	Activate	798
	Release	772
Terminate And Leave Active	—	754
Terminate And Leave Release	—	750

9. ADMINISTRATIVE INTERFACES

9.1 Administrative Link Options

DACS II ISX provides one synchronous X.25 link and four asynchronous links for administrative interfaces. All links are EIA RS-232D compliant. The RS-232D synchronous link has a maximum transmission rate of 20K baud, and maximum cable length of 150 feet. The four RS-232D asynchronous links each have a maximum transmission rate of 9.6K baud, and maximum cable length of 150 feet.

9.2 Asynchronous Administrative Links

9.2.1 Physical and Electrical

DACS II ISX provides 4 Snider asynchronous administrative links designed with physical and electrical interfaces according to EIA Standard RS-232D.

9.2.2 Terminal Requirements

Any terminal having the following features is acceptable for communicating with the DACS II ISX equipment, either locally or remotely via suitable modems:

- EIA RS-232D interface with full duplex operation
- ASCII characters (10 bits) with even parity (7 data bits, 1 start bit, 1 stop bit, and 1 parity bit)
- 300, 1200, 2400, 4800, and 9600 baud asynchronous operation
- Responds with ASCII "ACK" when it receives an ASCII "ENQ" character. DACS II ISX asynchronous Snider links implement the ENQ/ACK communication protocol, provisionable on a per-link basis, with "disabled" as the default selection.

  If the connecting terminal does not respond to DACS II ISX "ENQ" characters, communication between DACS II ISX and the terminal is still possible. However, all DACS II ISX command responses, other than echoes and immediate responses to commands, will be delayed by 2 seconds after an initial delay of 24 seconds. This 2-second delay on the asynchronous links is caused by ENQ/ACK protocol requirements. The delay may cause the output buffer in the DACS II ISX to fill, slowing down responses on other DACS II ISX administrative links as well. These delays will not occur if the ENQ/ACK protocol is disabled.
- A terminal has the option to employ the XON/XOFF flow control protocol on DACS II ISX asynchronous Snider links, to temporarily suspend DACS II ISX output messages. This option is provisionable on a per-link basis for Snider links, and the default selection is "enabled".

  The connection terminal may send DACS II ISX an XOFF, ASCII character "DC3", hexadecimal value 0x13, or CTRL-S, and DACS II ISX will suspend its output for up to 60 seconds. The terminal may send an XON, ASCII character "DC1", hexadecimal value 0x11, or CTRL-Q, prior to the 60-second time limit to resume transmission. If an XON is not received after 60 seconds, DACS II ISX will resume transmission automatically. Additional XOFF characters may be sent by the terminal to continue output control. XON/XOFF may only be used while a link is in output mode.

9.2.3 Modem Requirements

The recommended method for administering DACS II ISX frames remotely is via dedicated private line data circuits. For operation over 1200 b/s (asynchronous analog circuits), the recommended modem is an AT&T 202T type or equivalent with the following features:

- Asynchronous, binary, serial, full-duplex operation
- EIA RS-232D interface
- 4-wire private line operation
- 1200 b/s data rate without line conditioning
- Clear-to-send delay of 8 ± 0.3 ms
- Carrier detection:

  Operate = 6.9 ± 0.4 ms

  Release = 5.0 ± 0.5 ms
- Soft carrier turn-off: 8 ± 0.4 ms
- Received data is clamped when received line signal is off.

9.3 Synchronous Administrative Link

The DACS II ISX X.25 administrative link complies with CCITT X.25, 1984. The X.25 administrative link supports up to 16 Virtual Circuits (VCs), which may be provisioned in any combination of Permanent VCs or Switched VCs.

9.3.1 Packet Assembler/Disassembler Requirements

Any packet assembler/disassembler (PAD) having the following features is acceptable for communicating with the DACS II ISX:

- EIA RS-232D interface
- Up to 20K baud operation.

Direct connection to a PAD is supported with a synchronous modem eliminator.

9.3.2 Packet Network Interface Requirements

The recommended method for administering DACS II ISX frames remotely is via dedicated private line circuits. The modem must have the following features:

- Synchronous, binary, serial, full-duplex operation
- EIA RS-232D interface
- 4-wire private line operation
- Received data is clamped when received line signal is off.

9.4 Access Security and Screening

DACS II ISX provides the following link/user access security and screening feature for applications where it is necessary to administer the system over a public network:

- Link Access Restriction

  DACS II ISX allows its administrative links or virtual circuits (VCs) to be provisioned individually with the access restriction. With the restriction, the link can be accessed only if valid user identification and password are entered.

- Input Command Restriction

  DACS II ISX input commands are categorized into six functional groups. Different privileges of entering commands of a particular group are assignable to each link, VC, or user. A command is denied if it is entered from a link/VC/user without the correct privilege.

