Critical Release Notice

Publication number: 297-2401-502
Publication release: Standard 07.03

The content of this customer NTP supports the SN06 (DMS) and ISN06 (TDM) software releases.

Bookmarks used in this NTP highlight the changes between the baseline NTP and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the baseline NTP remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for the baseline NTP that is valid through the current release.

Red: Applies to new or modified content for NA017/ISN04 (TDM) that is valid through the current release.

Blue: Applies to new or modified content for NA018 (SN05 DMS)/ISN05 (TDM) that is valid through the current release.

Green: Applies to new or modified content for SN06 (DMS)/ISN06 (TDM) that is valid through the current release.

Attention!
Adobe® Acrobat® Reader™ 5.0 is required to view bookmarks in color.

Publication History

September 2005

Standard release 07.03 for software release SN06 (DMS).

Updates were made to description of subfield L1FLAGS in section “Advanced troubleshooting procedures ”, “Troubleshooting B- and D-channels” according to CR Q01112597.

March 2004

Standard release 07.02 for software release SN06 (DMS) and ISN06 (TDM).

Change of phone number from 1-800-684-2273 to 1-877-662-5669, Option 4 + 1.

297-2401-502

DMS-100 Family

Integrated Services Digital Network Primary Rate Interface

Maintenance Guide

CCM12 Standard 07.01 November 1999

NORTEL NETWORKS™

How the world shares ideas.

DMS-100 Family

Integrated Services Digital Network Primary Rate Interface

Maintenance Guide

Publication number: 297-2401-502
Product release: CCM12
Document release: Standard 07.01
Date: November 1999

Publication history

November 1999

CCM12 Standard 07.01

- added limit about 2100 logical terminal numbers of PRI to table 7–5

March 1999

CCM11 Standard 06.01

- added note about obsolete BRAKS LTIDs to List of Terms
- added log ISDN401 to tables 3–1 and 5–2
- added log ISDN402 to tables 3–1 and 5–2
- updated OM group PRADCHL2 in tables 4–2 and 4–3
- renamed the X75TTP level to the PHTTP level in figures 5–1 and 5–3
- updated the following commands in table 5–1: CKTLOC, LEVEL, LOOPBK, POST, and TST
- renamed command X75TTP to PHTTP in table 5–1
- created table 5–6 for error and information messages according to command
- added OM groups MWICTCAP and PRIMWIC to tables 4–1 and 4–2

November 1998

CCM10 Standard 05.01

- added log DFIL616

March 1996

CCM05 Standard 04.02

- added log ISDN118
- updated log ISDN112
- added logs TRK104 and TRK110

December 1995

CCM05 Standard 04.01

- updated List of Terms

June 1995

CCM04 Standard 03.01

- released due to new base DRU numbering scheme

December 1993

BCS36 and up Standard 02.02

- added “Advanced troubleshooting procedures” chapter
- added Appendix B “Troubleshooting example”

September 1993

BCS36 and up Preliminary 02.01

- added “Protocols” chapter
- added digital test access (DTA) information
- added unified process (UP) information for XPM PLUS

April 1993

BCS35 and up Preliminary 01.01 first release of this document

Contents

About this document

When to use this document

This document provides advanced maintenance and troubleshooting information for the integrated services digital network (ISDN) primary rate interface. The intended audience for this document is advanced maintenance personnel.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *DMS-100 Family Guide to Northern Telecom Publications*, 297-1001-001.

References in this document

The following documents are referred to in this document:

- *Alarm and Performance Monitoring Procedures*
- *Basic Administration Procedures*, 297-1001-300
- *Basic Translations Tools Guide*, 297-1001-360
- *CallTrak User Guide*, TAM-1001-012
- *Card Replacement Procedures*
- *Display Call (DISPCALL) User Guide*, TAM-1001-0003

- *Hardware Description Manual Reference Manual*
- *ISDN Primary Rate Access User-Network Interface Specification*, NIS AS211-1
- *Log Report Reference Manual*
- *Office Parameters Reference Manual*
- *Operational Measurements Reference Manual*
- *Peripheral Module Intercept System Test User Guide*, TAM-1001-007
- *PMDEBUG User Guide*, TAM-1001-004
- *Routine Procedures*
- *Switch Performance Monitoring System Application Guide*, 297-1001-330
- *Translations Guide*
- *Trouble Locating and Clearing Procedures*

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER Possibility of personal injury

DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING Possibility of equipment damage

WARNING

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION Possibility of service interruption or degradation

CAUTION

Possible loss of service

Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

>BSY

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

>BSY CTRL

Variables

Variables are shown in lowercase letters:

>BSY CTRL ctrl_no

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

1 Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no
and pressing the Enter key.

where

ctrl_no is the number of the CTRL (0 or 1)

Example of a MAP response:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

Maintenance overview

This chapter provides a maintenance overview of the DMS-100 integrated services digital network (ISDN) node. This manual contains maintenance information for primary rate interface (PRI) only.

Functional description

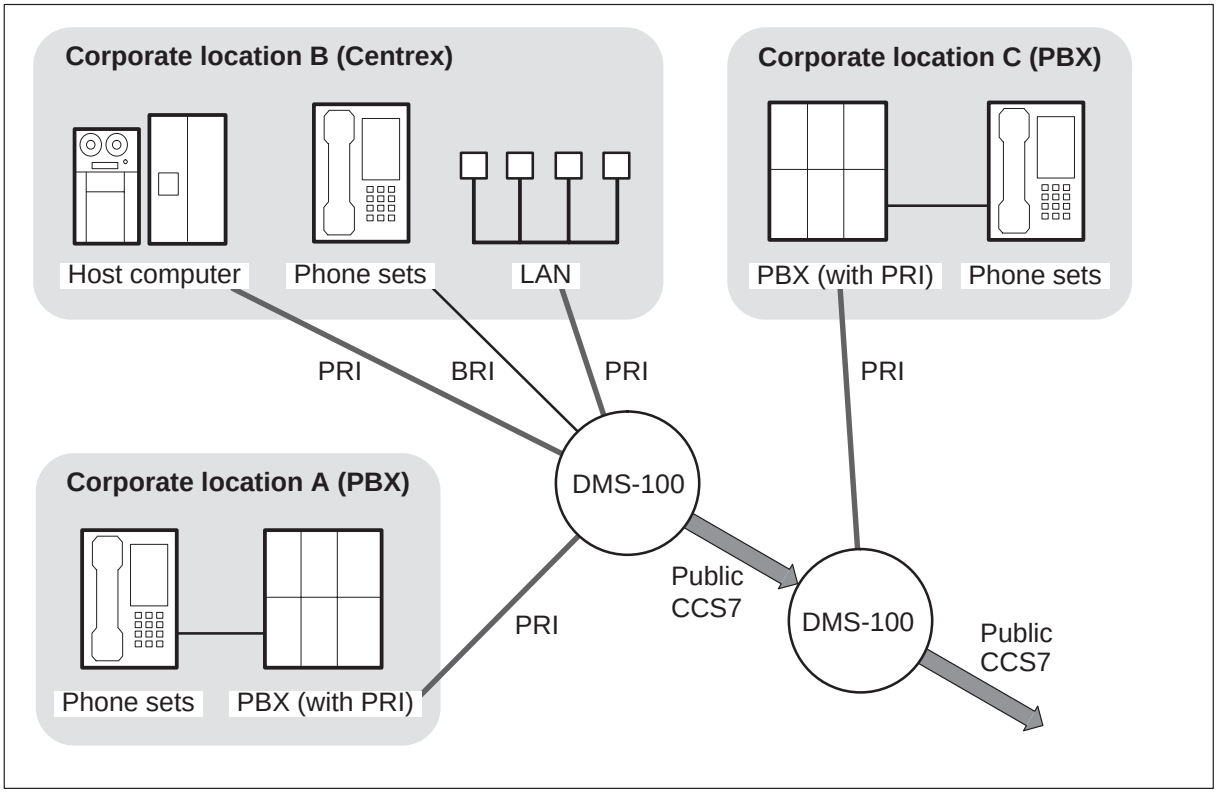
This section provides a brief description of the functions of the integrated services digital network primary rate interface (ISDN PRI). For a detailed description, including basic rate interface (BRI), refer to the *Translations Guide*.

Purpose of ISDN PRI

PRI, providing ISDN access over 23 B-channels and one D-channel, is typically used to create a logical private network by connecting ISDN switches, Meridian Digital Centrex (MDC) equipment, local area networks (LAN), computers, and private branch exchanges (PBX) such as the Meridian 1. With PRI, the B-channels carry voice and data at up to 64 kbit/s, and the D-channel carries out-of-band Q.931 signaling for one or more PRI links.

Increasingly, businesses are managing hybrid networks of public and private facilities, and Northern Telecom's (Nortel) ISDN PRI implementation helps solve the connectivity and consistency problems inherent in these networks. Figure 1-1 illustrates a typical corporate ISDN network, showing PRI as an access connection between the DMS-100 and customer premises equipment (such as PBXs and LANs), and as a trunk interface between central offices. As shown in the diagram, Nortel's PRI interworks with the Common Channel Signaling 7 (CCS7) protocol, providing transparent access to the CCS7 public network.

Figure 1-1
A typical PRI network



ISDN PRI services

PRI provides access to the following services:

- circuit-switched voice and data
- integrated service access (ISA), which allows call-by-call service selection of a trunk type to accommodate changes in the types of trunk traffic throughout the day
- network-wide calling features
  - — Network Ring Again (NRAG)
  - — Calling-line ID (CLID)
  - — Call Forward with Reason
  - — Network Automatic Call Distribution (ACD)
  - — Network Name Display
  - — Network Message Waiting

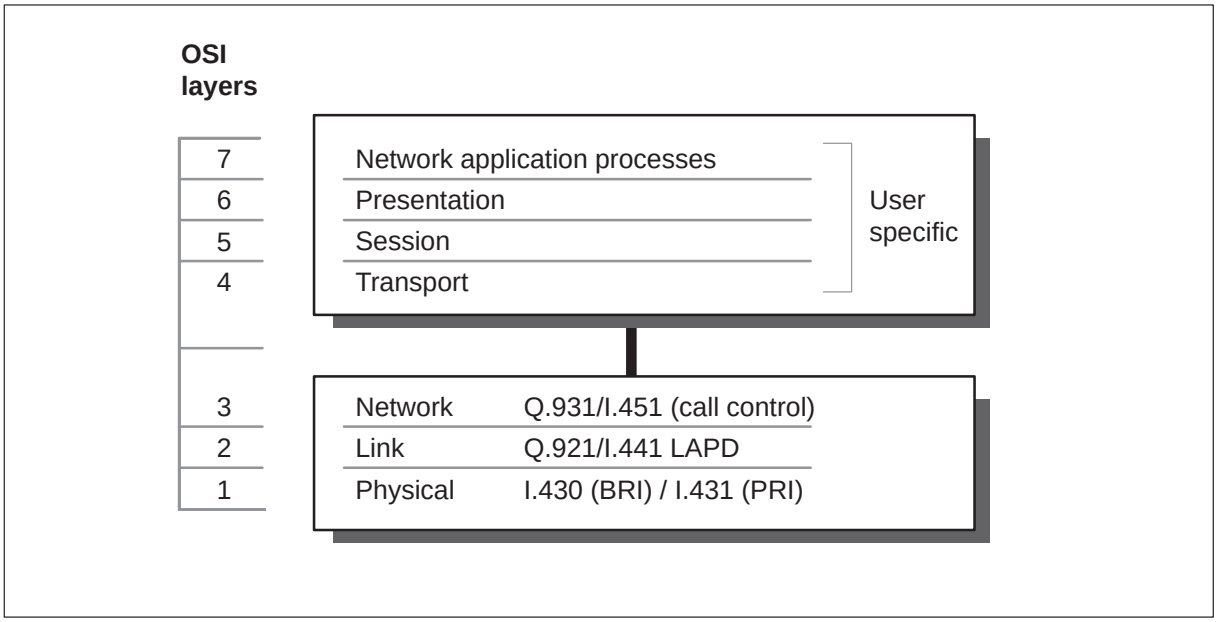
PRI does not provide a direct connection to the DMS packet handler (DMS PH) or the DPN packet handler.

OSI model and ISDN PRI protocols

ISDN PRI protocol follows the open systems interconnection (OSI) model developed by the International Standards Organization (ISO). The OSI model has seven layers, as shown in Figure 1-2 ISDN is implemented through layers 1 to 3 of the OSI model. Figure 1-2 also shows the CCITT standards that correspond to the first three layers.

Figure 1-2
OSI and ISDN model comparison

FW-xxxxx



Layer 1 (physical) protocol

The physical layer provides the physical characteristics. These include the physical wire connections, transmission of electrical signals between endpoints, the frame structure of the bit stream, channel allocation, and activation and deactivation of links.

The physical hardware for PRI includes digital trunks and the ISDN digital trunk controller (DTCI). PRI trunks employ the DS-1 signaling format. Two frame formats, superframe (SF) and extended superframe (ESF) are supported by the DMS-100 ISDN node. Figure 1-3 shows the superframe format and the DS-1 format.

Superframe and extended superframe

Superframe (SF) combines 12 standard DS-1 frames together. A multiframe framing pattern is used to identify the frame and superframe boundaries. This framing pattern is the binary code 100011011100 and is illustrated in Figure 1-3.

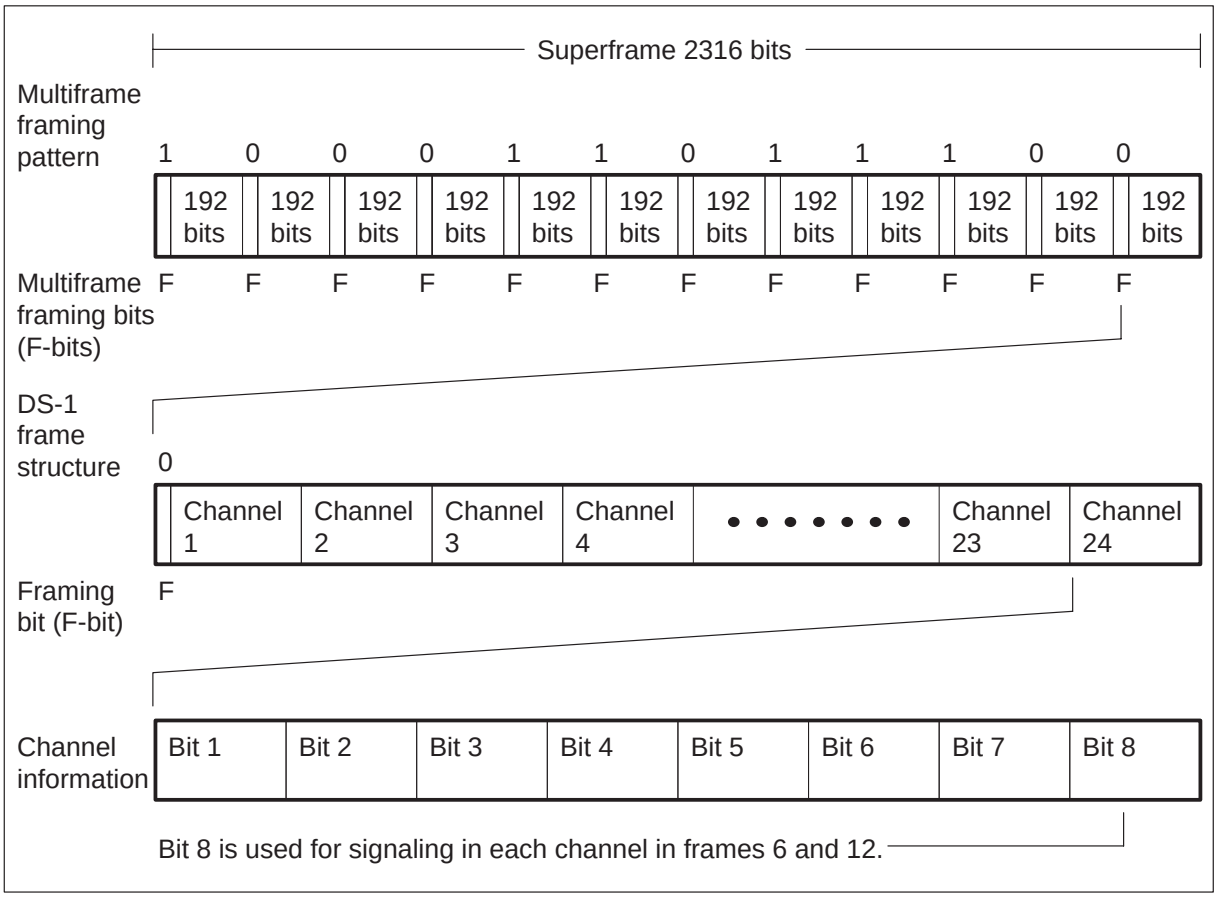
Extended superframe (ESF) combines 24 standard DS1 frames together. For more detailed information on the superframe and extended superframe formats, refer to the *ISDN Primary Rate Access User-Network Interface Specification*, NIS A211-1.

Two encoding formats are used for PRI:

- ZCS (Zero code suppression)
- B8ZS (Bipolar with 8-zero substitution)

ZCS prevents the transmission of more than eight consecutive zeros by changing the eighth bit to a 1. This process is known as bit robbing. B8ZS uses a line coding technique that does not affect the data bit stream.

Figure 1-3
DS-1 and Superframe signaling formats



Layer 2 (data link) protocol

The data link layer provides the logical links between the PBX and the DMS-100. There are two types of messaging formats: one relevant for the B-channels; the other, for the D-channel.

D-channel

For the D-channel, the layer 2 protocol is LAPD, a protocol defined by CCITT recommendation Q.921. LAPD, a derivative of the International Standards Organization (ISO) high-level data link control (HDLC) standard, uses an HDLC frame format that has two octets of data link layer address information consisting of

- a service access point identifier (SAPI) to identify a layer 3 entity
- a terminal endpoint identifier (TEI) to address individual terminal devices on an ISDN loop

Layer 3 (call control or network) protocol

Layer 3 is the call control layer of ISDN operating over the D-channel that defines the procedures for

- establishing, maintaining, and clearing one or more connections of the same type on a logical data link created by layer 2
- controlling access to supplementary services, among them Meridian Digital Centrex (MDC) features, through functional feature management

Q.931 protocol

The call control software communicates with functional signaling terminals on the D-channel using call control messages. The structure of a call control message is defined in the CCITT recommendation Q.931.

The protocol procedure is based on

- setup and takedown of calls and features between the network and PBX
- address displays and progress indicators at the PBX and network
- B-channel control from the network

The Q.931 protocol supports basic error-handling procedures and re-initialization after the occurrence of recoverable errors. The Q.931 protocol (level 3) also determines the signaling methods used in circuit-switched calls.

Functional (Bellcore) signaling

ISDN PRI uses functional call control procedures. Functional signaling is based on a peer-to-peer exchange of information between an intelligent terminal, the PBX, and the network. This signaling method facilitates ISDN

standardization and allows users to access new network features and services.

ISDN PRI equipment

The equipment required to provide PRI circuit-switched voice and data services is summarized below and illustrated in figure 1-4.

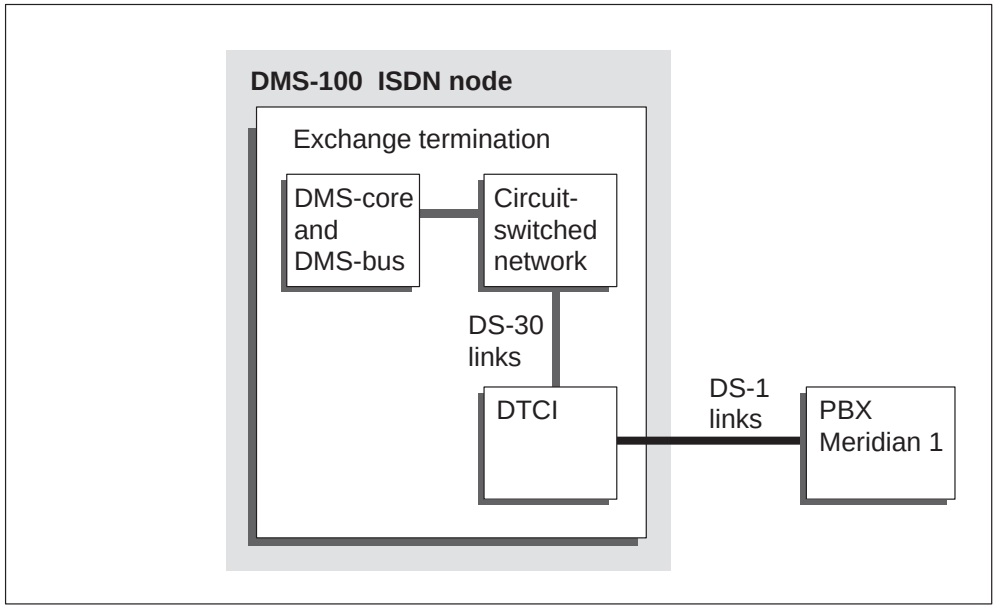
- DMS-core
- DMS-bus
- circuit-switched network
- ISDN digital trunk controller (DTCI), or line trunk controller (LTC) equipped for ISDN (not shown)
- DS-1 link
- customer PBX

Both the DTCI and LTC are extended multiprocessor system (XMS)-based peripheral modules (XPM) and perform the following functions:

- D-channel handling and processing
- call processing for all types of lines (ISDN, EBS, POTS, and Datapath)
- maintenance and diagnostics

The PBX performs the network termination function and converts the non-ISDN protocols of the user (subscriber lines, telephone sets, and personal computers) to the ISDN protocols required by the network. Figure 1-4 shows a DS-1 connected to a Meridian 1 PBX.

Figure 1-4
ISDN exchange termination



ISDN digital trunk controller

The DTCI may be configured in one of two ways:

- as an XPM PLUS which involves a unified processor (UP) and an enhanced ISDN signaling preprocessor (EISP)
- as an XPM which involves a master processor (MP), master processor memory (MPM), signaling processor (SP), signaling processor memory (SPM), and an ISDN signaling preprocessor (ISP)

The DTCI provides access to the digital PBX through DS-1 links in the peripheral-side (P-side) interfaces. The DTCI is shown in an XPM PLUS configuration in figure 1-5 and in an XPM configuration in figure 1-6. The DTCI also carries information through both planes of the network modules to the DMS-bus, and to other PMs, through the central-side (C-side) interface. In addition to PRI trunks, the DTCI supports DS-1 digital trunks using per-trunk signaling. The DTCI does not support CCS7 ISDN user part (ISUP) trunks. For a description of the DTCI shelf layout and individual cards, refer to the chapter ‘‘Card requirements.”

Line trunk controller

The line trunk controller (LTC) equipped for ISDN functions exactly like the DTCI equipped for PRI service. In addition, the LTC supports line concentrating modules (LCM) for both ISDN BRI and non-ISDN service. For a description of the LTC shelf layout and individual cards, refer to the chapter ‘‘Card requirements.”

Note: The LTC was previously referred to as the LTCI. Existing hardware with the LTCI designation is supported for datafill and displays under the LTC designation.

DS30

A DS30 is a four-wire transmission link used within the DMS-100 switch to connect XPMs to the switching network over distances of up to 229 m (750 ft).

DS512

A DS512 (not shown in Figure 1-4) is a fiber optic transmission link used within the DMS-100 switch to connect XPMs to the switching network over distances of up to 229 m (750 ft). A DS512 consists of 512 64-kbit/s channels. One DS512 fiber link is equivalent to 16 DS30 links, multiplexed onto a single optical fiber.

Figure 1-5
DTCI logical architecture for XPM PLUS

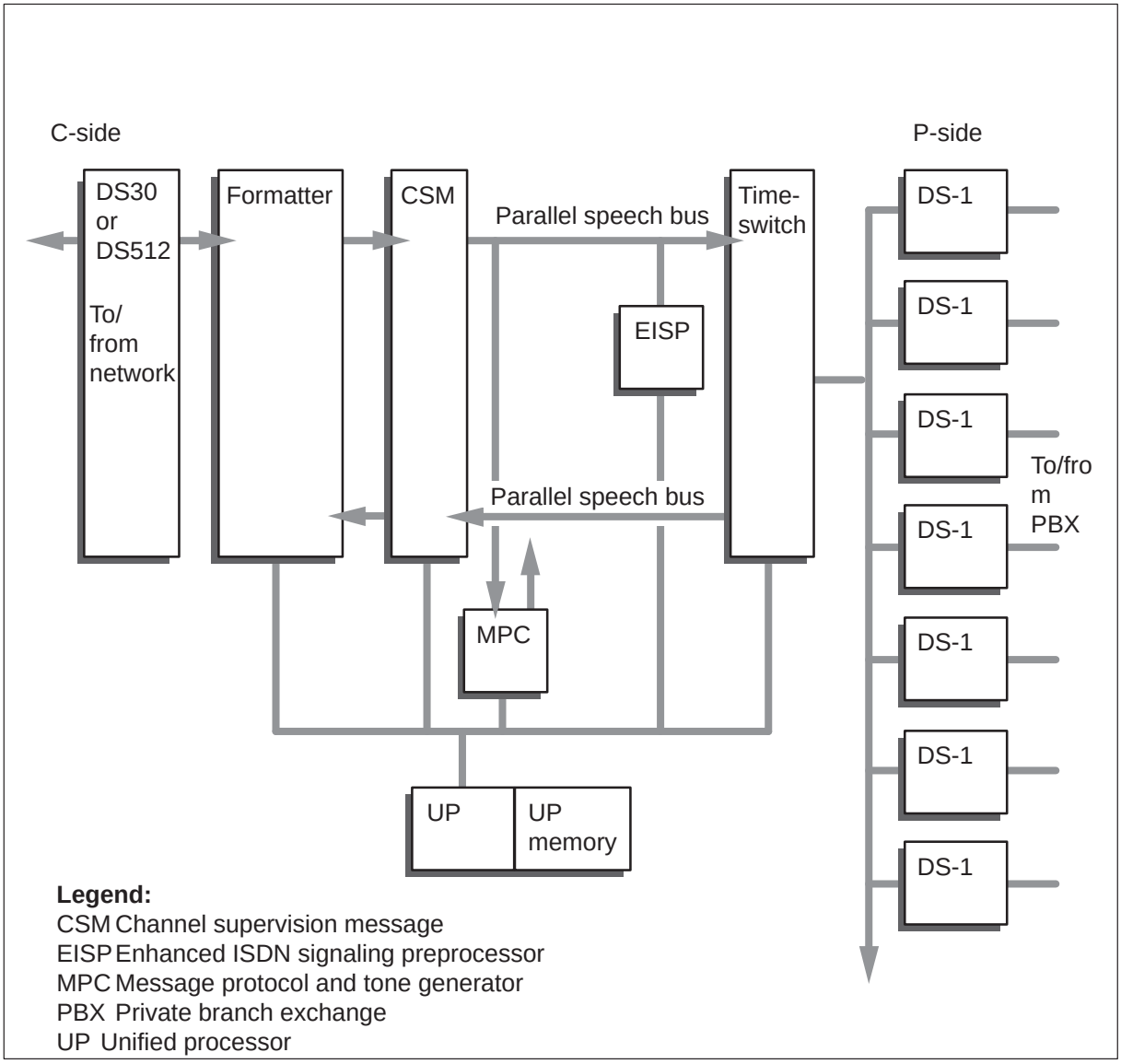
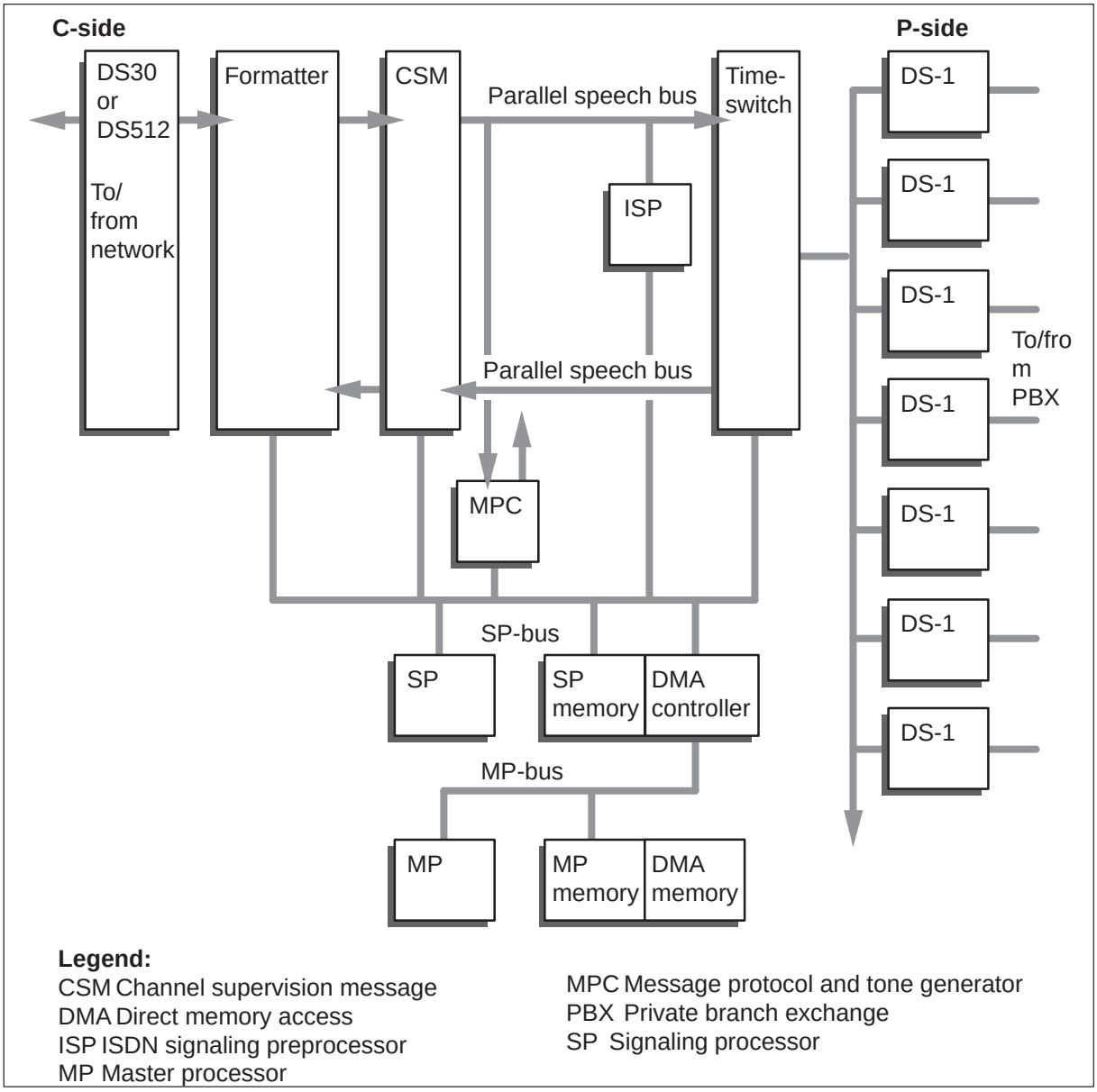


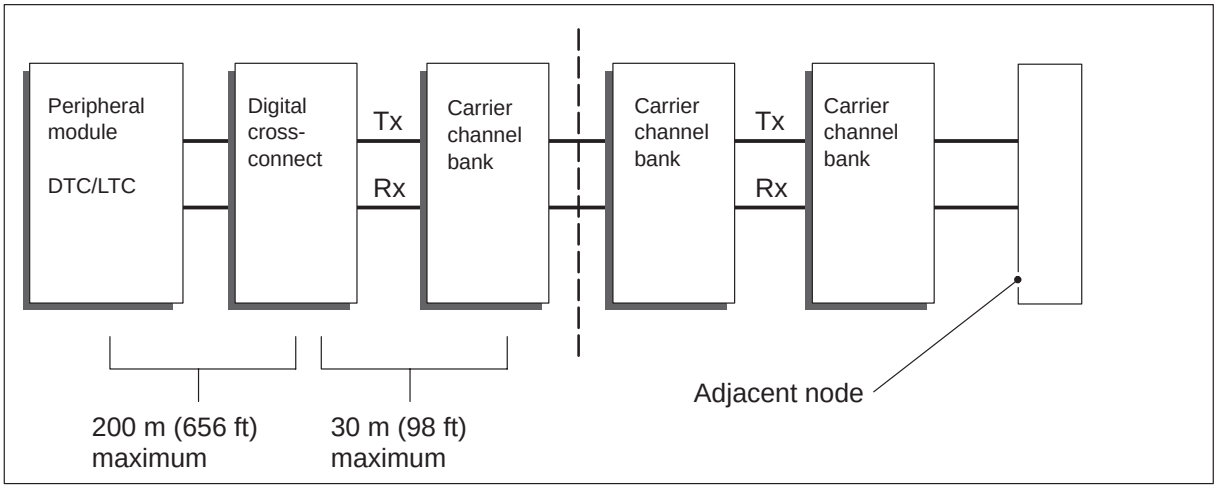
Figure 1-6
DTCI logical architecture for XPM



DS-1 link

Figure 1-7 illustrates the DS-1 equipment. Note the maximum allowable distances. Actual distances between units is set by switches on the appropriate cards.

Figure 1-7
DS-1 link equipment

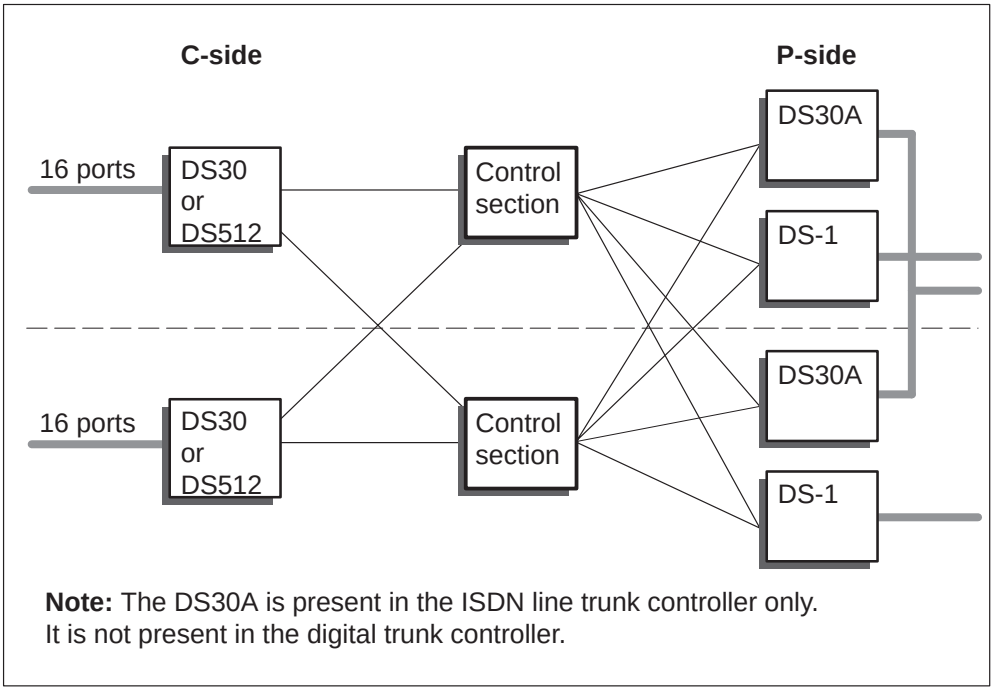


XPM hardware configuration

The high-level XPM hardware configuration used for ISDN XPMs is shown in figure 1-8. The configuration shown in figure 1-8 is for an LTC, not a DTCI. The DTCI does not have any DS30A interface cards. The XPM uses two independent units for reliability. Each unit is on a separate shelf, and has a control section which is the duplicate of the control section in the other unit. Control sections are connected by the intermodule communications (IMC) serial link. All interface cards are duplicated except DS-1 cards, making it important to have a backup D-channel on a different DS-1 card from the primary D-channel.

The central-side (C-side) of the XPM connects to the network using two redundant eight-port DS30 cards (two cards in each shelf). The two sets of cards send and receive the same data. In other words, the device connected to the C-side of the network can use either of the two paths on a channel-by-channel basis.

Figure 1-8
XPM hardware configuration



Note: The DS30A is present in the ISDN line trunk controller only. It is not present in the digital trunk controller.

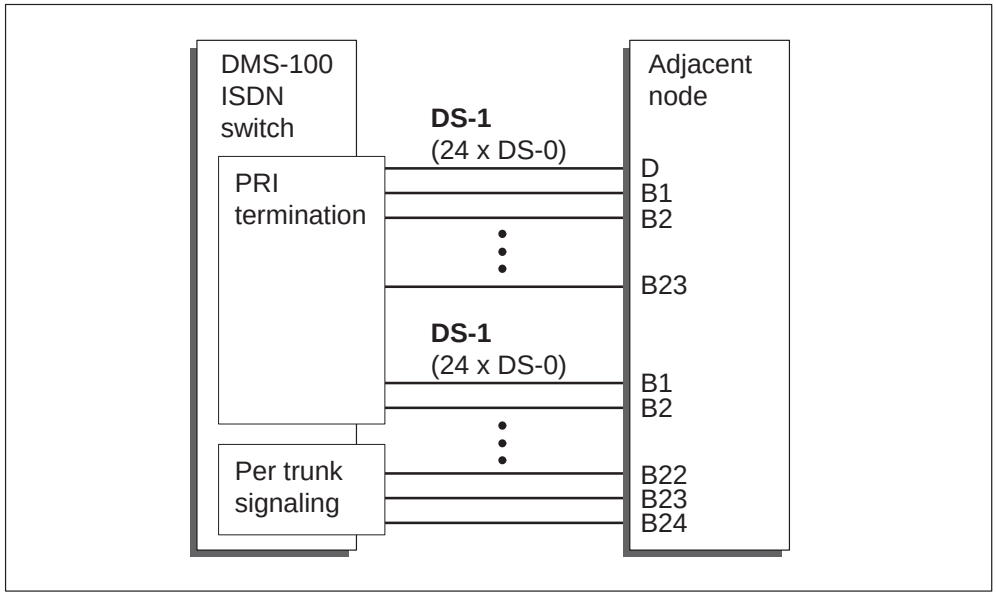
The peripheral-side (P-side) XPM connections use DS-1 or DS30A links. There are two DS-1 links on each DS-1 card (a total of 48 DS-0s per card). DS-1 cards are connected internally to the time switch by DS60 links.

The two units of the XPM operated in hot-standby mode, meaning that one unit is active and the other unit is on standby. The active unit handles all call processing, while the standby unit is ready to take over if a fault occurs in the active unit.

PRI channels

PRI channels are provided by DS-0 channels on standard 1.544-Mbit/s DS-1 links. A single DS-1 supporting a mixture of PRI channels and per-trunk signaling (PTS) or A/B trunks is known as an integrated trunk access (ITA) configuration. Figure 1-9 shows two DS-1 links, one of which is configured for ITA. In the figure, the first DS-1 link is configured for PRI only with one D-channel and 23 B-channels. For the second Ds-1 link, B-channels 1 to 21 are set up for ISDN PRI service, and B-channels 22 to 24 are set up for PTS.

Figure 1-9
PRI channels



There are two types of PRI channels, as illustrated in figure 1-9:

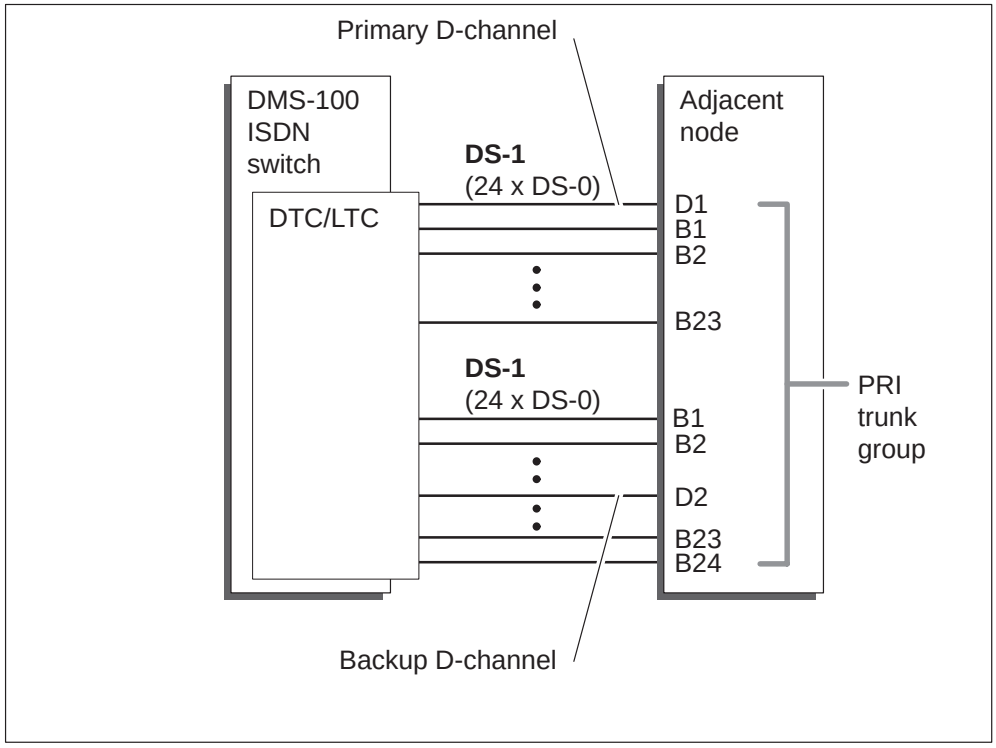
- D-channels (control channels) used for call control
- B-channels (bearer channels) used for voice and data transmission

The D-channels and B-channels used by PRI on one or more DS-1 links are collectively called a PRI trunk group. All channels in a trunk group must operate at the same speed, and terminate on the same XPM in the DMS-100 ISDN node.

D-channels

D-channels provide all signaling and call control for the B-channels using CCITT standard protocols. One D-channel can support signaling for multiple DS-1 links, and is referred to as consolidated signaling (see figure 1-10).