- Output Message Screening

  DACS II ISX provides an output screening feature so that a message of a specific function group will only be generated to the links/VCs/users with the correct screening privilege. This feature can also be used to avoid the receipt of unwanted outputs.

10. POWER AND BATTERY

10.1 Primary Power Supply Limits

Redundant power feeds (Feeder A and Feeder B) are used to supply power to DACS II ISX. A failure of either one of these feeds will not affect DACS II ISX operation.

DACS II ISX primary power supply limits are shown in the Table L.

Table L — DACS II ISX Primary Power Supply Limits

Condition	Limits
Normal Operating Voltage	-36 V to -75 V
Transient Voltage	1 kV*
* According to IEC-801-4 1988 test method	

10.2 Total Power Consumption

The total power consumption for a fully equipped system consisting of 2 PUs, 1 MC, 2 SXCs, and a combination of up to 32 EDDC/EDPC circuit packs is less than 150 watts.

10.3 Manual Interface

DACS II ISX provides the following indicators and controls for local maintenance.

Status and Alarm Panel:

- Power On LED indicator
- Indicator fuses for input power supplies

- LEDs indicating the alarm state of the system
  - — System Minor
  - — System Major
  - — System Critical
  - — Main Controller Failure.

  The System Minor, System Major, and System Critical LEDs are labeled differently for the Bellcore compliant and CCITT compliant versions of the Status and Alarm Panel as shown in Table M.

Table M — Status and Alarm Panel LED Indicators

Alarm	Status and Alarm Panel Type	
	Bellcore	CCITT
Critical	CR	PMA CR
Major	MJ	PMA MJ
Minor	MN	DMA MN

- Alarm Cutoff (ACO) switch to silence local audible alarms, with LED display
- System reset switch and reset enable switch
- Front access to administrative link No. 1 for connecting a maintenance terminal
- LED test switch
- ESD wrist strap grounding jack.

Power Unit:

- LEDs on power units
  - — Green LED indicates good input power
  - — Red LED indicates unacceptable output power.
- Test lead access jacks for output voltage measurements.

Enhanced Dual Primary Circuit (EDPC) Packs - TG192

- Signal Monitor Points

  The TG192 circuit pack provides two software selectable 75 Ohm or 120 Ohm E1 line terminations. The TG192 circuit pack provides monitor points for both the receive and transmit interfaces for both NPCs on the circuit pack. These monitor points are attenuated by slightly different levels depending on the line impedance selected.

The attenuation values are shown in Table N.

Table N — TG192 Monitor Point Attenuation Values

Selected Impedance	Attenuation
75 Ohms	23.75 dB
120 Ohms	20 dB

The EDPC monitor jack layout is shown in Figure 2.

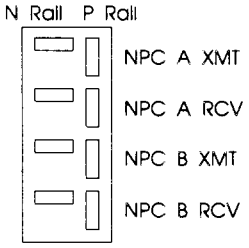

Figure 2 — TG192 EDPC Monitor Jack Layout

10.4 Power Failure Indicators

In the event of a failure in one of the Power Units, a light emitting diode (LED) is illuminated on the failed unit and an alarm message is transmitted over the administrative links. In addition, summary alarm indications are sent to the office audible and visual alarm systems and to remote systems (via telemetry).

10.5 Power Protection

Since sufficient redundancy is provided in the number of low voltage power converters and in the power distribution, transmission service will not be affected by a failure of any one of the two feeders or by any one of two Power Units.

11. PHYSICAL SPECIFICATIONS

11.1 DACS II ISX Dimensions

The DACS II ISX dimensions are:

Height: 400mm (15.75").

Width: 445mm (17.5").

Depth: 343mm (13.5").

Minimum Front Aisle: 760mm (2' 6")

Minimum Rear Aisle: 570mm (1' 10.5")

11.2 Shipping Dimensions

Table O — DACS II ISX Shipping Dimensions

Dimension	Inches	Millimeters
Height	30	762
Width	43	1092
Depth	31	787

11.3 Installed Weight and Shipping Weight

The following table specifies the maximum installed weight and shipping weight for a fully equipped DACS II ISX.

Table P — DACS II ISX Shelf Weight

Weight	Pounds	Kilograms
Installed*	70 lbs	32 kg
Shipping	101 lbs	46 kg

* Installed weight is less external cables.

12. ENVIRONMENTAL SPECIFICATIONS

12.1 Temperature and Humidity

DACS II ISX is compliant with Bellcore NEBS thermal requirements, TR-NWT-000063, Issue 4, July 1991, in accordance with the tests specified below.