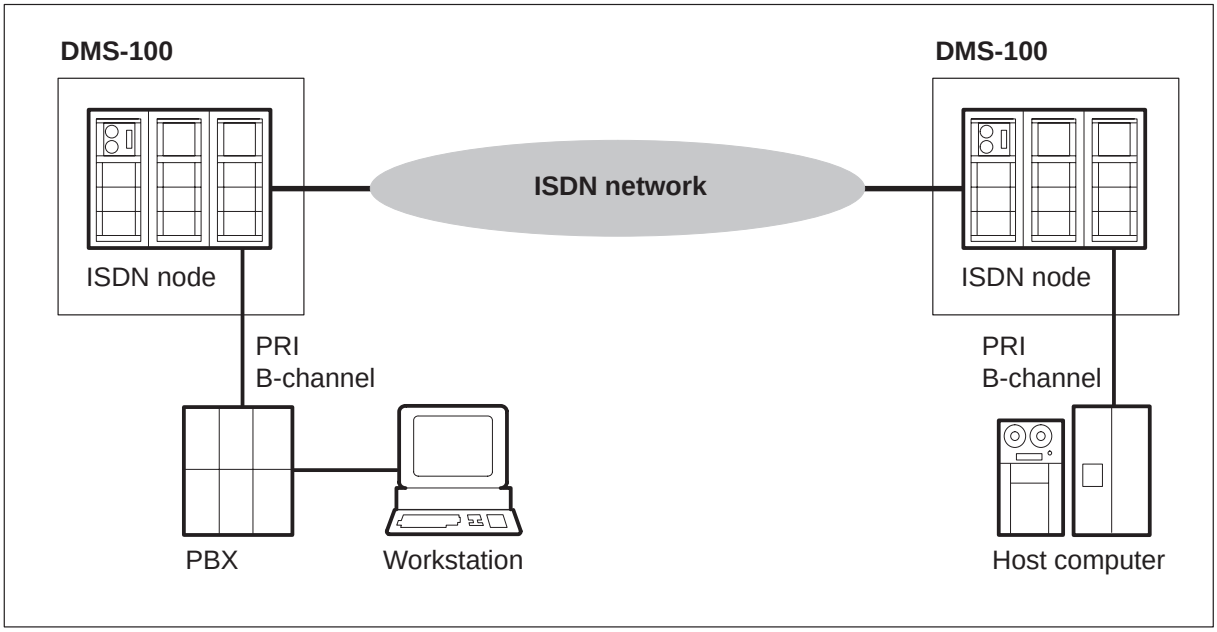
Figure 1-10
PRI consolidated signaling



B-channels

B-channels carry circuit-switched voice or data between the DMS-100 switch (or ISDN node) and the adjacent node. Unused B-channels in a PRI DS-1 can be datafilled as idle, or as PTS A/B bit trunks for non-ISDN use. The ISDN node does not monitor B-channels for signaling, therefore all formatting and protocol processing must be provided by the subscribers at each end of the call. See figure 1-11 for an example of a B-channel data call.

Figure 1-11
B-channel data call example



B-channels can have different bearer capabilities. Bearer capability is defined by the field values in the bearer capability information element of the Q.931 call setup message. A brief description of these fields is shown in table 1-1. The network confirms that the bearer capability information element received from the user matches the bearer service provided to that user by the network. If a mismatch occurs, the network rejects the call.

The following call types are possible for bearer capability:

- speech
- unrestricted data, 64-kbit/s rate adapted from 56 kbit/s
- unrestricted data, 64 kbit/s clear
- restricted data, 64 kbit/s
- 3.1-kHz audio

Table 1-1
Bearer capability information element

Field	Possible values
Information transfer capability	speech, or unrestricted digital information, or restricted digital information, or 3.1 kHz audio (see note)
Transfer mode	circuit mode
Information transfer rate	64 kbit/s
Structure	8 kHz integrity
Configuration	point–to–point
Establishment	demand
Symmetry	bidirectional
User information re: Layer 1 protocol	rate adapted, or μ-law speech
User rate	55 kbit/s

Note: speech and 3.1 kHz audio receive identical treatment

D-channel protocol

Under supervision of the DMS-core, the PRI XPM software performs connection management, including

- internal channel allocation and deallocation
- call connection timing
- connection integrity supervision

Note: For simplicity, all references to the EISP mean the EISP or ISP, and all references to the UP mean the UP or the SP and the MP.

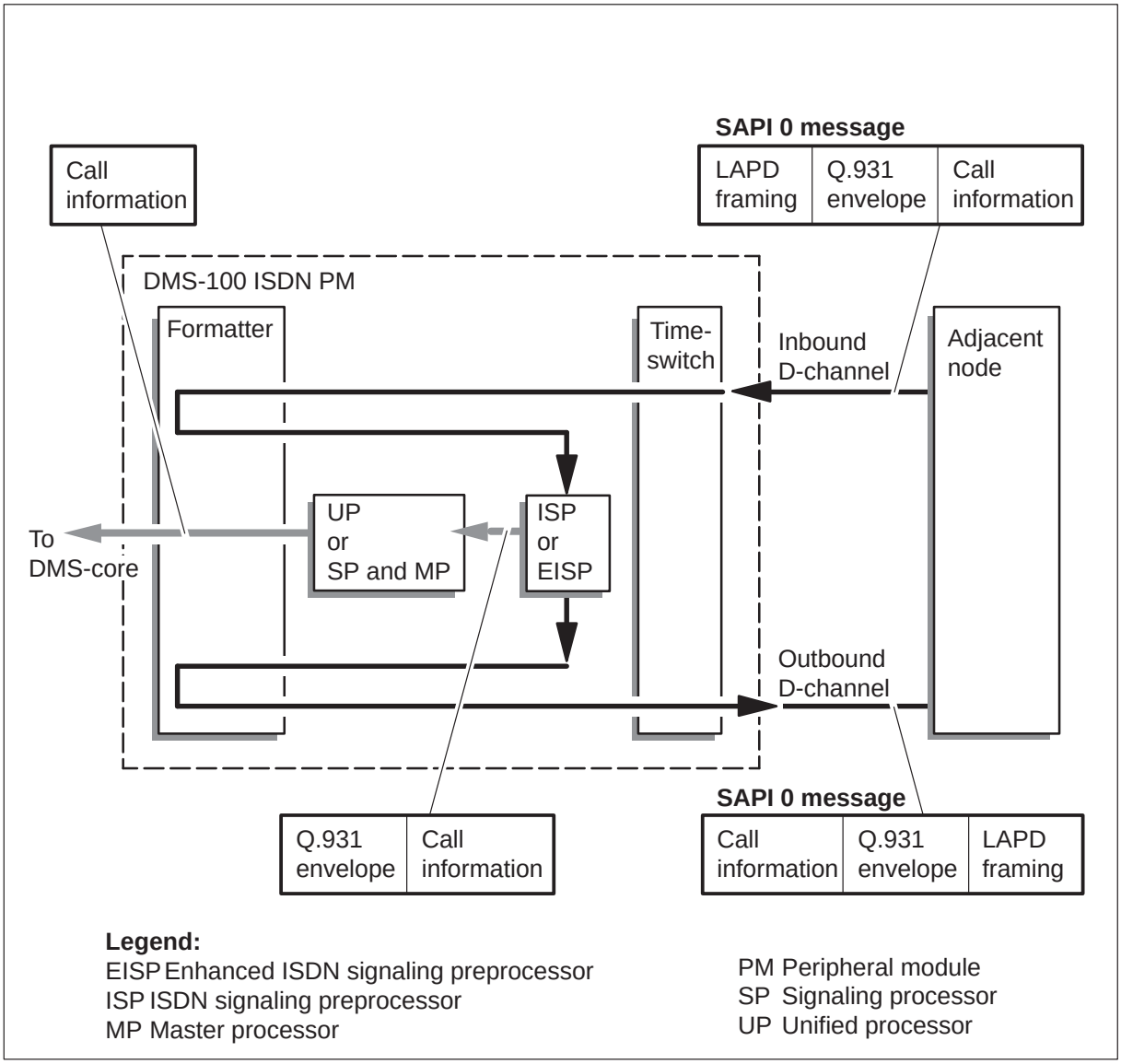
D-channel operation requires the creation of logical data links. These links are set up between service access points within the ISDN using service access point identifiers (SAPI). The D-channel handles SAPI 0 (call control) messages. The destination of SAPI 0 messages from the adjacent node is the EISP.

The EISP checks the frame sequencing and the digits that are built into the Q.931 frame and requests a retransmission of missing or invalid frames. The EISP assembles the Q.931 messages destined for the adjacent node and responds to requests for retransmission.

The UP converts Q.931 SAPI 0 messages into the DMS-core format and forwards them to the DMS-core. The UP also performs the reverse function, reformatting DMS-core messages into Q.931 format for the adjacent node. The UP software also tracks call states and sends call state information to the adjacent node.

Figure 1-12 shows how the lower layers are removed from the Q.931 message as it passes through the processing steps, leaving only the call information going to the DMS-core.

Figure 1-12
PRI D-channel processing



Fault conditions

The purpose of this section is to list the types of faults that can affect PRI. These faults might suggest a course of investigation when troubleshooting a PRI problem. Since virtually every component in the DMS-100 can be the source of one or more faults, it is impossible to provide an exhaustive listing. This section lists general fault conditions associated with ISDN PRI, along with a few detailed examples.

These general types of things can go wrong with PRI:

- hardware faults
- software errors
- datafill errors
- cabling problems
- provisioning issues

Table 1-2
Other hardware fault conditions

Fault condition	Description
Activity timeout	The C-side message links are broken, so messaging cannot occur.
Duplicate fault	A critical hardware fault has occurred.
Jammed	The unit has been jammed, meaning that it cannot change its active/inactive status.
Static data corruption	There is a checksum error in the static data.
Hardware trap	Processor trap occurred caused by parity, bus error or memory management.

Fault condition results

Faults can generate alarms, logs, or OMs. Another indication of faults may be received as customer complaints. Refer to the “Trouble isolation and correction methods” chapter for information on the test tools that can be used in diagnosing and clearing faults. Refer to the chapter “User interface” for information on MAP levels, MAP commands, and XPM, trunk, carrier, and D-channel status indicators.

Automatic maintenance

DMS-100 switch automatic maintenance combines fault detection and fault correction. Fault detection is made possible by a combination of hardware and software functions.

Once a fault is detected, the DMS-100 switch uses three strategies to automatically correct the fault:

- isolate and replace the faulty unit (for example, SWACT)
- reload corrupted software
- find a new data path

ISDN XPM automatic maintenance

The DMS-100 switch has many self-checking features, including switch of activity (SWACT) and routine exercise (REx) test.

Switch of activity (SWACT)

In the SWACT process, two mate units switch activity. The active unit becomes the inactive unit, and the inactive unit becomes the active unit and takes over call processing. The SWACT can be

- cold (all calls are dropped)
- warm (established calls are maintained but unestablished calls are dropped)
- controlled (requested by system or operating company personnel)
- uncontrolled (the unit stops responding)

Routine exercise (REx) test

A REx test is a series of tests performed on an XPM unit. It combines the diagnostic and functional routines available on XPMs. A REx test should be performed each day, initiated automatically by the system scheduler or, manually by operating company personnel. Results of the REx test can be divided into four types:

- not performed
- passed
- failed
- cancelled by manual action (the REx test was cancelled using the FORCE option or ABTK command)

All four classes output a log or display a message at the MAP terminal. Passed and failed REx test results are stored in the maintenance record. Log PM600 provides information on failure reasons when the REx test fails. For

more information on REx tests, refer to chapter ‘‘Preventive maintenance strategies.”

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the DMS-100 switch, the DMS-100 switch provides trouble indicators to reveal that a fault condition still exists. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and failure of automatic maintenance. Manual intervention becomes necessary as maintenance personnel at the MAP terminal attempt to isolate and clear the fault.

Preventive maintenance strategies

This chapter contains an overview of preventive maintenance strategies, a description of the processes involved, and references to additional information. The information helps maintenance staff to recognize less-than-optimal operating conditions before they become alarm-generating troubles.

Overall preventive maintenance

Preventive maintenance consists of performing routine tests, and monitoring equipment and circuits to forestall service degradation. By monitoring the performance of the switch, maintenance personnel can recognize non-optimal operating conditions and take measures to restore optimal operating conditions. This may mean, for example, maintaining a low bit error ratio.

An effective preventive maintenance strategy uses some or all of the following processes:

- maintenance manager's morning report (AMREP)
- Switch Performance Monitoring System (SPMS)
- routine exercise (REx) testing
- network maintenance
- focused maintenance
- operational measurements (OM)
- routine maintenance

These maintenance processes are applied to the following ISDN PRI components:

- exchange termination (ET)
- ISDN signaling and trunks

The maintenance processes also include the following DMS-100 overhead activities:

- network and peripheral module (PM) integrity parity maintenance

- DS-1 carrier maintenance
- TTP functions
- routine maintenance (BERP, NETFAB)

Maintenance manager's morning report

The maintenance manager's morning report (AMREP) is a switch management tool (software package NTXJ35AA [Maintenance Manager's Report]) that provides a 24-h summary of performance, administrative, and maintenance information about the DMS-100 switch. The report, output and printed as a DMS-100 log report, can be generated automatically at a scheduled time or on request from a MAP terminal. It is divided into two parts:

- DMS-100 switch performance
- scheduled test results

The report provides a summary of the following key maintenance and operations indicators:

- switch performance information including
  - — SPMS indicators
  - — call processing performance
  - — CPU occupancy
  - — network performance
  - — software performance
  - — OM threshold log count
  - — PM switch-of-activity (SWACT) information
- scheduled test results including
  - — scheduled trunk maintenance using automatic trunk testing (ATT)
- switch operations including
  - — image dump results
  - — patch summary
  - — outage indicators
  - — table data integrity check
  - — unscheduled PM REx test

Switch Performance Monitoring System

The SPMS analyzes OMs to provide a summary of switch performance. The summary is a series of numeric indexes with values between 0 and 100.

SPMS indexes differ from OMs because SPMS indexes are weighted to reflect the impact of the OM on switch performance.

Figure 2-1 shows the highest levels of the SPMS indexing hierarchy. The levels shown are described in table 2-1.

Figure 2-1
SPMS indexing hierarchy

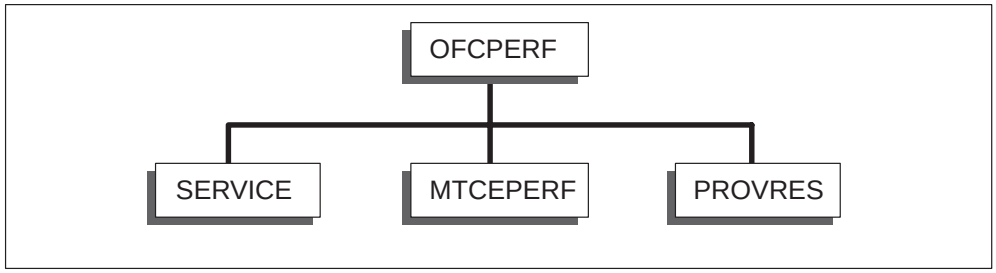


Table 2-1
SPMS indexes

Level	Description
OFCPERF	Office Performance Index: A summary of total office performance. It is computed from the weighted average of its three direct descendants.
SERVICE	Service Performance Index: A summary of the contributions of maintenance and traffic provisioning to the overall service results.
MTCEPERF	Maintenance Performance Index: A summary of switch performance as it would be observed by a person running the switch.
PROVRES	Provisionable Resource Index: A summary of the performance of traffic.

SPMS indexes are assigned the ratings summarized in the following table.

Table 2-2
SPMS indexes of performance ratings

Level	Description
100	perfect
96–99	above average

Table 2-2
SPMS indexes of performance ratings (continued)

Level	Description
95	average
91–94	below average
90 or less	much below average
Note: An index of 90 or less indicates a situation that requires correction.	
—end—	

SPMS should be used daily to detect and correct maintenance and provisioning problems that have not been detected by other means. SPMS indicates trends that can lead to problems. Some indicators that help to recognize trends include the following:

- call processing performance rating
- CPU occupancy indicator
- SWACT indicator
- NETINTEG indicator
- automatic trunk test (ATT) indicator

For more information on SPMS, refer to the *Switch Performance Monitoring System Application Guide*, 297-1001-330, which provides lists of all indexes. The following information is provided for each index:

- a description of the index
- a definition of the index
- a list of the OMs used to compute the index
- a description of how the index is normalized
- the name of the diagnostic used to investigate the problem shown by the index

The *Switch Performance Monitoring System Application Guide*, 297-1001-330, also describes the relationship between OMs and SPMS indexes, and contains procedures for creating custom reports.

Call processing performance rating

The call processing performance (CPPERF) indicator displays information regarding total call attempts, total lost calls, and completion percentage during the past 24 h. From this data, the program calculates a completion

percentage. When the completion percentage begins to decline, further investigation is required.

CPU occupancy indicator

The CPU occupancy indicator provides the highwater mark for CPU usage during a specified report period. The indicator provides the current setting for the highwater mark and peg counts for the number of times the CPU threshold, set to a default value of 60%, was exceeded. If the threshold count has been exceeded several times, this problem should be investigated further.

SWACT indicator

The PM SWACT indicator provides a list of PMs that have undergone a SWACT. The items contained in the indicator include the PM type, and a count of manually-initiated, system-initiated, cold, and warm SWACTs. If the report shows system-initiated SWACTs, corrective maintenance may be required.

Network integrity fail count indicator

The NETINTEG indicator provides a peg count of network integrity failures and a peg count of total calls. The number of network integrity failure reports is equal to the number of integrity failures received from all the PM controllers in the switch.

Automatic line test (ALT) indicator

The ALT indicator provides counts of the number of lines tested, passed, failed, and skipped by the ALT feature for the past 24 h. A decrease in the number of lines tested may indicate either out-of-service equipment or a disabled test. An increase in the number of failed or skipped lines may indicate that further analysis is required.

Automatic trunk test (ATT) indicator

The ATT indicator provides counts of the number of trunks tested, passed, failed, and skipped by the ATT feature for the past 24 h.

Routine exercise tests

REx testing is the primary preventive maintenance tool for equipment that has dual units, such as the PRI XMS-based peripheral modules (XPM). REx tests run automatically, but must be enabled manually as follows:

1 Schedule the REx test by datafilling the parameter NODEREXCONTROL in table OFCVAR.

2 Enable the REx test on individual XPMs by first posting the XPM, then using the TST REX ON/OFF command.

For more information on the office parameter NODEREXCONTROL, refer to the *Office Parameters Reference Manual*.

Log PM600 is generated when a REx test fails. It provides information on the following:

- the steps performed by the REx test
- the reason for failure for the step that failed
- the start time of each step
- the peripheral node and unit status
- the location of the XPM

Logs PM131, PM128 and PM181 are suppressed when a REx test fails and the log PM600 is generated. For more information on PRI logs, refer to the chapter ‘‘Logs.”

REx test sequence

The sequence of events performed by the REx test controller is enumerated as follows:

1 Test the inactive unit (in-service tests only).

2 Busy the inactive unit.

3 Return the inactive unit to service (out-of-service tests only).

4 Wait for superframe and data synchronization to be achieved.

5 Perform a pre-SWACT audit.

6 Perform a warm SWACT.

7 Busy the newly inactive unit.

8 Return the inactive unit to service.

9 Wait for superframe and data synchronization to be achieved.

10 Test the newly active unit (in-service tests only).

11 Test the inactive unit (in-service tests only).

REx test restrictions

Certain operating conditions that limit the ability of the system to perform automatic REx tests include the following:

- the XPM must not be overloaded
- the REx test ends instead of performing a cold SWACT if a warm SWACT is not possible

The following restrictions apply to REx tests:

- In order for a REx test to run, the node must be in one of the following states:
  - — in-service (InSv)
  - — in-service trouble (ISTb) because a previous REx test failed
  - — in-service trouble (ISTb) because the P-side DS-1 links are out of service
- If a restart occurs while a REx test is in progress, the PM600 log is not generated because the restart deallocates the temporary data store used to build the PM600 log.
- No SWACT controller override is provided for manual REx tests.

The following notes also apply to REx testing:

- OMs normally generated for certain system actions are suppressed if the REx test initiates the action.
- The last REx test date and time stored in the maintenance record may be due to either a system or manual REx test and is measured from the last system reload restart.
- The REx test maintenance record is maintained during warm and cold restarts and is reinitialized during reload restarts and BCS applications.

Network maintenance

For the network to function properly, a low bit error rate (BER) must be maintained. Table 2-3 list the various tools that identify the bit error rate. The bit error rate test (BERT), for example, gives a measure of the transmission quality of a line or trunk. The test consists of sending a stream of known data over a specified B-channel on a DS-1 and comparing the returned signals.

The resident DMS-100 tools used for network maintenance and low bit error rate testing are listed in table 2-3.

Table 2-3
Test tools available for network maintenance

Test tool	Use
Integrated bit error rate testing (IBERT)	Tests the subscriber's data path
Integrity check traffic simulator (ICTS)	Simulates high volume calling to exercise every network link and channel to every XPM in the office.
Network fabric teting feature (NETFAB)	Identifies network problems by automatically integrating its testing procedure with that of ICTS.
XPM bit error rate testing (XPM/LCM XBERT)	Detects BER errors in the XPM/LCM configuration.
Bit error rate performance (BERP)	Assesses BER performance in the switch.
NETPATH	Performs fault isolation and verification on the network components of a speech path.
NETINTEG	Analyzes network integrity.

Focused maintenance

Although not strictly a preventive maintenance tool, focused maintenance (FM) can be used to identify potential troubles on trunks, and XPMs.

Focused maintenance is primarily a tool for managing trunk and line log messages. FM techniques can reduce trunk and line log messages by up to 80%.

FM uses buffers to accumulate failure data, which are output in log messages (FM100 for trunk groups) when preset thresholds have been exceeded. An alarm may then also be generated. Information concerning any alarms can be obtained by accessing the appropriate MAP level, that is, TRKSTRBL.

The operation of FM is described in detail in "Section 197 (Lines)" in the data schema section of the *Translations Guide*.

Operational measurements

Operational measurements (OM) are counts of events or changes of state in the DMS-100 switch that reflect the performance of the system. Single events measured individually are referred to as peg counts. Sampled states, used to determine system resource usage, are called usage counts and are sampled during a scan. A scan period is either 10 or 100 s.

There are more than 2000 OMs organized into approximately 150 OM groups. OMs are the most significant information source for determining service-affecting problem conditions, both immediate and potential. Analysis of OMs can be based on measurements collected over a long period of time, for example, one month, or based on measurements collected in a few minutes (real-time analysis).

For more information on ISDN PRI OMs, refer to the chapter "Operational measurements."

Routine maintenance

On-going maintenance aims to sustain the network and XPMs at the high-speed data transmission criterion of less than two NET102 log messages for every 10 000 calls at a parity threshold of 1.

For preventive maintenance, operating company personnel should perform routine maintenance procedures based on the schedule in table 2-4.

Table 2-4
Recommended routine maintenance procedures

Procedure	Interval
ALT analysis	Daily
ATT analysis	Daily
Automatic BIC relay test	Weekly
BERP	Daily
Circuit test	Daily
Extended diagnostics	Daily
IBERT	Daily
ICTS	Determined by operaing company personnel
NETFAB	4 h every night (continuous)
NETINTEG	Determined by operating company personnel
Replacement of cooling filters	Every 3 months
REx testing	Daily
Short diagnostics (SDIAG)	Daily

—continued—

Table 2-4
Recommended routine maintenance procedures (continued)

Procedure	Interval
Switch BER indicator for trunks	Determined by operating company personnel
Testing of wrist strap grounding cords	Monthly
TRKBERT	Determined by operating company personnel
Verification and adjustment (if required) of time of day clock)	Daily
XPM/LCM XBERT	Determined by operating company personnel
—end—	

For further information regarding routine maintenance procedures, see *Routine Procedures*.

Logs

This chapter contains background information on PRI logs, a table listing the log numbers associated with ISDN PRI, and a table listing the priority logs and the actions to take for each.

Log reports

Log reports are messages generated by the DMS-100 switch whenever a significant event has occurred, such as the DTCI changing from an in-service state to a system busy state. Log reports include status and activity reports, as well as reports on hardware or software faults, test results, changes in state, and other events or conditions likely to affect the performance of the switch.

For more information on log reports, refer to the *Log Report Reference Manual*.

Log utility

The log utility (LOGUTIL) allows you to browse through software buffers for information about messages, and to temporarily control the routing and generation of output reports.

ISDN PRI logs

Table 3-1 lists all logs associated with ISDN PRI and includes a description of each log.

Though PM logs are generated for all types of peripherals in the office, the descriptions in the table that follows describe the ISDN PRI XMS-based peripherals, the DTCI and the LTC only. PM logs contain a peripheral identification field in the first line of the log. For ISDN PRI peripherals, this field contains the abbreviations DTCI or LTC.

Table 3-1
Summary of ISDN PRI related logs

Log	Definition
All trunks busy logs	
ATB100	An attempt to seize a trunk was blocked and the call was advanced to another route.
ISDN logs	
ISDN103	A manual action changed the state of the B channel.
ISDN105	Synchronization was lost on the B-channel, and the B-channel was removed from service.
ISDN110	One D-channel is in service and the other D-channel is in standby.
ISDN111	One D-channel is active and the other D-channel is out of service.
ISDN112	Both D-channels in a dual configuration are out of service, or the D-channel in a single configuration is out of service.
ISDN113	A manual D-channel switchover occurred. The log shows the active and out-of-service D-channels after the switchover.
ISDN114	An automatic D-channel switchover occurred. The log shows the active and out-of-service D-channels after the switchover.
ISDN118	Synchronization has been established on the D-channel.
ISDN401	The log report shows the layer 2 transmission performance details of a single D-channel.
ISDN402	The log report shows the details about the layer 2 and layer 3 protocol abnormalities of a single NTNI PRA D-channel.
Network logs	
NET130	A network path was not found.
Network management subsystem logs	
NWM100	The Directional Reservation Equipment (DRE) feature was turned on or off for a trunk group.

—continued—

Table 3-1
Summary of ISDN PRI related logs (continued)

Log	Definition
NWM101	The Protectional Reservation Equipment (PRE) feature was turned on or off for a trunk group.
NWM102	A cancel-to (CANT) network management control was applied to or removed from a trunk group.
NWM103	A cancel-from (CANF) network management control was applied to or removed from a trunk group.
NWM104	A skip (SKIP) network management control was applied to or removed from a trunk group.
NWM105	The Incoming Trunk Busy (ITB) feature was activated or deactivated on the incoming trunk group.
NWM106	The Selective Trunk Reservation (STR) feature was activated or deactivated on the incoming trunk group.
NWM107	A flexible reroute (FRR) control was applied to or removed from a two-way or outgoing trunk group.
Peripheral module logs	
PM101	An XPM failed a checksum test (CHKSUM-TST).
PM102	An XPM changed state to system busy (SysB) because of a system request.
PM103	An XPM changed from manual busy (ManB) to offline (OffL), or an XPM has been added to the LTCINV inventory table while OffL and unequipped (Uneq).
PM104	An XPM changed from offline (OffL) to unequipped (Uneq), or a tuple was deleted from the LTCINV inventory table.
PM105	An XPM changed to manual busy (ManB).
PM106	An XPM was returned to service (RTS).
PM107	An XPM changed to central-side busy (CBsy) because of a system-busy request or a manual-busy request from the C-side node.
PM108	The peripheral processor has a firmware or hardware error.
PM109	The T1 carrier line changed to system busy (SysB).

—continued—

Table 3-1
Summary of ISDN PRI related logs (continued)

Log	Definition
PM110	A change occurred in the service count level. No trunks are removed from service when an out-of-service limit is set; however, since 24 trunks are affected, maintenance personnel must determine whether to deload the trunks using the trunk test position (TTP).
PM112	This log is generated every 24 h for each digital carrier module when the DMS-core sets the T1 carrier slip counter to zero.
PM113	Message congestion occurred in a peripheral processor.
PM114	An XPM load, test, initialization, or return–to–service procedure failed.
PM115	Miscellaneous trouble occurred on the peripheral processor during normal operation.
PM116	Message error report from an XPM
PM117	Trouble during normal operation
PM118	Miscellaneous trouble occurred on the peripheral processor during normal operation. This report contains a field that defines which plane of the XPM is affected. PM115 does not contain this field.
PM128	An XPM changed to in-service trouble (ISTb).
PM179	A hardware condition affected the normal operation of the DMS-100 switch or its XPM. This log supplies information for the XPM hardware exception report.
PM180	An XPM encountered a software exception, that is, an occurrence of an improper execution of the software. This log can also be generated due to a hardware-related software exception.
PM181	An XPM exception occurred as a result of diagnostics.
PM182	An XPM P-side link changed to manual busy (ManB).
PM183	An XPM P-side link changed to system busy (SysB).
PM184	An XPM P-side link was returned to service (RTS).

—continued—

Table 3-1
Summary of ISDN PRI related logs (continued)

Log	Definition
PM187	An XPM carrier changed to system busy (SysB).
PM188	A XPM carrier was returned to service (RTS) or was protection-switched.
PM600	An XPM failed a REx test.
Trunk logs	
TRK101	The percentage of busy trunks reached or exceeded the threshold value for a minor alarm.
TRK102	The percentage of busy trunks reached or exceeded the threshold value for a major alarm.
TRK103	The percentage of busy trunks reached or exceeded the threshold value for a critical alarm.
TRK104	The percentage of busy trunks drops below the threshold for a minor, major, or critical alarm.
TRK106	A diagnostic test on trunk equipment failed
TRK109	A diagnostic test on a DS-1 facility failed.
TRK110	A facility problem occurred and the trunk state is changed from call processing busy (CPB) to system busy (SysB) or Lockout (LO).
TRK111	Trouble occurred or treatment was assigned during the routing of an incoming trunk to trunk call.
TRK113	Trouble occurred during the call processing of a trunk-to-trunk call.
TRK114	Trouble occurred during dial pulse (DP) reception for an incoming call over a trunk, and the call destination was not determined.
TRK115	Trouble occurred during DP reception for an incoming call over a trunk, and the call destination was not determined.
TRK116	Trouble occurred during multifrequency (MF) reception for an incoming call over a trunk, and the call destination was not determined.
TRK117	Trouble occurred during MF reception for an incoming call over a trunk, and the call destination was not determined.

—continued—

Table 3-1
Summary of ISDN PRI related logs (continued)

Log	Definition
TRK118	Trouble occurred during automatic number identification (ANI) spill for an incoming call over a trunk and the call origination address was not determined.
TRK119	An operator keyed in the originating station number identification and then released the call because trouble occurred with DMS ANI.
TRK121	Trouble occurred during the outpulsing of a call on a specific outgoing trunk.
TRK122	The DMS-core detected integrity loss on both planes of the trunk equipment.
TRK138	A call was routed to treatment after being call processing busy.
TRK162	Trouble occurred during the outpulsing of a trunk-to-trunk call or a line-to-trunk call using digital multifrequency (DTMF) signaling.
TRK182	Trouble occurred during Digitone (DGT) reception for an incoming call over a trunk and the call destination was not determined.
TRK183	Trouble occurred during DGT reception for an incoming call over a trunk, and a permanent signal problem occurred.
TRK213	Trouble occurred on the identified trunk.
Datafill subsystem	
DFIL616	Generation of this log warns the operating company that real-time call traps are possible if the ATTEMPTS value (subfield in routing tables) exceeds 50.
—end—	

Priority logs

ISDN PRI priority logs can be categorized in the following manner:

- service-affecting logs
- potential-service affecting logs
- provisioning and engineering information logs

Service-affecting logs indicate a loss of service. Potential service-affecting logs indicate a potential loss of service if more than one component is involved. For example, if one D-channel goes out of service, PM111 is generated, and service is maintained if the backup D-channel is in service. If the backup D-channel goes out of service, PM112 is generated and service is interrupted. Provisioning and engineering information logs indicate that insufficient resources are available to provide service. Successive occurrences of provisioning and engineering information logs indicate that the operating company may need to upgrade its office capacity.

Table 3-2 lists the service-affecting logs for ISDN PRI. The table includes the alarm class, where applicable, and the action to be taken for each log.

Table 3-2
ISDN PRI service-affecting logs

Log	Alarm class	Action
ISDN112	ciritcal	Return the OOS D-channels to service. If the alarm continues, ensure that the transmission line is functioning properly by performing either a continuity test (CONT) or a loopback test (LOOPBK).
PM102	critical	Clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.* If the DS-1 link is out of service, clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM107	minor	Determine if a network alarm is present. Clear the alarm by performing the appropriate Net alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*

—continued—

Table 3-2
ISDN PRI service-affecting logs (continued)

Log	Alarm class	Action
PM109	minor	If this log appears for less than 2 min, do not take any action. If this log appears for more than 2 min, clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM183	minor	Perform tests and diagnostics on the P-side link. Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.* PM110 may appear at the same time as PM183. PM110 is useful for determining the cause of the change of state to system busy.
PM187	no alarm	Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
TRK122		Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
—end—		

Table 3-3 lists the potential service-affecting logs for ISDN PRI. The table includes the alarm class, where applicable, and the action to be taken for each log.

Table 3-3
ISDN PRI potential service-affecting logs

Log	Alarm class	Action
ISDN111	major	Return the out-of-service (OOS) D-channel to service. If the alarm continues, ensure that the transmission line is functioning properly by performing either a continuity test (CONT) or a loopback test (LOOPBK).
ISDN114	major	Return the OOS D-channel to service. If the alarm continues, ensure that the transmission line is functioning properly by performing either a continuity test (CONT) or a loopback test (LOOPBK).
PM101		Repeat the CHECKSUM test. If the test fails, replace the card by performing the appropriate card replacement procedure in *Card Replacement Procedures.* Rerun the test. If the test fails, replace the next card on the card list. Continue until the test passes or until all the cards on the card list have been replaced.
PM108	minor	Clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM110	minor	If the maintenance limit is cleared, do not take any action. If the maintenance limit or out-of-service limit is set, clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*

—continued—

Table 3-3
ISDN PRI potential service-affecting logs (continued)

Log	Alarm class	Action
PM115	no alarm	If this log appears with log PM108, clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM116	no alarm	If this log is preceded by log PM108, clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM117	minor	Clear the alarm by performing the PM ISTb alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM118	no alarm	If this log appears less than three times over a period of 2 min, do not take any action. If this log appears with log PM108, clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.* If no fault is found, try reloading the XPM.
PM128	minor	Clear the alarm by performing the PM ISTb alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM179		Test the XPM. If the test fails, replace the card by performing the appropriate card replacement procedure in *Card Replacement Procedures.* Rerun the test. If the test fails, replace the next card on the card list. Continue until the test passes or until all the cards on the card list have been replaced.

—continued—

Table 3-3
ISDN PRI potential service-affecting logs (continued)

Log	Alarm class	Action
PM180	minor	If the character string indicates a hardware problem, perform diagnostic maintenance on the suspect equipment. Clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
PM600	major	Clear the alarm by performing the DTCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
TRK109	no alarm	Perform the appropriate card replacement procedure in *Card Replacement Procedures.*
—end—		

Table 3-4 lists the provisioning and engineering information logs for ISDN PRI. The table includes the alarm class, where applicable, and the action to be taken for each log.

Table 3-4
ISDN PRI provisioning and engineering information logs

Log	Alarm class	Action
ATB100	minor	Save all ATB100 reports for the network planning personnel.
PM113	minor	If this log appears for less than 2 min, do not take any action. If this log appears for more than 2 min, clear the alarm by performing the appropriate alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
—continued—		

Table 3-4
ISDN PRI provisioning and engineering information logs (continued)

Log	Alarm class	Action
TRK101	minor	Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
TRK102	major	Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
TRK103	critical	Clear the alarm by performing the appropriate TRK alarm clearing procedure in *Alarm and Performance Monitoring Procedures.*
—end—		

Operational measurements

Operational measurements (OM) are a useful surveillance tool for ISDN primary rate interface (PRI). OM information can be used for real-time maintenance activities, long-term maintenance analysis, and administration.

ISDN PRI OM groups

The following table lists the OM groups associated with ISDN PRI. For detailed explanations of OM registers, refer to *Operational Measurements Reference Manual*. For detailed information about how to activate OMs, refer to *Basic Administration Procedures*, 297-1001-300.

Table 4-1
ISDN PRI related OM groups

Group	Description
DS1CARR	DS1CARR provides information about maintenance thresholds and out-of-service (OOS) thresholds for digital trunks on peripheral modules (XPM). When the OOS threshold is exceeded, the DS-1 is removed from service until it is manually returned to service.
MWICTCAP	MWICTCAP collects and displays counts for TCAP messages for each ISDN PRI access interface that has MWI control feature provisioned.
PM	PM provides information on the performance of dual-unit XPMs: for PRI, this includes DTCIs and LTCs.
PRADCHL2	PRADCHL2 monitors the performance of PRI D-channel layer 2 traffic.
PRAFAC	PRAFAC measures message traffic that is generated by network ring again (NRAG) on primary rate access (PRA) D channels.

—continued—

Table 4-1
ISDN PRI related OM groups

Group	Description
PRIMWIC	PRIMWIC collects and displays counts for MWIC transactions for each PRI access interface that has MWIC capability.
TRK	TRK provides information on trunk traffic for each trunk group.

—end—

The following table lists the ISDN PRI performance factors and their related OM groups, registers, and logs.

Table 4-2
ISDN OM registers

Performance factor or system fault	OM group	Registers	Associated logs
DS-1 link availability, DS-1 link failures	DS1CARR	DS1AIS	none
		DS1BER	none
		DS1BPV	none
		DS1CBU	PM107
		DS1ECF	TRK109
		DS1ES	none
		DS1LCGA	PM109, TRK109
		DS1LOF	PM110
		DS1MBU	PM105, PM182
		DS1PBU	PM183
		DS1RCGA	PM109, TRK109
		DS1SBU	PM109, TRK109
		DS1SES	none
		DS1SLP	PM112
		DS1UAS	none

—continued—

Table 4-2
ISDN OM registers (continued)

Performance factor or system fault	OM group	Registers	Associated logs
Module faults	PM	PMCCTDG	LINE101, LINE131
		PMCCTFL	LINE101
		PMCCTOP	none
		PMERR	NET102, PM101, PM108, PM113, PM115, PM116, PM117, PM118, PM119, PM121, PM122, PM124, PM125, PM126, PM128, PM150,
		PMFLT	PM160, PM180, PM181, PM190, PM194, PM198, PM270, TRK123
		PMINTEG	PM100, PM101, PM102, PM114, PM117, PM122, PM151, PM161, PM162, PM164, PM180, PM181, PM185, PM 199
			NET102, PM101, PM108, PM113, PM118, PM119, PM122, PM124, PM180, PM181, PM182, PM185, PM191

—continued—

Table 4-2
ISDN OM registers (continued)

Performance factor or system fault	OM group	Registers	Associated logs
Module faults	PM	PMMBP	PM182, PM191
		PMMBTCO	none
		PMMCXFR	PM128, PM180
		PMMMBU	PM105, PM128, PM170, PM182,
		PMMSBU	PM191
		PMMWXFR	PM102, PM128, PM170, PM183,
		PMPSERR	PM190, PM192
		PMPSFLT	PM102, PM128,
		PMRGERR	PM183
		PMRGFLT	PM110, PM181,
		PMSBP	PM183
		PMSBTCO	PM109, PM181, PM183
		PMSCXFR	PM109, PM181, PM183
		PMSWXFR	PM161, PM162, PM163
		PMUMBU	PM107, PM183, PM190, PM192
		PMUSBU	none
			PM128, PM179, PM180, PM181
			PM128, PM179, PM180, PM181
			PM105, PM128, PM182, PM191
			PM102, PM128, PM152, PM183, PM190, PM192

—continued—

Table 4-2
ISDN OM registers (continued)

Performance factor or system fault	OM group	Registers	Associated logs
DS-1 link performance, DTCI overload, PRI D-channel traffic, D-channel failures	PRADCHL2	PRDCRC	none
		PRDDISCR	none
		PRDDISCT	none
		PRDL2SVD	none
		PRDL3SVD	none
		PRDREJRX	none
		PRDREJTX	none
		PRDRNRRX	none
		PRDRNRTX	none
		PRDS0RX	none
		PRDS0TX	none
		PRDSBMRX	none
		PRDSBMTX	none
		PRFLSHED	none
MWIC usage	MWICTCAP	ACTATT	none
		DEACTATT	none
		ACTPROB	none
		DEACTPRB	none
		UNIDIREC	none
		UNITDATS	none
	PRIMWIC	ACTATT	none
		DEACTATT	none
		UNSUCACT	none
		UNSUCDAC	none
		TASKRFSD	none
		TMREXPRD	none
		NOTFUNAV	none
		RESUNAV	none
		INVARG	none

—continued—

Table 4-2
ISDN OM registers (continued)

Performance factor or system fault	OM group	Registers	Associated logs
Network traffic on PRI D-channels, D-channel failures	PRAFAC	FACMSGOR	none
		FACMSGTM	none
		FACMSGTR	none
		DISNORTX	none
		DISCNGST	none
		DISRTUNA	none
		REJMSGOR	none
		REJMSGTM	none
		REJMSGTR	none
		REJMSGDS	none
		REJNORTX	none
		REJCNGST	none
		REJRTUNA	none

—continued—

Table 4-2
ISDN OM registers (continued)

Performance factor or system fault	OM group	Registers	Associated logs
Trunk group performance	TRK	ANF	TRK120
		AOF	TRK118, TRK119
		CONNECT	none
		DEFLDCA	NWM100, NWM101, NWM102, NWM103, NWM104, NWM106, NWM108
		DREU	NWM100
		GLARE	TRK113, TRK121
		INCATOT	none
		INFAIL	TRK111, TRK114, TRK115, TRK116, TRK117, TRK138, TRK182, TRK183,
		MBU	TRK213
		NATTMPT	none
		NOVFLATB	none
		OUTFAIL	ATB100
			TRK113, TRK121, TRK122, TRK162,
		OUTMTCHF	TRK213
		PRERTEAB	NET130
		PREU	TRK113, TRK116
		SBU	NWM101
		TANDEM	TRK106, TRK109
		TOTU	none
		TRU	none
			none

—end—

ISDN PRI priority OM registers

ISDN PRI priority OM registers can be categorized in the following manner:

- service-affecting OM registers
- provisioning and engineering OM registers

Service-affecting OM registers indicate a loss of service. Successive occurrences of provisioning and engineering OM registers indicate that the operating company may need to upgrade its office capacity.

Table 4-3 lists the service-affecting OM registers for ISDN PRI.