- *Section 5.2.1 of TR-NWT-000063* Normal and Emergency Short Term High Temperature
- *Section 5.2.2 of TR-NWT-000063* Normal and Emergency Short Term Low Temperature.

DACS II ISX is compliant with the following European Telecommunications Standards for storage, transportation and operation.

- ETS 300 019-1-1, Class 1.1 "Weather Protected, Partly Temperature Controlled Storage Locations"
- ETS 300 019-1-2, Class 2.3 "Public Transportation"
- ETS 300 019-1-3, Class 3.1 "Temperature Controlled Locations".

12.2 Handling, Transportation, and Office Vibration

DACS II ISX suffers no damage or degradation to performance when subjected to the transportation vibration test and drop-distance test specified in the following sections:

- *Section 5.4.1 of TR-NWT-000063* Handling Drop Tests and Railroad Car Coupling Impact Tests - Packaged Equipment Weighing Less than 200 lbs
- *Section 5.4.4 of TR-NWT-000063* Transportation Vibration - Packaged Equipment
- *Section 5.5.1 of TR-NWT-000063* High-Temperature Thermal Shock

- *Section 5.5.2 of TR-NWT-000063* Low-Temperature Thermal Shock
- *Section 5.5.3 of TR-NWT-000063* Cyclic Temperature - High Relative Humidity
- *Section 5.5.4 of TR-NWT-000063* Cyclic Temperature - Low Relative Humidity.

12.3 Electrostatic Discharge (ESD)

DACS II ISX suffers no equipment damage and no network service-affecting failures during contact discharge in accordance with TR-NWT-001089, Issue 1, October 1991.

12.4 Electromagnetic Interference (EMI)

12.4.1 Radiated Emission

DACS II ISX is compliant with the limits specified in FCC Part 15B Class A and EN55022 Class A.

12.4.2 Radiated Field Immunity

DACS II ISX is compliant with the tests specified in IEC801-3:1984 with a modified frequency range of 26 MHz to 1000 MHz. The applied carrier wave field strength shall be 3 V/m with amplitude modulation of 1 kHz at 80% mod depth. In addition, DACS II ISX operates without malfunction when subjected to radiated field emission energy at 1.89 GHz with a field strength of 10 V/m.

12.4.3 Conducted Radio Frequency Immunity

DACS II ISX is compliant with IEC-801-6 in the frequency range 150 KHz to 80 MHz.

12.4.4 Surge Immunity

DACS II ISX is compliant with IEC-801-5, 1990 at test levels of 0.5 kV and 1 kV.

12.4.5 Transients Immunity

DACS II ISX is compliant with IEC-801-4, 1988.

12.5 Fire Resistance and Flammability

All components of DACS II ISX Release 1.0 have an oxygen index of 28% or greater as determined by the American Society for Testing and Materials (ASTM) Standard D2863-77, *Standard Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)*, and a 94 V-1 or better rating as determined by Underwriters Laboratories (UL) Standard 94, *Test for Flammability of Plastic Materials for Parts in Devices and Appliances*, in the paragraph titled: "Vertical Burning Test for Classifying Material 94 V-0, 94 V-1, or 94 V-2.

12.6 Safety Listing

- UL1459, File E60667
- CSA, File LR 93283-X
- VDE, Registration Number 1634
- IEC (EN60) 950, File E121070.

13. SYSTEM RELIABILITY

Table Q provides a summary of the steady-state failure rate, availability, outage, and Mean Time Between Failure (MTBF) predictions for the individual DACS II ISX circuit packs. Failures in 10^9 hours (FIT) rates are based on calculations based on Bellcore Technical Reference TR-NWT-000332, "Reliability Prediction Procedures for Electronic Equipment", Issue 4, September 1992. Availability and outage figures are based on an assumed 2-hour Mean Time To Repair (MTTR) interval which includes the dispatch, diagnostic, repair, and restoral time to bring the system back to its original state.

Table Q — Circuit Pack Reliability

Circuit Pack	FITs	Failure Rate (Failures/Hour)	Unavailability (Min/Year)	Availability (Min/Year)	Outage (Min/Year)	MTBF (Years)
TG-191 (EDDC)	1322	0.000001322	2.644×10^{-6}	0.999997356	1.390	86.35
TG-192 (EDPC)	2268	0.000002268	4.536×10^{-6}	0.999995464	2.384	50.33
KER3 (SXC)	4799	0.000004799	9.5979×10^{-6}	0.999990402	5.045	23.79
KER4 (MC)	7403	0.000007403	1.4806×10^{-5}	0.999985194	7.782	15.42
424AA (PU)	2446	0.000002446	4.892×10^{-6}	0.999995108	2.571	46.67
Memory Card	4000	0.000004	7.99994×10^{-6}	0.999992	4.205	28.54

The yearly outage predictions shown in Table R for the DACS II ISX hardware were calculated based on the circuit pack failure rates listed previously in Table Q.