Table 4-3
ISDN PRI service-affecting OM registers

Group	Register	Associated logs	Description
DS1CARR	DS1LCGA	PM109, TRK109	Counts each time a local carrier group alarm message is received from the PM.
	DS1RCGA	PM109, TRK109	Counts remote carrier group alarm messages that are received from the PM.
	DS1PBU	PM183	Measures the amount of time (in CCS or deci-erlangs) that the DS-1 carrier is P-side busy. A carrier is P-side busy when its remote (P-side) PM is OOS.
	DS1SBU	PM109, TRK109	Measures the amount of time (in CCS or deci-erlangs) that the DS-1 carrier is system busy
PM	PMFLT	PM100, PM101, PM102, PM114, PM117, PM122, PM151, PM161, PM162, PM164, PM180, PM181, PM185, PM199	Counts the number of faults in either unit of an in-service XPM that causes the unit or the XPM to become system busy.

—continued—

Table 4-3
ISDN PRI service-affecting OM registers (continued)

Group	Register	Associated logs	Description
	PMMSBU	PM102, PM128, PM170, PM183, PM190, PM192	Records the time (in CCS) that the PM is SysB. Scored when either both units are SysB or one unit is SysB and the other unit is in a not-in-service state.
	PMPSFLT	PM109, PM181, PM183	Counts the number of faults detected on facilities associated with the PM.
	PMSBTCO	none	Scored for every terminal in the call processing busy (CPB) or the call processing deload (CPD) state when the PM is made system busy (SysB) or central-side busy (CBsy). For two terminals involved in a two-port call, the peg is scored only once.
	PMUSBU	PM102, PM128, PM152, PM183, PM190, PM192	Records the time (in CCS) that the PM is SysB.
TRK	INFAIL	TRK111, TRK114 TRK115, TRK116 TRK117, TRK138 TRK182, TRK183 TRK213	Counts the number of events that occurred for an originating call on a trunk before the call failed. Causes include permanent signal, partial dial time out, or bad digits.

—continued—

Table 4-3
ISDN PRI service-affecting OM registers (continued)

Group	Register	Associated logs	Description
	OUTFAIL	TRK113, TRK121 TRK122, TRK162 TRK213	Counts the number of failed attempts to seize an outgoing trunk in the group due to seizure failures, signaling problems, loss of integrity, or outgoing failures.
	SBU	TRK106, TRK109	Measures the amount of time (in CCS or deci-erlangs) that a trunk is in one of the following states: remote busy, peripheral module busy, system busy, carrier fail, or deloaded.
		—end—	

Table 4-4 lists the provisioning and engineering OM registers for ISDN PRI.

Table 4-4
ISDN PRI provisioning and engineering OM registers

Group	Register	Associated logs	Description
PM	PMERR	NET102, PM101, PM108, PM113, PM115, PM116, PM117, PM118, PM119, PM121, PM122, PM124, PM125, PM126, PM128, PM150, PM 160, PM180, PM181, PM190, PM194, PM198, PM270, TRK123	The number of errors detected for an in-service PM regardless of further maintenance action.
PRADCHL2	PRDS0RX	none	Counts the number of successfully received SAPI0 frames.
	PRDS0TX	none	Counts the number of successfully transmitted SAPI 0 frames.
TRK	NOVFLATB	ATB100	Counts the number of times that call processing overflows a trunk group because there are no idle trunks.

User interface

This chapter describes the user interface associated with ISDN PRI, including information about:

the MAP (maintenance and administration position) level hierarchy

menu MAP commands

unlisted MAP commands

MAP level diagrams

XMS-based peripheral module (XPM) status indicators

trunk status indicators

carrier status indicators

D-channel status indicators

messages

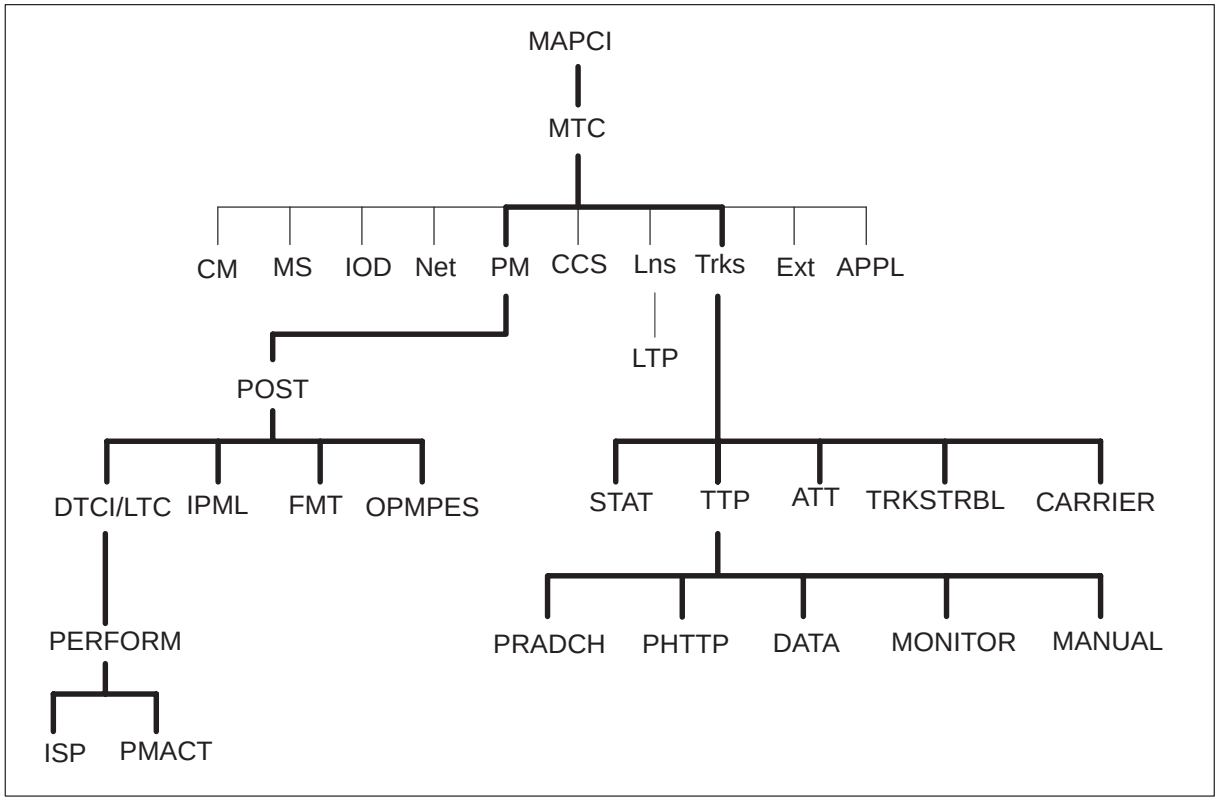
Note: Although the commands and status indicators at the peripheral module (PM) level apply to all peripherals in the office, the descriptions that follow have been modified to describe the ISDN PRI XPMs, the ISDN digital trunk controller (DTCI), and the line trunk controller (LTC). For simplicity, references to XPM include XPM product life upgrade strategy (PLUS).

The user interface can vary in appearance. Some MAP levels and commands are available only when specific hardware or software, or both, is provisioned.

MAP level hierarchy

Figure 5-1 illustrates the MAP hierarchy for ISDN PRI maintenance. The maintenance levels for PRI are highlighted with bold lines.

Figure 5-1
ISDN PRI MAP sublevels



Commands

This section lists and describes ISDN PRI menu MAP commands and unlisted MAP commands.

Menu MAP commands

Table 5-1 lists all the ISDN PRI menu MAP commands.

Table 5-1
Menu MAP commands

Command	Level	Description
ATT	TRKS	Accesses the automatic trunk testing (ATT) level.
BERT	DATA	Runs the bit error ratio test (BERT) between offices.
BTERM	DATA	Registers the type of termination that is to be set up in the far-end office for the duration of the BERT trunk test. Also displays the termination, or cancels (resets) the registry of the termination.
BSY	DTCI LTC	Changes the state of the posted DTCI or LTC to manual busy (ManB).
	TTP	Sets the currently posted trunk circuit to manual busy, installation busy, or system busy.
CARRIER	TRKS	Accesses the trunk carrier (CARRIER) level.
CKT	TTP	Connects the specified trunk circuit to the circuit in the control position.
CKTINFO	TTP	Displays information specific to a trunk circuit.
CKTLOC	TTP	Displays the physical location of the trunk circuit in the control position. This command displays • the location and its maintenance and transmission data • the floor, row, bay, or shelf location of the PM connected to the trunk in the control position • additional information for packet trunks (X75 and packet PRI) This information includes details and states for the associated digital trunk controller (DTC), network interface unit (NIU), X.25/X.75 link interface unit (XLIU), channel bus (C-bus), and speccon connection. This command is available at the TTP and the PHTTP sublevel.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
CKTMON	MONITOR	Turns the trunk circuit monitor feature on or off.
CLRALM	TRLSTRBL	Clears the alarm associated with the call processing or maintenance buffers for a trunk group, and resets the failure counters. This command also resets the attempt counter for the call processing buffer.
CLRBUF	TRKSTRBL	Clears the call processing or maintenance buffers for the specified trunk group.
CONNECT	PRADCH	Connects DTA test equipment to a PRI D-channel for monitoring PRI protocol messages.
CONT	PRADCH	Runs a continuity test on the posted D-channel.
CREATESET	TRKSTRBL	Creates a list of the trunk troubles recorded in the call processing or maintenance buffers.
DELMAN	ATT	Deletes manual test entries for a specified trunk group.
DISP	DTCI LTC PM TRKSTRBL	Displays a list of, trunks, carriers, or XPMs in a specified state, or a summary of diagnostic failures.
DISPGRP	STAT TKGRP	Displays information on specified trunk groups.
EQUIP	PRADCH	Reserves, queries, and releases DTA monitor equipment for testing two DS-0 channels on a PRI trunk. To use this option, the DS-0 channels must be provisioned for 64-kbit/s clear transmission.
FRLS	MONITOR	Forces the call processing busy (CPB) trunk circuit in the control position to manual busy. If another trunk circuit is connected to the circuit in the control position, the connection is released.
HALTMAN	ATT	Stops all automatic trunk testing.
HCPYGRP	STAT TKGRP	Continuously displays or prints information on trunk groups.
HOLD	TTP	Places the trunk circuit in the control position in the first available hold position.
HSET	MANUAL	Connects a headset to the trunk circuit in the control position by a headset trunk.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
JACK	MANUAL	Connects one of the trunk test position (TTP) test jacks to the control position.
ITEM	STAT TKGRP	Displays data on trunk circuits within a trunk group, and accesses the STAT TRKS level.
LEVEL	TTP	Accesses the TTP sublevel display.
LISTALM	TRKSTRBL	Lists the trunk groups that have an active alarm. This information is retrieved from the call processing and maintenance buffers.
LISTMAN	ATT	Displays data about manual tests.
LISTSET	DTCI LTC	Lists the discrimination numbers of the XPM types in the posted set.
LSTCLLI	ATT	Displays a list of all the scheduled automatic trunk circuit tests and associated data for a trunk group.
LSTSTOP	ATT	Lists all inactive entries in the scheduling table ATTSCHED.
LSTWAIT	ATT	Lists the active and waiting tests.
LOADPM	DTCI LTC	Loads the peripheral program files into the posted DTCI or LTC.
LOOPBK	PRADCH	Sets, removes, or checks the status of the loopback point for the posted D-channel.
	PHTTP	Sets or removes a loopback on a posted packet trunk. This command is valid at the X75TTP level (pre-NA011) and the PHTTP level (post-NA011). Use this command to perform maintenance on the X75 and the packet trunks before you perform the continuity test on the trunks. Valid on X75 and packet PRI trunks. An error message displays on the PHTTP MAP level if operating company personnel set a loopback on any trunks other than an X75 or packet PRI trunk.
LOSS	MANUAL	Measures the received signal loss of the trunk circuit in the control position.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
MONLINK	MONITOR	Sets up a connection between the headset of the TTP communications device and the trunk circuit that is linked to the circuit in the control position. The MONLINK command supports digital monitoring with digital test equipment.
MONPOST	MONITOR	Sets up a connection between the headset of the TTP communications device and the trunk circuit in the control position. The MONPOST command supports digital monitoring with digital test equipment.
MONTALK	MONITOR	Establishes a three-party conference trunk circuit connection among the circuit in the control position, the circuit linked to it, and the headset of the TTP. The connections are set up through a three-port conference circuit.
NEXT	Most PM and TRKS levels	Moves the next trunk or XPM in the posted set into the control position.
NEXTGRP	STAT TKGRP	Displays data on the next 12 trunk groups of a group type and alarm.
NOISE	MANUAL	Measures noise by connecting the trunk circuit in the control position to the noise-measuring circuit. The measurement displays are updated continuously.
OFF L	DTCI LTC	Changes the state of DTCI or LTC to offline (OffL).
OP	MANUAL	Outpulses a specified number on the trunk circuit in the control position.
PERFORM	DTCI LTC	Accesses the PERFORM level. The PERFORM level displays information about the processors of a posted XPM. The MAP display is updated every minute.
PFQUERY	PERFORM	Identifies the XPMs currently undergoing the performance process by XPM type and number, and accesses the ISDN signaling preprocessor (ISP) level.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
PHTTP	TTP	Use this command to enter the PHTTP MAP level. The existing X75TTP MAP level is renamed PHTTP to provide an integrated maintenance level for the packet handler trunks. Use the PHTTP MAP level to perform maintenance on the X75 and the packet PRI trunks. The IN PULSE and OUT PULSE fields under the TYPE heading in the MAP display differentiates between the packet PRI and the X75 trunks when an X.25 packet PRI is posted.
PMACT	PERFORM	Accesses the PMACT level and displays the status of activities within the posted XPM. Some examples of the types of activities monitored are as follows: number of peak terminations and originations, average number of peak terminations and originations, number of channels available for call processing, number of channels in use, and the number of processes for the master processor, signaling processor, and ISP.
POST	Most PM and TRKS levels	Posts one or more trunks, carriers, channels, XPM units, or XPMs for maintenance.
	PRADCH	All primary rate access (PRA) B-channels, D-channels, and other trunks, such as Common Channel Signaling 7 (CCS7) and MF, can be posted with this command. Quitting from the PRADCH level to the TTP level clears all the post and hold queues. Originally, the PRADCH level was intended for posting signaling trunks only. The TTP level is not for signaling trunks.
	TTP level and PHTTP sublevel	Use this command to enter the PHTTP MAP level. The pre-NA011 X75TTP MAP level, renamed PHTTP in NA011, provides an integrated maintenance level for the packet handler trunks. Use the PHTTP MAP level to perform maintenance on the X75 and the packet PRI trunks. The IN PULSE and OUT PULSE fields under the TYPE heading in the MAP display differentiates between the packet PRI and the X75 trunks when an X.25 packet PRI is posted. For X.75, the impulse and outpulse will be X7.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
POSTISP	ISP	Posts an enhanced ISDN signaling processor (EISP) channel. *See* PERFORM, PFQUERY.
QSUP	TRKSTRBL	Lists all the trouble types that are suppressed.
QUERYPM	DTCI LTC	Displays information about the posted line XPM, including equipment location, load name, and status.
RESUME	TRKSTRBL	Cancels the suppression of the specified trouble type.
REX	Most PM levels	Performs a routine exercise (REx) test on a XPM unit or XPM.
RLS	TTP	Releases the connection to the trunk circuit in the control position.
RTS	Most PM and TRKS levels	Returns a posted trunk, carrier, XPM unit, or XPM to service.
RUNATT	ATT	Restarts all scheduled ATT or restarts all tests that were stopped by the HALTATT command.
SEIZE	TTP	Seizes a trunk circuit for maintenance action.
SETSTST	ATT	Sets the maximum number of tests that can be run simultaneously.
START	ATT	Starts a test sequence on a specified trunk group or restarts only those tests that were stopped with the STOP command. A test is always restarted from the beginning, regardless of where in the test sequence it was stopped.
STAT	TRKS	Accesses the trunk group status (STAT TKGRP) level.
	TRKSTRBL	Accesses the STAT TKGRP level.
STATUS	PM	Shows the XPM status.
STOP	ISP PMACT	Stops the performance process begun by the STRT command. *See* PERFORM, PMACT, PFQUERY.
	ATT	Stops a test sequence on a specified trunk group.
STOPDISP	TRKSTRBL	Stops the periodic updating of the screen that was started using the DISP command.

—continued—

Table 5-1
Menu MAP commands (continued)

Command	Level	Description
STOPLOG	ISP PMACT	Stops the performance process begun by the STRTLOG command. *See* PERFORM, PMACT, PFQUERY.
STRT	ISP PMACT	Starts the timer and the performance testing process. *See* PERFORM, PMACT, PFQUERY.
STRTLOG	ISP PMACT	Starts generating the XPM logs for the performance testing process. *See* PERFORM, PMACT, PFQUERY.
SUPPRESS	TRKSTRBL	Causes the specified trouble types to be ignored.
SWACT	DTCI LTC	Switches active and inactive units in the posted DTCI or LTC.
	PRADCH	Switches the D1 activity from in-service to lockout and D2 activity from standby to in-service.
TDET	MANUAL	Identifies the tone signal received on the trunk circuit in the control position by connecting the tone detector.
TESTREQ	ATT	Requests a manual test.
TGEN	MANUAL	Sends a tone over the trunk circuit in the control position to a distant office.
TRKSTRBL	TRKS STAT TKGRP	Accesses the trunks trouble (TRKSTRBL) level.
TRNSL	DTCI LTC	Displays the C-side link or P-side link information.
TST	Most PM and TRKS levels TTP PHTTP	Tests the posted trunk, carrier, channel, link, card, XPM unit, or XPM. TST with X.25i will perform an internal continuity test on a packet PRI trunk.
TTP	TRKS	Accesses the TTP level.

—end—

Unlisted MAP commands

Table 5-2 lists all the ISDN PRI unlisted MAP commands.

Table 5-2
Unlisted MAP commands

Command	Level	Description
ABTK	DTCI LTC	Cancels all active maintenance action, including loading, on the posted LTC.
BERTTIME	DATA	Specifies the duration of the BERT.
CPSTAT	PM	Displays the software processing status for a given node number of a XPM.
CREATE_TTP	TRKS TTP	Creates a new TTP.
DATATTP	TRKS TTP	Accesses the DATA-level menu.
DELETE_TTP	TRKS TTP	Deletes a TTP.
FRLS	TRKS	Forces the call processing busy (CPB) trunk circuit in the control position to manual busy. If another trunk circuit is connected to the circuit in the control position, the connection is released.
LDPMALL	PM	Simultaneously loads or reloads more than one XPM.
LOADFW	TRKS TTP	Loads firmware to a multiline test unit (MTU) or to a digital test unit (DTU) that is attached to a maintenance trunk module (MTM).
LOADNOTEST	DTCI LTC	Performs the same function as the LOADPM commands, but omits the read-only memory (ROM) test.
NEXT	PM	Displays status information for the next XPM in the posted set.
PATCHXPM	DTCI LTC	Loads new or changed software for a single change supplement (SCS).
PHTTP	CI	Enters the PHTTP MAP level to perform maintenance on the X75 trunks and packet on PRI.
PMLOADER	PM	Queries the cause of the PMLOAD alarm or forces an audit that reattempts autoloading.

—continued—

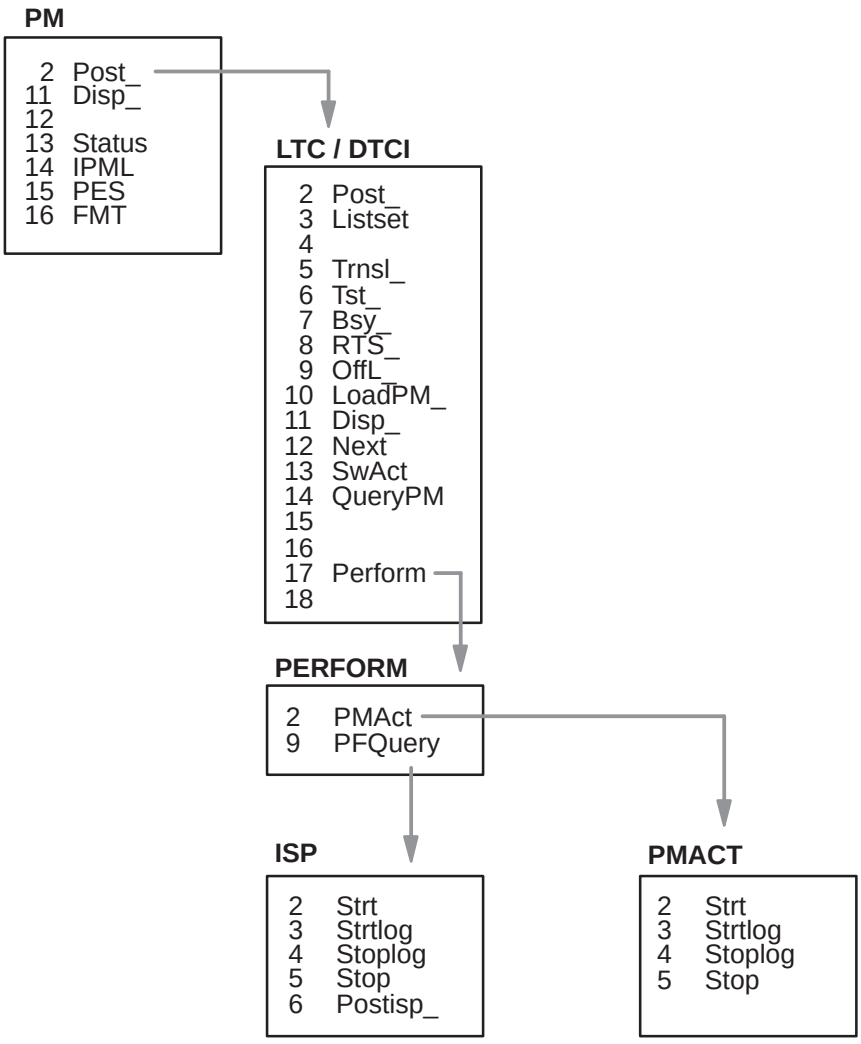
Table 5-2
Unlisted MAP commands (continued)

Command	Level	Description
PRADCH	TTP	Access the PRADCH level.
QRYABN	PRADCH	Displays the layer 2 and 3 protocol abnormality counts for the NTNI PRA D-channels posted.
QRYPERF	PRADCH	Displays the layer 2 transmission performance measurements of the NTNI PRI of D-channels posted. (Options exist to display either the current 24-h measurements or the past 24-h measurements being held.)
REPEAT	TRKS	Repeats a test or a sequence of tests.
WARMSWACT	DTCI LTC	Performs a warm SWACT.
XPMLOGS	DTCI LTC	Allows logs to be generated from the XPM and reports SWERRS.
X75TTP	TTP	Enters the PHTTP MAP level instead of the X75TTP MAP level. This level is used as an integrated MAP level for maintaining packet handler trunks. Maintain both X75 and packet PRI trunks at this level.
		—end—

MAP level diagrams

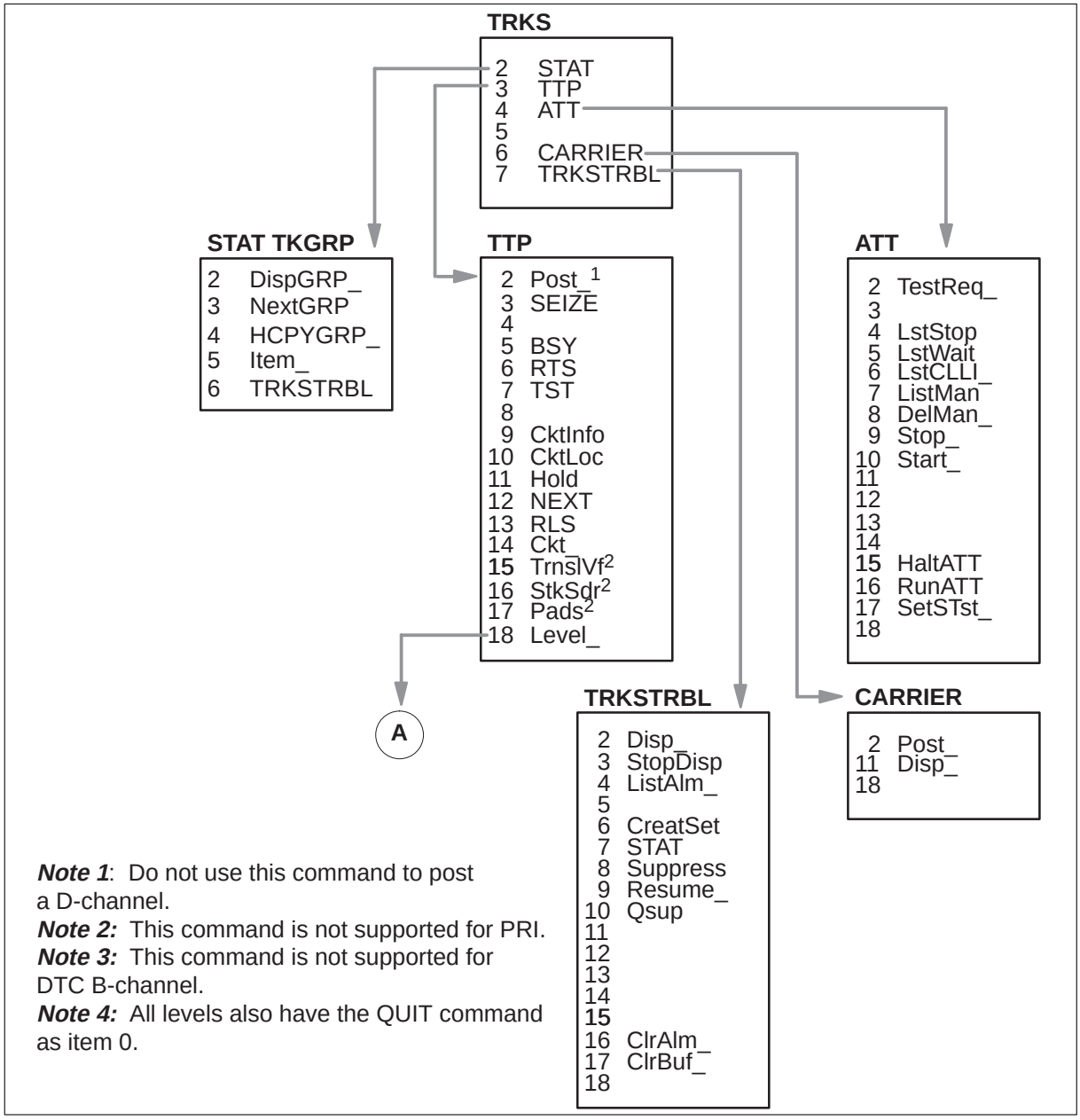
The following section provides information on PM level and TRKS level menu commands as they appear on the MAP display. Figure 5-2 shows the ISDN PRI-related PM levels and menu commands. Figure 5-3 shows the ISDN PRI-related TRKS levels and menu commands.

Figure 5-2
PM level commands



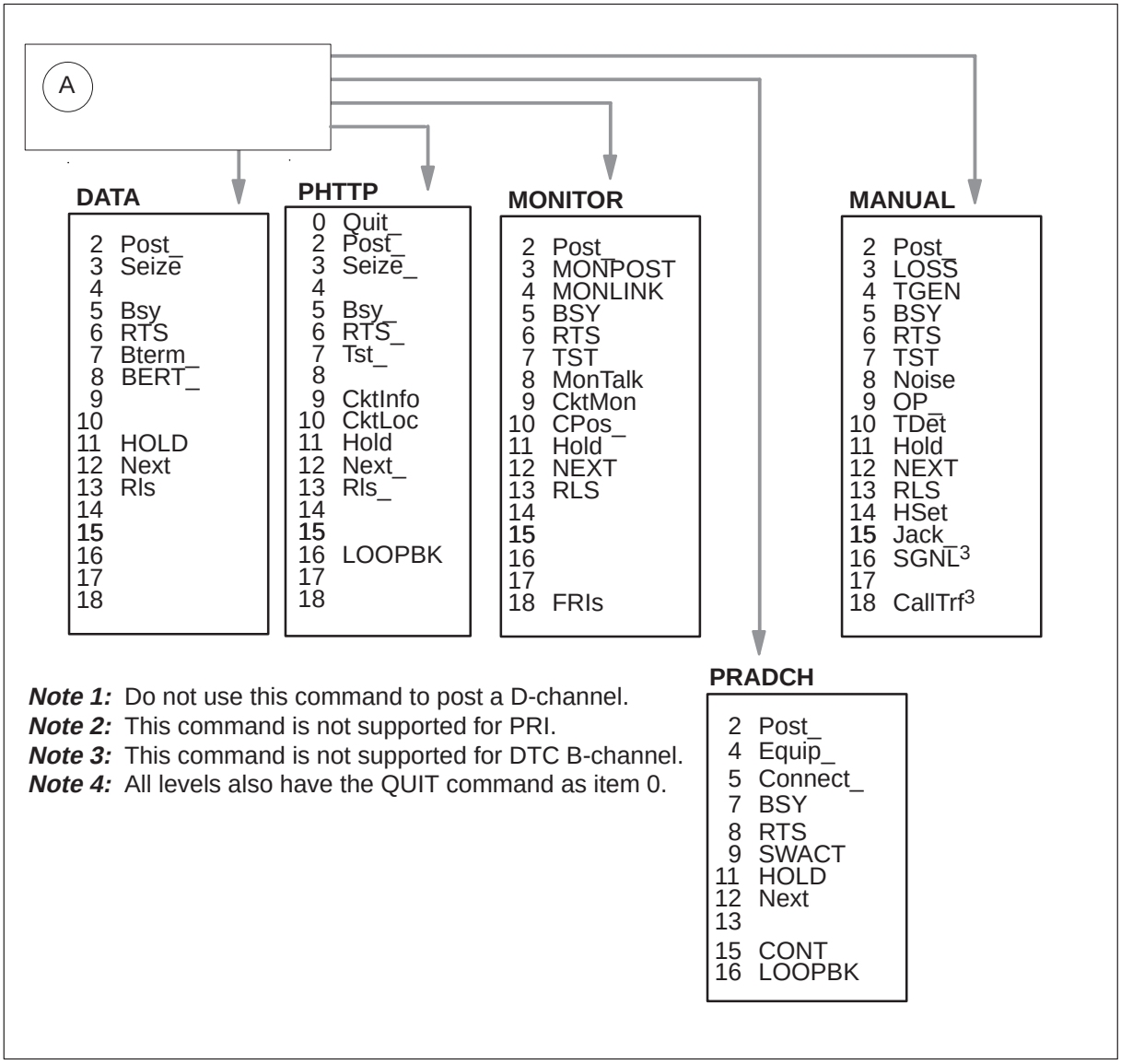
***Note 1*:** The same menu items at different MAP levels may have different parameters.
***Note 2*:** All levels also have the QUIT command as item 0.

Figure 5-3
TRKS level commands



Note 1: Do not use this command to post a D-channel.
Note 2: This command is not supported for PRI.
Note 3: This command is not supported for DTC B-channel.
Note 4: All levels also have the QUIT command as item 0.

Figure 5-4
TRKS level commands (continued)



Note 1: Do not use this command to post a D-channel.
Note 2: This command is not supported for PRI.
Note 3: This command is not supported for DTC B-channel.
Note 4: All levels also have the QUIT command as item 0.

Status indicators

This section describes ISDN PRI XPM, trunk, carrier and D-channel status indicators. Table 5-3 lists and describes the DTCI and LTC states.

Table 5-3
DTCI and LTC states

State	Description
CBsy	*Central-side (C-side) busy* There is no access to the XPM from the network. One or more links from the network to the XPM are out of service.
InSv	*In service* The XPM is in service.
IsTb	*In-service trouble* A fault exists on the XPM, however, services are not affected.
ManB	*Manual busy* Manual maintenance is in progress.
OffL	*Offline* The XPM is offline.
SysB	*System busy* The system detected an XPM fault and removed the XPM from service.

Table 5-4 lists and describes DS-1 trunk states.

Table 5-4
DS-1 trunk states

State	Description
CBSY	*Central-side busy* The carrier is not available for service because the associated C-side node is busy.
CPB	*Call processing busy* The trunk circuit is carrying traffic.
CPD	*Call processing deload* The trunk circuit is carrying traffic but will be available for maintenance once call processing is completed.
CFL	*Carrier failure* The carrier has failed and the trunk has been removed from service.
DEL	*Deload* The trunk circuit that was previously CPD is now available for maintenance.

—continued—

Table 5-4
DS-1 trunk states (continued)

State	Description
DFL	*D-channel failure* The D-channel has been removed from service by the system.
DMB	*D-channel manual busy* The D-channel has been manually removed from service
IDL	*Idle* The trunk circuit is available for service.
INB	*Installation busy* The trunk circuit is installed but is not in service.
INI	*Initializing* All trunks are placed in this state after a cold or reload restart.
INSV	*In service* The carrier is in service.
ISTB	*In-service trouble* The trunk is in service but faults have been detected on the trunk circuit.
LO	*Lock out* The D-channel associated with the trunk is in service but layer 3 cannot communicate with the far-end for one of the following reasons: • layer 2 is out of sync • layer 2 is in sync but no logical link is established • layer 3 is not responding to a restart or release
MANB	*Manual busy* The carrier has manually been removed from service for maintenance.
MB	*Manual busy* The trunk has manually been removed from service for maintenance.
NEQ	*Not equipped* The hardware or datafill associated with the trunk is not provisioned.

—continued—

Table 5-4
DS-1 trunk states (continued)

State	Description
NMB	*Network management busy* The trunk has been removed from service by Network Management.
OFFL	*Offline* The carrier is offlined for maintenance and is unavailable for service.
PBSY	*Peripheral-side (P-side) busy* The carrier is not available for service because the associated P-side node is busy.
PMB	*Peripheral manual busy* The trunk circuit is not available for service because the associated XPM is out of service.
RMB	*Remote made busy* The trunks has been removed from service by either the far end or near-end office.
SZD	*Seized* The posted trunk has been seized for maintenance.
SB	*System busy* The system has detected a fault on the trunk circuit and has removed it from service.
SYSB	*System busy* The system has detected a fault on the carrier and has removed it from service.
UNEQ	*Unequipped* The hardware or datafill associated with the carrier is not provisioned.
—end—	

Table 5-5 lists and describes the D-channel states.

Table 5-5
D-channel states

State	Description
CFL	*Carrier fail* The carrier on which the D-channel is provisioned has been removed from service by the system.
LO	*Lockout* The D-channel is in lockout because of a logical link or hardware failure.
INB	*Installation busy* The D-channel is installed but is not in service.
INI	*Initializing* The D-channel is initializing.
INS	*In service* The D-channel is in service and is available for call processing.
MB	*Manual busy* The D-channel has manually been removed from service for maintenance.
PMB	*Peripheral manual busy* The peripheral has been removed from service by maintenance personnel, causing the D-channel to PMB.
RNR	*Remote not responding* Layer 3 at the far-end is not responding, although layer 2 is established and ready.
RST	*Restart transmitted* A restart message has been sent to the far end.
STB	*Standby* The D-channel is in the multiple frame state established at layer 2, but is not carrying any layer 3 call-control messages on the logical data link.
WAI	*Wait* The D-channel is in standby.

Messages

NA011 introduces error messages and information messages associated with commands. If the operating company personnel try to issue a command that is invalid for a PKT PRI trunk at the TTP level or sublevels, the following error message displays:

```
Command not allowed with PKT PRI trunks.
```

The following table lists the error messages and information messages that display when using the commands listed in the following table.

Table 5-6
Error and information messages associated with commands

Command	Message	Description
LOOPBK	Failed, Posted CKT is neither X75 nor a PKT PRI trunk.	Displays on the MAP terminal when operating company personnel try to set a loopback on trunks other than an X75 or packet PRI trunk. Action: Post an X75 or packet PRI trunk to perform loopback set, remove, or query.
	Loopback set on the trunk. Use LOOPBK REMOVE at PHTTP level.	Displays on the MAP terminal when operating company personnel try to issue a valid command (other than the Post or Next command) on a packet PRI trunk on which a loopback was previously set by other operating company personnel. Action: Enter the PHTTP level and issue a loopback remove command to remove the loopback set on the trunk.
POST D	<PKT PRI DN> is a PKT PRI DN and will not be posted.	Generates when operating company personnel try to post a packet PRI non-shared DN at the LTP MAP level. ***Note:*** The packet PRI DN/LTID is associated with a CLLI rather than a LEN. It is not maintained at the LTP level.
	The PMD Calltype of <PKT PRI shared DN> is PKT PRI and will not be posted.	Generates when operating company personnel try to post a packet PRI shared DN at the LTP level. Action: Use QPHF LTID <ltid>. This action displays CLLI and member. Use CLLI and member to post at the PHTTP level.
POST DK	This is a PKT PRI DN and will not be posted.	Generates when operating company personnel try to post a packet PRI non-shared DN and the associated key at the LTP level.

—continued—

Table 5-6
Error and information messages associated with commands (continued)

Command	Message	Description
		Note: The packet PRI DN/LTID is associated with a CLLI rather than a LEN. It is not maintained at the LTP level. Action: Use QPHF LTID <ltid>. This action displays CLLI and member. Use CLLI and member to post at the PHTTP level.
	The PMD Calltype is a PKT PRI DN and will not be posted.	Generates when operating company personnel try to post a packet PRI shared DN and the associated key at the LTP level. Action: Use QPHF DN and post at the PHTTP level.
POST H	The PKT PRI Hunt members will not be posted.	Generates when operating company personnel try to post a packet PRI hunt group at the LTP level. ***Note:*** The packet PRI DN/LTID is associated with a CLLI rather than a LEN. It is not maintained at the LTP level. Action: Use QPHF LTID <ltid> . This action displays CLLI and member. Use CLLI and member to post at the PHTTP level.
POST LT	The LTID is not mapped to a loop.	Generates when operating company personnel try to post a packet PRI LTID at the LTP level. A packet PRI LTID maps to a CLLI rather than a LEN. ***Note:*** The packet PRI DN/LTID is associated with a CLLI rather than a LEN. It is not maintained at the LTP level.

—continued—

Table 5-6
Error and information messages associated with commands (continued)

Command	Message	Description
		Action: Use QPHF LTID <ltid> . This action displays CLLI and member. Use CLLI and member to post at the PHTTP level.
TST	Ext cont test is invalid on PKT PRI trunks.	Displays when operating company personnel try to perform an external continuity test on a packet PRI trunk.
	TST command diag invalid with PKTPRI. Use X25i option.	Displays when operating company personnel try to perform a TST command on a packet PRI trunk.
	Test passed.	Displays on the MAP terminal when the internal continuity test successfully completes. The display indicates on which trunk member the test was performed.
	Test failed.	Displays on the MAP terminal when the internal continuity test on the packet PRI trunk fails. The display indicates on which packet PRI trunk member the internal continuity test was run.
	Test aborted.	Displays on the MAP terminal when the internal continuity test on the packet PRI trunk does not complete because of a software failure. The display indicates on which packet PRI trunk member the internal continuity test was run.
X75TTP	Control transferred to PHTTP level.	Displays when operating company personnel issue the X75TTP command at the TTP level.

—end—

Card requirements

This chapter describes ISDN PRI shelf layouts and ISDN PRI-related cards. For information on ISDN frames and cabinets, refer to the *Translations Guide* or the *Hardware Description Manual Reference Manual*.

Shelf layouts

This section describes the shelf layouts for PRI-related hardware. It includes descriptions of the ISDN digital trunk controller (DTCI) and the ISDN line trunk controller (LTC).

Note: Only the PRI-related information is included in the description of the LTC. For information on BRI, refer to the *ISDN BRI Maintenance Guide*, 297-2401-501.

DTCI shelf layout

A DTCI has two shelves, unit 0 and unit 1. The DTCI supports two configuration options, XPM and XPM PLUS. Figure 6-1 shows the shelf layout for a DTCI configured as an XPM PLUS. Figure 6-2 shows the shelf layout for a DTCI configured as an XPM.