Table R — DACS II ISX Outage Estimates

Parameter	DACS II ISX Estimate (Minutes/Year)
Unavailability per T1 Port	1.45
Unavailability per E1 Port	2.44
Total System Outage	0.057
Unavailability for Reconfiguration	7.84
Unavailability for Alarming	7.84

14. TERMINOLOGY

This section contains a list of acronyms and abbreviations and their definitions.

TERM	DEFINITION
ACK	Acknowledge
ACO	Alarm Cutoff
AIS	Alarm Indication Signal (Also known as all 1s signal)
AMI	Alternate Mark Inversion
AMS	Alternate Message Store
ANSI	American National Standards Institute
B8ZS	Bipolar Eight Zero Substitution
BER	Bit Error Rate
BES	Bursty Errored Second
BOS	Bit-Oriented Signaling
BPV	Bipolar Violation
CAS	Channel Associated Signaling
CCITT	International Telephone and Telegraph Consultative Committee
CCS	Common Channel Signaling
CEPT	Conference Europeene des Postes et Telecommunications
CFA	Carrier Failure Alarm
CGA	Carrier Group Alarm
CRC	Cyclic Redundancy Checking
CSA	Canadian Standards Association
CSS	Controlled Slip Seconds
DACS II ISX	Digital Access and Cross-Connect System II - Integral Shelf Cross-Connect
DCE	Data Circuit-terminating Equipment
DCS	Digital Cross-Connect System
DMA	Deferred Maintenance Alarm
DMI-BOS	Digital Multiplexed Interface-Bit Oriented Signaling
DS0	Digital Signal Level 0 (64 kbit/s)
DS1	Digital Signal Level 1 (1.544 Mbit/s)
DSX	Digital Signal Cross-Connect
DTE	Data Terminal Equipment
E1	2.048 Mbit/s Data Rate
EDDC	Enhanced Dual Digroup Circuit
EDPC	Enhanced Dual Primary Circuit
EER	Excessive Error Rate

TERM	DEFINITION
EMI	Electromagnetic Interference
ENQ	Enquiry
ES	Errored Seconds
ESD	Electrostatic Discharge
ESF	Extended Superframe
ETSI	European Telecommunication Standardization Institute
FAS	Frame Alignment Signal
FBE	Framing Bit Error
FDL	Facility Data Link
FRER	Framing Error
HDB3	High Density Bipolar of order 3
IEC	International Electrotechnical Commission
ISX	Integral Shelf Cross-Connect
LAN	Local Area Network
LBO	Line Build Out
LED	Light-Emitting Diode
LFER	Line Format Error Rate
LFV	Line Format Violation
LFVR	Line Format Violation Rate
LMA	Local Multiframe Alarm
LOF	Loss Of Frame
LOS	Loss of Signal
MBER	Minor Bit Error Rate
MER	Multiframe Alignment Errors
MC	Main Controller
MI	Maintenance Information
MJ	Major
MML	HuMan-Machine Language
MN	Minor
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NEBS	Network Equipment Building System
NFW	Non Frame Word
NPC	Network Processing Circuit
NPCTP	NPC Test Port
NSA	Non-signaling Associated
NZCS	No Zero Code Suppression
OA&M	Operation, Administration and Maintenance
OOF	Out-Of-Frame

TERM	DEFINITION
OS	Operations System
PBA	Primary Block Alarms
PBF	Primary Block Failure
PCM	Pulse Code Modulation
PDS	Program Documentation Standards (Language)
PMA	Prompt Maintenance Alarm
PU	Power Unit
PVC	Permanent Virtual Circuit
RAI	Remote Alarm Indication
RAIS	Remote AIS
RAM	Random Access Memory
RBER	Remote Bit Error Rate
RFA	Remote Frame Alarm
RMA	Remote Multiframe Alarm
RPP	Reliability Prediction Procedures
SES	Severely Errored Seconds
SF	Superframe
SFDT	Signaling Freeze Delay Time
SFI	Synchronization Failure Indication
SVC	Switched Virtual Circuit
SXC	Synchronizer Cross Connect
T1	1.544 Mbit/s Data Rate
T1DM	T1 Data Multiplexer
TAD	Test Access Digroup
TC	Trunk Conditioning
TP	Test Port
TCON	Two-Way Cross-Connection
TM	Transparent Mode
TS0	Time Slot 0
TS16	Time Slot 16
UAS	Unavailable Seconds
UL	Underwriters Laboratories
US	Unavailable Seconds
VC	Virtual Circuit
VDE	Verband Deutscher Elektrotechniker
ZCS	Zero Code Suppression