The XPM PLUS configuration has the following processor cards:

- enhanced ISDN signaling processor (EISP) card
- unified processor (UP) card

The XPM configuration has the following processor cards:

- ISDN signaling preprocessor (ISP) card
- master processor (MP) card
- MP memory (MPM) card
- signaling processor (SP) card
- SP memory (SPM) card

Each shelf has the following cards, in addition to the XPM or XPM PLUS processor cards, to complete the DTCI control complex:

- time switch card

- message protocol and tone generator (MPC) card
- formatter (FORM) card
- channel supervision message (CSM) card

Each shelf has the following cards providing central-side (C-side) and peripheral-side (P-side) interfaces:

- DS30 interface card (C-side)
- DS-512 interface card (C-side)
- DS-1 interface cards (P-side)

Figure 6-1
DTCI shelf layout for an XPM PLUS configuration

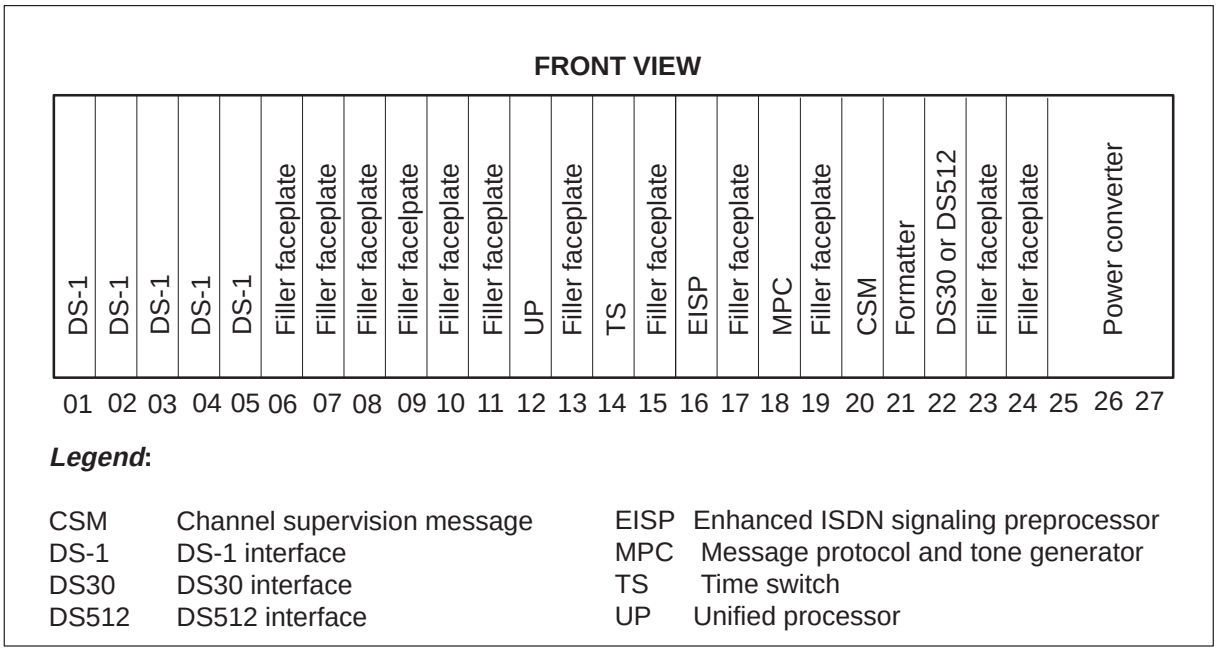
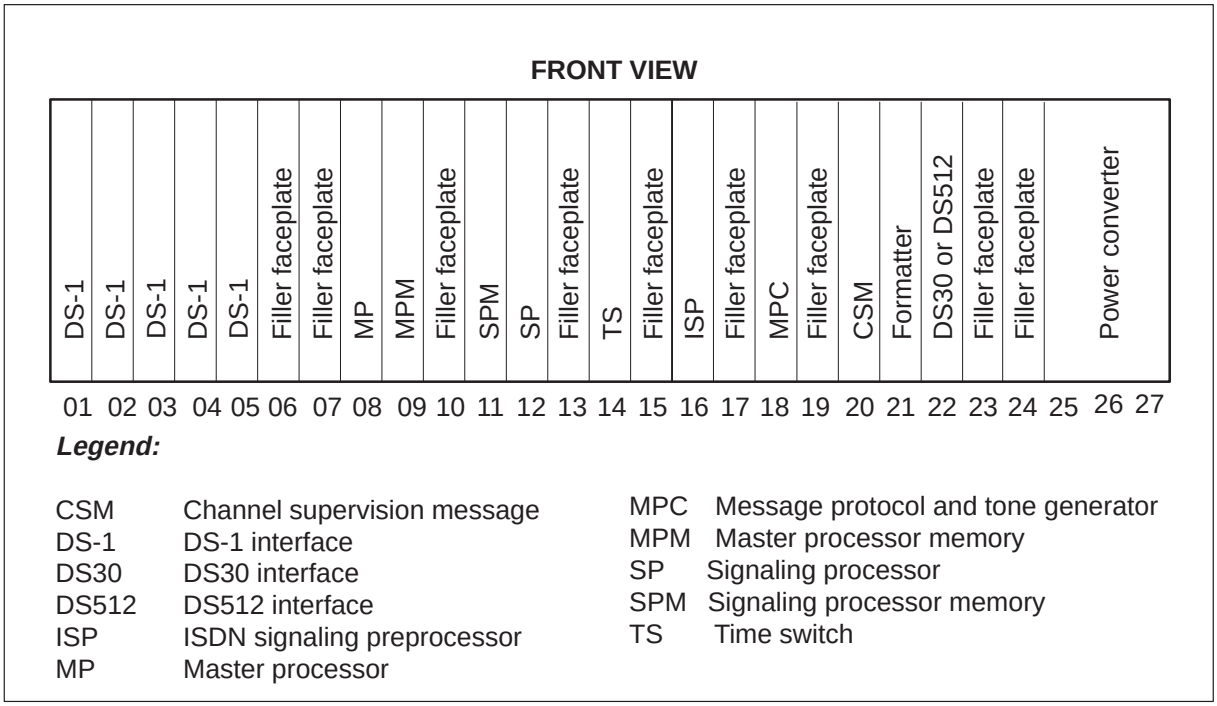


Figure 6-2
DTCI shelf layout for an XPM configuration

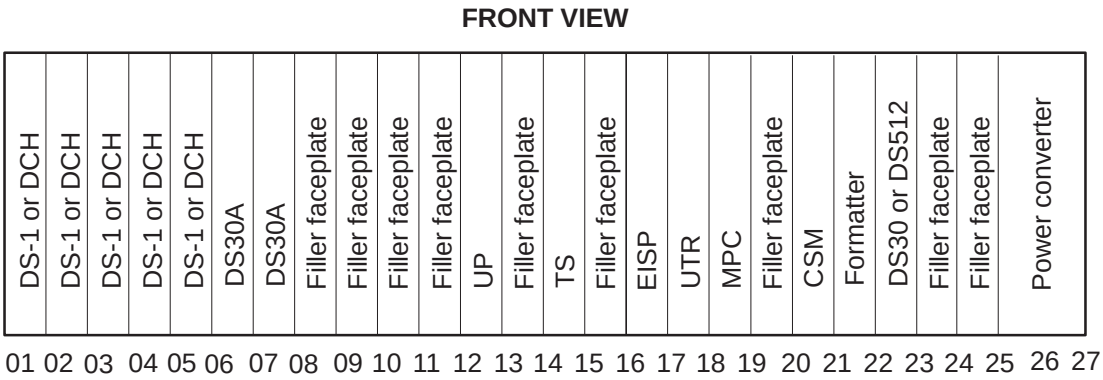


ISDN line trunk controller

The arrangement of cards in an ISDN line trunk controller (LTC) is shown in figure 6-3. The cards in each shelf of the LTC are identical to the cards on a DTCI shelf except that slots 1 to 5 may contain a D-channel handler (DCH) card or a DS-1 interface card, and slot 17 contains a universal tone receiver (UTR) card.

When used for both ISDN PRI and basic rate interface (BRI), the ratio of DCH cards to DS-1 cards is flexible and depends on the requirements for each type of service in each office.

Figure 6-3
LTC equipped for ISDN shelf layout



Legend:

CSM	Channel supervision message card	MPC	Message protocol and tone generator
DS-1	DS-1 interface	TS	Time switch
DCH	D-channel handler	UP	Unified processor
EISP	Enhanced ISDN signaling preprocessor	UTR	Universal tone receiver

Note 1: Each LTC is provisioned with at least two DCH cards, one in each line group array.
Note 2: Only the EISP card can be used with the UP card.

Cards

Table 6-1 lists the following information for each ISDN PRI-related card:

- product engineering code (PEC) code
- PEC suffix
- card name
- slot number
- functions and comments

Table 6-1
ISDN PRI cards

PEC	PEC suffix	Card name	Slot	Comments and functions
NT0X50		Filler card	any slot not occupied	*Functions* • Fills any slot not occupied by a functional card.
NT2X70	AE	Power converter card	25 to 27	*Functions* • Converts –48V input to a +5V, –5V, and +12V output.
NT6X40	AC BA	DS30 C side interface card	22 and 23	*Functions* • Converts the internal DTCI signal to the bipolar encoded signal used on a DS30 link. • Carries B- and D-channels between the DTCI and the network.
NT6X40	CA DA	DS512 C side interface card	22 and 23	*Functions* • Converts the internal DTCI signal to the 512 channel, pulse code modulated (PCM) signal that can be connected to a fiber link and to the enhanced network (ENET). • Carries B- and D-channels between the DTCI and the network.

—continued—

Table 6-1
ISDN PRI cards (continued)

PEC	PEC suffix	Card name	Slot	Comments and functions
NT6X41	AA	Speech bus formatter card	21	*Functions* • Converts the parallel bit stream used on the internal speech bus to a DS30 bit stream, and the DS30 bit stream to a parallel bit stream.
NT6X42	AA	Channel supervision message (CSM) card	20	*Functions* • Manages the speech link between the DTCI and the network. • Reports error conditions to the SP or the UP card.
NT6X44	AA AB	Time switch card	14	*Functions* • Converts a serial data stream received from (or transmitted to) the DS30A interface card to a parallel data stream used on the internal speech bus. • Associates a DS30A or a DS-1 channel with a time slot on the parallel speech bus, and transfers data between the DS30A or DS-1 channel and the time slot.

—continued—

Table 6-1
ISDN PRI cards (continued)

PEC	PEC suffix	Card name	Slot	Comments and functions
NT6X45	AB, AC,BA	LTC/DTC/LGC processor CP card	08 or 12	*Functions* • The NT6X45BA is functionally equivalent to the NT6X45AB and NT6X45AC versions, but is application-specific. *Functions* • Runs the programs that control the formatter card, the channel supervision message card, and the timeswitch card.
NT6X46	BA,BB	Signaling processor memory card	11	*Comments* • The SP can be equipped with only one NT6X46BA card. • The NT6X46BA is functionally equivalent to the NT6X45BB. *Functions* • Provides the RAM for the SP card and also contains the direct memory access (DMA) memory.
NT6X47	AC	Master processor memory circuit card	09 to 10	*Functions* • Provides random access memory (RAM) for the MP card and contains the DMA memory.

—continued—

Table 6-1
ISDN PRI cards (continued)

PEC	PEC suffix	Card name	Slot	Comments and functions
NT6X50	AB	DS–1 interface card	01 to 05	*Functions* • Converts between the unipolar signal type used for internal DTCI communication and the bipolar encoded signal used on a DS-1 link.
NT6X69	AB AC	CPP message protocol and tone circuit pack	18	Comments • NT6X69AC is compatible with fiberoptics applications. *Functions* • Supervises the receipt of all incoming control messages and the transmission of all outgoing messages between the DTCI and the DMS-core.

—continued—

Table 6-1
ISDN PRI cards (continued)

PEC	PEC suffix	Card name	Slot	Comments and functions
NTBX01	AA AB	ISDN signaling preprocessor card	16	*Comments* • NTBX01AB is the enhanced ISP (EISP) card. • The EISP card provides the following enhancements: — 3 Mbyte more memory (when used with a UP card) — faster clock speed by 4 MHz — data bus with twice the width (32 bits) *Functions* • Provides call control messaging functions and D-channel maintenance functions • Provides an interface between the D-channel cards and the other processors in the DTCI (MP, SP, and UP). • Receives Q.931 messages from the D-channel and recodes them into a format suitable for the switching network. • Sends the recorded messages to the MP or the UP, which are sent to the switching network through the DS30 card.

—continued—

Table 6-1
ISDN PRI cards (continued)

PEC	PEC suffix	Card name	Slot	Comments and functions
NTMX77	AA	Unified processor (UP) card	12	*Comments* • Replaces NT6X45, NT6X46, and NT6X47 cards. *Functions* • Replaces the MP and SP processor cards and their associated memory cards. • The UP card offers increased real-time capacity, increased addressable memory, and decreased power consumption by shelf.
				—end—

Card replacement procedures

Refer to the document *Card Replacement Procedures* for information on the cards described in this chapter.

Trouble isolation and correction methods

This chapter provides general methods and information on PRI trouble isolation and correction. The material presented in this chapter falls into these categories:

- test tools on page 7-2 including TRAVER, DISPCALL, PMIST, PMDEBUG, and CallTrak
- PRI hardware and software maintenance model on page 7-4
- general troubleshooting procedure for PRI on page 7-6
- troubleshooting initial installation and in-service troubles on page 7-7
- using D-channel loopback for troubleshooting on page 7-8
- DS-1 maintenance signaling notes on page 7-8
- techniques for PM troubleshooting on page 7-14
- troubleshooting PRI datafill on page 7-15
- troubleshooting PRI call processing and protocol on page 7-18
- using digital test access on page 7-28

A chart relating specific trouble symptoms to possible causes is provided in the ‘‘Troubleshooting chart” chapter. Isolation and correction of PRI troubles requires consideration of non-DMS equipment that completes the path from the DMS PM to the adjacent node. This equipment includes T1 spans and PBXs from various manufacturers.

For more information on the user interface (MAP) commands mentioned in this chapter, refer to the ‘‘User interface” chapter.

Test tools

The following section describes software tools that can be used to troubleshoot PRI problems. The translation verification (TRAVER) utility is a standard utility provided for the DMS-100 switch. The following test tools are optional and may or may not be present in your office:

- DISPCALL
- PMIST
- PMDEBUG
- CallTrak

The effective use of these optional test tools depends on a high level of understanding of the DMS hardware and software. Incorrect use of some of the tools could cause service disruption.

TRAVER

TRAVER will verify that PRI translation and routing datafill is consistent and correct. TRAVER simulates the processing of a telephone call in software, and displays the route to the destination—which may be a line, trunk, or operator position.

DISPCALL

DISPCALL is a low-level internal diagnostic tool that captures and displays call condense blocks (CCB), call data block (CDB), message buffers and agent data for dead calls or calls being held for trouble analysis. DISPCALL can also be used to analyze AUDIT log reports.

Details of using DISPCALL are contained in *Display Call (DISPCALL) User Guide*, TAM-1001-003.

PMIST

Peripheral module intercept system test (PMIST) intercepts, records, and dispatches messages flowing between the central control (CC) and peripheral module (PM). Examination of these messages can be used to determine if the CC and PM are processing each other's messages properly.

PMIST performs the following functions:

- records I/O messages between CC and PM
- inserts user-specified I/O messages
- performs node-to-name translations
- stores messages in a file

Details of using PMIST are contained in *Peripheral Module Intercept System Test User Guide*, TAM-1001-007.

PMDEBUG

PMDEBUG is a low-level internal diagnostic tool used to debug peripheral modules. PMDEBUG has been extended to including tracing and simulating ISDN Q.931 messages.

PMDEBUG performs the following functions:

- displays CSM, trap, and SWERR information
- displays channel data
- performs internal PM diagnostics
- performs a call trace
- communicates with the peripheral through monitor commands

The following commands are used for debugging time-critical signaling processor (SP) functions:

- A/B bit scanning
- time-switch control
- CSM transmit and receive
- network module message transmit and receive

The following commands are also used for debugging the master processor (MP) call processing functions:

- digit collection
- channel assignment
- CC message interpretation
- PM message interpretation

Details of using PMDEBUG are contained in *PMDEBUG User Guide*, TAM-1001-004.

CallTrak

CallTrak provides the ability to trace calls from one or more terminals, either line or trunk, by selecting the originating terminal of the call. CallTrak contains individual tools to collect and display data. CallTrak supports the tools PGMTRACE, MSGTRACE, and TIMECALL. PGMTRACE is based on the existing tool CALLCT, and provides procedure call tracing for the call process CALLCP. MSGTRACE is based on PMIST, and provides incoming and outgoing message monitoring for all messages to and from a

traced call. TIMECALL provides a listing of the call events and the real-time cost of those events. TIMECALL also provides the total real-time cost for the call.

CallTrak is a call-processing specific tool, and should be used to collect data for call-processing applications. CallTrak does not replace the CALLCT and PMIST tools.

Details of using CallTrak are contained in *CallTrak User Guide*, TAM-1001-012.

PRI maintenance model

This section presents a maintenance model for PRI. The model defines terms and relationships among PRI elements. The model has two sub-models:

- the hardware model (the physical D- and B-channel connections)
- the software or call control model (logical D-channel operation)

Hardware model

The hardware model is shown in figure 7-1. Subscriber A represents the entity at the adjacent node that initiates or terminates the call. This entity could be a user placing a call on a telephone, or a computer placing a call through a direct connection to the adjacent node. The adjacent node could be any entity that can handle PRI, such as a PBX or computer.

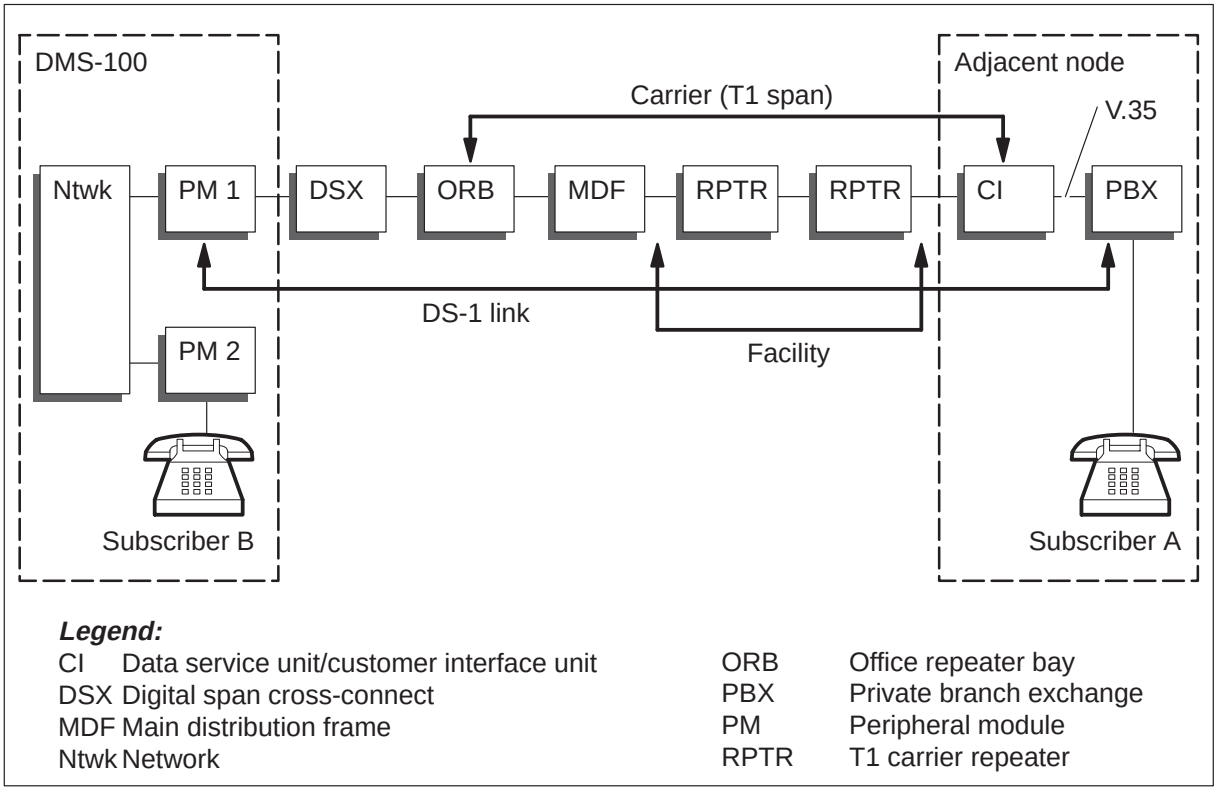
The adjacent node includes the connection to the T1 carrier through a customer interface (CI), which may be a data service unit or customer service unit (DSU/CSU).

In this model the call is completed to a subscriber whose line or trunk terminates on a peripheral module (PM) different from the PM supplying PRI at the DMS-100 switch.

The five sections of the PRI physical model include the following:

- the DMS-100 switch that includes the PM (DTCI or LTC for PRI)
- the DS-1 link between the PM and the adjacent node
- the T1 span from the office repeater bay
- the facility
- the adjacent node

Figure 7-1
PRI hardware model



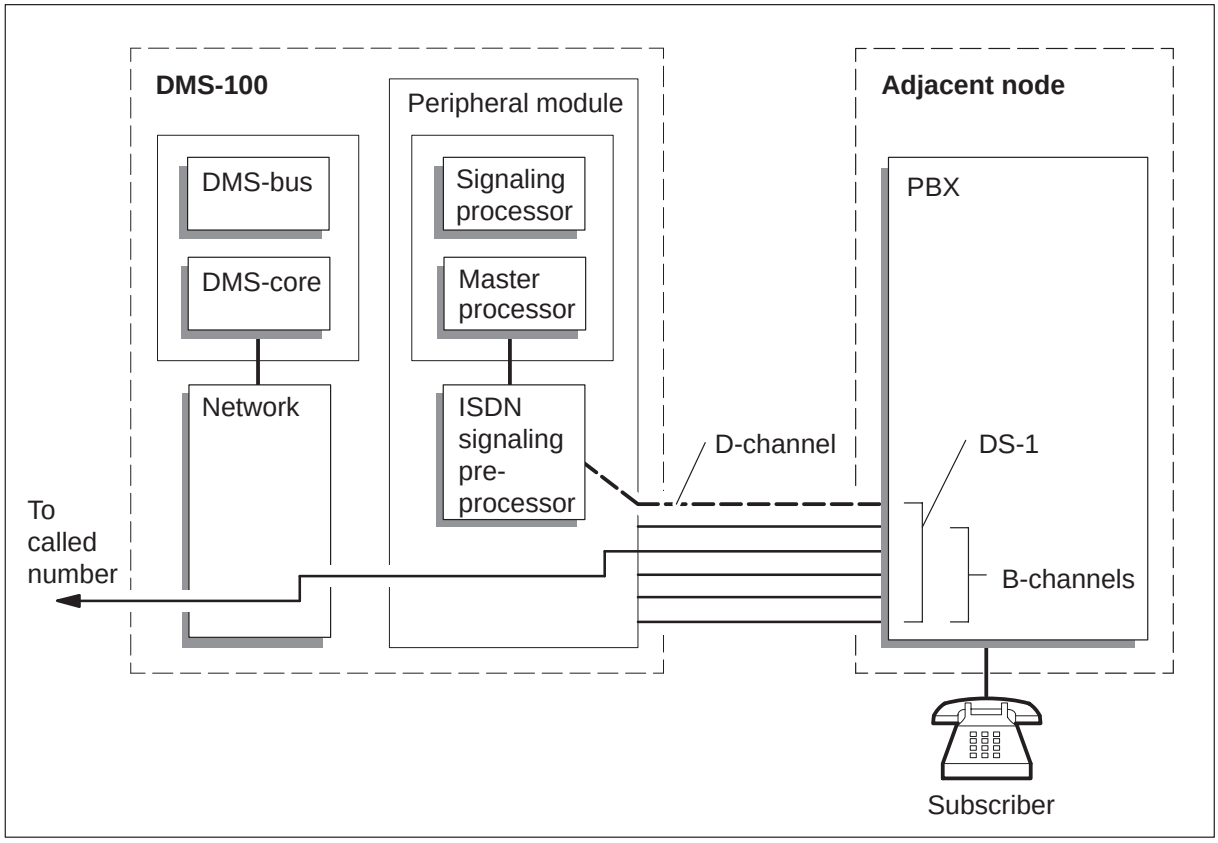
Legend:

CI	Data service unit/customer interface unit	ORB	Office repeater bay
DSX	Digital span cross-connect	PBX	Private branch exchange
MDF	Main distribution frame	PM	Peripheral module
Ntwk	Network	RPTR	T1 carrier repeater

Software or call control model

The second part of the PRI maintenance model, shown in figure 7-2, is the call processing model that relates the channels and call processing elements. In the model, the D-channel from the adjacent node terminates at the ISDN signal processor (ISP) of the PM. Call setup data is extracted from the Q.921/Q.931 messages by the EISP or ISP and is transferred to the unified processor (UP) or signaling processor (SP) and master processor (MP). From the UP or MP, call data is sent to the network for routing. When the call processing and routing is completed, the B-channel is connected through the PM and network to the destination.

Figure 7-2
Call processing model



General troubleshooting procedure

This section presents a number of steps that can be followed to isolate a problem with PRI. The steps are summarized in table 7-1.

The office equipment (OE) list sets out the components of an individual circuit, and its logical and physical interconnections. The method of obtaining this OE list depends on your company's operational support system (OSS).

The primary tool for isolating a physical fault in the DS-1 path is the loopback. Protocol errors can be isolated using digital test access on the D-channel. Both tools are described in more detail later in this chapter.

Table 7-1
Troubleshooting steps

Step	Action	Notes
1	Check for alarms	Refer to the *Alarm and Performance Procedures* for clearing PM alarms. Refer to the *Alarm and Performance Monitoring Procedures* for clearing TRK alarms.
2	Check logs	Use LOGUTIL commands OPEN and BACK to search for applicable logs (PM, ISDN, TRKS).
3	Verify the OE list	Use QUERY to check the connections specified in the OE list.
4	Post components	For DS-1 status use TRKS;CARRIER;POST for the PM use PM;DTCI or LTC.
5	Set loopbacks and perform internal or external continuity tests	Refer to the *Trouble Locating and Clearing Procedures* for procedures on how to perform internal or external continuity tests.
6	Look at OMs	Use OMSHOW.
7	Monitor protocol	Use digital test access (DTA) to monitor the protocol.

Some notes on troubleshooting

The following material is presented as general and miscellaneous notes that might be helpful in isolating some PRI troubles.

Initial installation troubles

Initial installation trouble occurs when a PRI is put into service for the first time. Although everything in the chain of service is suspect, two primary causes of initial installation trouble are the following:

- datafill
- the T1 span

Datafill problems

A common problem is the datafill for integrated service access (ISA) and the role of information elements NPI/NSF. More details on integrated service access are presented on page 7-16.

T1 span problems

A common problem related to the DS-1 link is that facility line coding (ZCS or B8ZS) is not the same over the entire T1 span.

In-service troubles

Field experience indicates the most likely PRI failure is in the T1 span. Unfortunately, because of the variety of equipment used in T1 spans, no standard step-action procedures can be given. T1 faults must be isolated and corrected using local operating company procedures.

Failures also occur when a feature or function is used for the first time on a circuit that has been providing satisfactory PRI service. This type of failure is usually related to datafill.

D-channel loopback

The D-channel can be looped back to perform both internal and external continuity tests. Continuity tests must be run from the PRADCH level of the MAP. For information on how to access the PRADCH level, refer to the ‘‘User interface commands” chapter. The CONT command sets, removes, and reports the status of the loopback point for the posted D-channel.

Note: Before invoking the CONT command, the D-channel must be in the manual busy state.

DS-1 maintenance signaling notes

DS-1 maintenance signaling is done in-band in the superframe (SF) format, or in the data link of the extended superframe (ESF) format. Both support the following signals

- Remote alarm indicator (RAI) is the yellow alarm sent to the remote end, indicating a loss of incoming data from the remote end. The signal has a minimum duration of 1 s, and lasts for the duration of the outage. For SF, the RAI signal sets bit two to zero (0). For ESF the RAI signal consists of alternating hexadecimal digits FF and 00.
- Alarm indication signal (AIS) is the blue alarm indicating the loss of an originating signal or other service disruption. The signal is a continuous unframed binary one (1) digit. AIS can also indicate a loss of network synchronization.
- Loopback signaling is done in-band using framed pulse patterns: activate is 5 s of 00001, deactivate is 5 s of 001.

To support maintenance function on the DS-1 facility, ESF incorporates a block error detection scheme (CRC-6), and a data link. Errors on the DS-1 can be detected by

- cyclic redundancy check (CRC)
- bad framing pattern or loss of framing
- non-B8ZS bipolar violations (BPV)

- controlled slips (if customer interface is in a synchronized network)
- replication or deletion of a frame

The customer interface (CI) reports the error parameters each second over the data link.

Other DS-1 issues

The DS-1 link can be

- dead (no continuity, no loopback possible)
- low quality as reported by service limits being exceeded, or from BERTs (bipolar violations, framing errors, CRC errors)

Some notes on the DS-1 card

The information below may be helpful in working with the DS-1 card:

- Activities involving the DS-1 card are pegged in OM group DS1CARR.
- Changes to DS-1 parameters in table CARRMTC do not take effect until the CC updates the PM. An audit for static data mismatch occurs every time the PM is manually or automatically tested or returned to service. If the audit detects changes (a mismatch) the PM is reloaded.
- The state of a carrier (DS-1) is not the same as the state of the individual trunks (DS-0s).

Causes of DS-1 line errors

Some common causes of line data errors are

- outside electrical interference
- line repeaters
- office repeaters
- DS-1 interface card
- adjacent node

Testing for DS-1 line errors with BERT

Bit error rate tests (BERT) can be used to test for line errors. BERTs are invoked from MAPCI;MTC: TRKS;TTP;LEVEL DATA. The commands used to conduct a BERT are summarized in table 7-2.

Table 7-2
Data level commands for testing for line errors

Command	Description
POST	Gains ownership of the trunks to be tested
SEIZE	Seizes the trunk to be tested
BSY	Places the trunk in the out-of-service state
RTS	Returns the trunk to service
BTERM	Registers far-end termination type
BERT	Controls the actual BERT
HOLD	Puts the trunk in first available hold position
NEXT	Places another trunk in the control position
RLS	Returns the trunk to service
BERTTIME	(Nonmenu) sets the test duration

Before beginning the BERT, do the following to the trunk to be tested:

- reserve the trunk with the POST command
- busy the trunk with the BSY command
- specify far-end termination with the BTERM command

Then use the BERT commands as summarized in table 7-3.

Table 7-3
BERT command sequence

Command	Description
BERT START <speed> <pattern>	Starts the test. <speed> is 56 or 64. <pattern> is P511 or P2047
BERT INJECT <error_bits>	Inject error bits into the test pattern
BERT RESET	Resets the test results
BERT QUERY TEST	Display trunks on which tests are active

—continued—

Table 7-3
BERT command sequence (continued)

Command	Description
BERT QUERY RESULT	Display all the test results
BERT STOP	Stop the test
—end—	

NT6X50AB DS-1 card maintenance notes

The DS-1 card options described below can be checked using the MAPCI CARRIER level command DISP. Note that the options selected for a DS-1 link are effective only after the link has been returned to service.

The NT6X50AB is a general replacement for the NT6X50AA card on both the C-side and P-side of an XPM. The AB version of the card provides

- extended super frame format (ESF)
- bipolar eight-bit zero substitution (B8ZS)
- alarm indication signal (AIS)

The following functions are supported by both AA and AB versions of the card:

- frame format, super frame (SF)
- zero code suppression (ZCS)
- bit error ratio (BER) base, bipolar violation (BPV)
- data links
- local loops
- alarm detection: local (red), remote (yellow)

The following functions are supported by the AB version:

- extended super frame format (ESF)
- bipolar eight-bit zero substitution (B8ZS)
- bit error ratio (BER), cyclic redundancy check (CRC)
- data links for SLC-96 and facility data link (FDL) to enable the carrier facility
- remote loops
- alarm indication signal (AIS) detection

The following combinations are *invalid* for the NT6X50AB card:

- SF with BER based on CRC
- SF with FDL
- ESF with SLC-96

DS-1 link error reporting

The PM tracks the following errors with respect to the DS-1 link:

- bit error rate (BER)
- cyclic redundancy check (CRC) violations
- bipolar violation (BPV) for either frame format
- out of frame (OOF) and slips
- errored seconds (ES)
- severely errored seconds (SES)
- unavailable seconds (UAS)

BER calculations based on CRC errors detect problems on the T1 span, whereas BPV errors are only relevant to the last line in the span. Therefore, CRC-based BER is preferred over BPV-based BER for day-to-day monitoring. The BPV BER is available for investigating problems with the last DS-1 line in the path. Only BPV-based BER is available with fixed maintenance and out-of-service thresholds.

For errored seconds (ES), 16 coding violations are treated as one unit of measurement.

Severely errored seconds (SES) count the quantity of seconds during which coding violations are experienced with an approximate BER of 10^{-3}. The measurement occurs only during unavailable seconds (UAS).

After ten consecutive SES, the service is made SysB by the system. All subsequent seconds are UAS, but after ten consecutive non-SES, the service is made unavailable by the system.

DS-1 fault indications

A fault in the transmit direction of the DS-1 interface can produce the following errors:

- no data is transmitted over the DS-1 link
- only one side of the line is active, resulting in a continuous bipolar violation state at the far end

- the outgoing signals are poor, resulting in a high error rate and poor synchronization at the far end

A fault in the receive direction can produce the following errors:

- loss of synchronization due to a poor or a non-existent signal
- high error rate for a receive signal
- high bipolar violation rate
- no receive clock being generated, so that the incoming serial bit stream cannot be sampled

Receive faults show up as

- a synchronization problem
- a high bipolar violation rate
- a high cyclic redundancy check (CRC) rate in the EFF

DS-1 alarm thresholds

Some thresholds signify a maintenance level and the others signify the out-of-service level.

The carrier group alarms—local, remote, and alarm indication signal (AIS)—also have user-defined alarm points associated with each digroup. These alarm points signify the filter period used to time the alarm. Two filter periods are needed: one to define the entry into the alarm, and one to define the exit from the alarm.

The default settings for the alarm points are summarized in table 7-4.

Table 7-4
DS-1 alarm thresholds

Alarm	Threshold
Local carrier group alarm (red)	Entry: 2.5 s, exit: 10 s
Remote carrier group alarm (yellow)	Entry: 0.5 s, exit: 0.5 s
AIS carrier grou alarm entry	1.5 s, exit: 10 s
BIT error rate (BER)	Maintenance level: 10^{-6} Out-of-service level: 10^{-3}

—continued—

Table 7-4
DS-1 alarm thresholds (continued)

Alarm	Threshold
Out of frame (OOF)	Maintenance level: 17 in 24 h, Out-of-service level: 511 in 24 h
Slips	Maintenance level: 4 slips in 24 h, Out-of-service level: 256 in 24 h
ES	864s
SES	100s
—end—	

PM troubleshooting notes

This section contains some notes that may be helpful while troubleshooting PM-related PRI problems.

Auditing data mismatches

The DMS-core continually audits static data and programs of PMs using checksums. If the audit passes then a return to service (RTS) does not have to reload the PM software and tables. If the audit fails, a SWACT occurs, the affected PM is system busied, returned to service and reloaded with software.

Activity monitoring with PMACT and ISP commands

PMACT and ISP commands of the PM;PERFORM level are used to analyze the real-time usage of the signaling processor (SP), the master processor (MP), and the ISDN signaling preprocessor (ISP). Measurements are made in the following categories:

- call processing occupancy
- high priority background occupancy
- low priority background occupancy

The combination of the call processing occupancy and the high priority background occupancy represent time used in providing service. Low priority background occupancy represents time used for audits and testing. The displayed data is updated once each minute and includes an average occupancy for the last 15 min.

At the PMACT level, used primarily for PM performance monitoring, other displayed data include the peak and the average use of universal tone receivers (UTR) and of P-side channels. Originations and terminations are

also counted. Terminations are defined as calls that cause ringing (or flashing). The counts include the quantity of channels that are available to call processing.

The ISP level is used primarily to monitor ISP and D-channel performance. Data is collected on ISP real-time occupancy and the displayed data includes the number and type of service access point identifier (SAPI) frames transmitted and received successfully, and the total number of SAPI frame errors transmitted and received.

Both PMACT and ISP tools can be used simultaneously on the same node. All data measurements are accumulated for up to 1 h, and only on the active unit. The accumulated data is not maintained for a warm or cold SWACT. Only one user at a time can monitor the performance data for a PM, but up to five PMs can be included in the data accumulation.

Logging PERFORM data

All of the data collected by the PERFORM command may be recorded in logs PRFM200, PRFM201, PRFM204, and PRFM210, including the names of the XPM loads. By default, logs are generated every 15 min under any of the following conditions:

- A SWACT occurs.
- The active unit drops activity and is not backed up by the inactive unit.
- The command STOP is used at the PMACT or the ISP level.
- The timer for producing logs expires.

Datafill issues

Errors in the datafill of PRI-related tables will produce operational problems. To help track down such datafill-related problems, table 7-5 lists various PRI capabilities and features against the data tables that contain information related to the capability. Notice that some tables contain information related to more than one capability.

For more detail on PRI datafill, refer to the *Translations Guide*.

Table 7-5
Table categories

Capability	Tables
Base service	ADJNODE, CARRMTC, CLLI, LTCINV, LTCPSINV,LTDEF, LTGRP, LTMAP, PADDATA, TRKGRP, TRKMEM, TRKSGRP
Bearer capability routing	BCDEF, HNPACONT.RTEMAP, HNPACONT.RTEREF, IBNMAP, IBNRTE, IBNXLA, LTCALLS, OFRT, OFRTMAP, PXLAMAP, RCNAME, RTECHAR, TRKGRP, XLAMAP
Network Name Delivery	CUSTNTWK, NETNAMES
Network Ring Again	CUSTNTWK, MSGRTE, NETNAMES
Backup D–channel	TRKSGRP
PRI call routing	ISAXLA, LTCALLS, LTDATA
Message Waiting	MSGRTE, NETNAMES
Display information element blocking	TRKSGRP, ISDNPARM
Flexible timers	ISDNPROT
CLI blocking	LTCALLS, LTDATA
Equal access	LTCALLS
ISDN call treatments	LTDATA
PRI trunk groups	CLII, PADDATA, TRKGRP, CARRMTC
Logical terminal (the adjacent node)	LTGRP, LTDEF, LTMAP, ADJNODE
Switching node connection	PRIPROF
For PRI there is a maximum of 2100 T1 equivalents for each office	DNSCRN, LTCALLS, LTDATA, LTDEF, LTMAP, TRKGRP

Integrated service access (ISA) troubleshooting

PRI call failures may be due to problems associated with integrated service access (ISA). ISA is the part of PRI call routing that allows different types of calls to be routed over the same PRI trunk group. The call types supported by ISA are described in table 7-6.

Table 7-6
ISA types

ISA Type	Description
Public (PUB)	These calls connect the end user to the public switched telephone network (PSTN). With direct inward dialing (DID), public calls connect the DMS-100 to a PBX. With direct outward dialing DOD, public calls connect the PBX with the DMS-100. Dialed digits must conform to E.164.
Private (PVT)	These calls connect the PBX to its virtual private network (VPN). The DMS-100 uses the PSTN to support a private numbering plan. The dialed digits may not conform to E.164.
OUTWATS (WATS)	These calls to PSTN destinations are charged in blocks of time for flat monthly rates according to geographical zones or bands.
INWATS	800 numbers that are charged to the called party customer.
Foreign exchange (FX)	A trunk connecting the usual end office of a PBX to some other remote office. This provides the equivalent of local service in the remote location for the PBX for incoming and outgoing PSTN calls.
Tie line (TIE)	Tie lines are trunks that directly connect two PBXs.

The Q.931 setup message contains two critical information elements, numbering plan indicator (NPI) and network specific facilities (NSF). Errors in either of these elements cause the intended call to fail. The NPI element is contained in the called party number (CDN) information element of the setup message, and indicates whether the numbering plan is public or private. The NSF indicates which network facilities should be used for the call.

The NSF contains

- a service selector that specifies the type of service requested
- an optional service identifier (SID) to specify the actual facility to be used to route the call. INWATS calls can be routed on the SID for all call types except public.

For a PRI-to-non-PRI call, the NSF is used by LTCALLS to determine the translations, and then ignored because it is not used by the terminator.

For a PRI-to-PRI call, the NSF is used by both originator and terminator. Since the information is specific to the particular PRI, the NSF can be different on each PRI of the call.

For a non-PRI-to-PRI call, there is no NSF in the origination and so the NSF information is obtained from the routing tables. If ISA is not used as the routing selector, then no NSF is generated for the terminator.

For more details on how the DMS-100 switch routes ISA PRI calls, refer to the *Translations Guide*.

Troubleshooting PRI call processing

This section presents detailed information about PRI call processing, including descriptions of call states and the steps performed in call processing. The terminology viewpoint in this section is from the user's side (the adjacent node) of the PRI.

Circuit-switched call states

Table 7-7 shows the states that a call may be in during its existence. The call direction terms, incoming and outgoing, are as viewed from the user side of the interface. Note these states are for an individual call, not for the interface, since the interface can have several calls occurring simultaneously.

Table 7-7
PRI call states

User state	Network state	State name	Call direction	Description
UO	N0	Null	no call exists	
U1	N1	Call Initiated	outgoing	User has requested call establishment from the network and is awaiting a response.
U3	N3	Outgoing Call Proceeding	outgoing	User has received acknowledgment that the network has received information necessary to establish a call.
U4	N4	Call Delivered	outgoing	User has received an indication that remote user alerting has been initiated.
U6	N6	Call Present	incoming	User has received call establishment request but has not yet responded.

—continued—

Table 7-7
PRI call states (continued)

User state	Network state	State name	Call direction	Description
U7	N7	Call Received	incoming	User has initiated local alerting but not yet answered.
U8	N8	Connect Request	incoming	User has answered and is waiting to be awarded the call.
U9	N9	Incoming Call Proceeding	incoming	User has acknowledged receiving all information necessary to establish a call.
U10	N10	Active	incoming	User has received notification from the network that the user has been awarded the call.
U10	N10	Active	outoing	User has received information that the remote user has answered.
U11	N11	Disconnect Request	either	User has requested the network to clear the end-to-end connection and is awaiting a response.
U12	N12	Disconnect Request	none	Network has received a request to disconnect because the user has disconnected the end-to-end connection.
U19	N19	Release Request	none	User has requested for the network to release the user-network connection, and is awaiting a response.

—end—

Global states

The possible states of the PRI interface, as opposed to the states of calls on the interface, are shown in table 7-8.

Table 7-8
PRI global states

User state	Network state	State name	Call direction	Description
R0	R0	Null		No transaction exists.
R1	R1	Restart request	outgoing	User or network has requested a restart and is awaiting a response.
R2	R2	Restart	outgoing	User or network has received a request from the network or user for a restart and responses have not been received from all locally active call references.

Note: There is only one global call reference for each interface.

Call establishment at the originating interface

Before call procedures are invoked, a reliable data link connection must be established between user and network using the DL-DATA-REQUEST primitive from the network layer to the data link layer.

Call request

The call is initiated by the SETUP message which contains a call reference, bearer capability, channel ID, and called party number. Sending the SETUP message puts the call in the call-initiated state. The user may indicate that a specific channel is required with no alternative allowed, or that a specific channel is requested and any alternative is acceptable.

If a channel is available, the network returns the B-channel identifier in the response, and activates the B-channel connection. The network assumes that the B-channel is attached after the network has delivered call proceeding (CALL PROC), progress (PROG), or alerting (ALERT) messages to the user with progress indicator 8—the in-band information or the appropriate pattern is now available. Before this occurs the network will not assume the B-channel is connected.

If the requested channel is not available, the network responds with release complete (REL COM) with cause 44—the requested channel is not available, or if the maintenance state of the link is manual busy, the network responds with cause 82—the identified channel does not exist.

If any of the information elements in the SETUP message are invalid, the call will be cleared with one of the following causes:

- cause 1—unallocated number

- cause 3—no route to destination
- cause 22—number changed
- cause 28—invalid number format

Call proceeding

If the SETUP message is valid, and the network is attempting to complete the call, the network will respond with CALL PROC and both user and network go into the Outgoing Call Proceeding state.

If the requested service is not available or not authorized then the call is cleared with one of the following causes:

- cause 34—no circuit/channel available
- cause 57—bearer capability not authorized
- cause 58—bearer capability not presently available
- cause 63—service/option not available, unspecified
- cause 65—bearer capability not implemented

If the call is not end-to-end ISDN, the progress indicator 1—call not end-to-end-ISDN and further information may be available in-band, is returned to the user. The caller should stop supervisory timers and connect to and monitor the B-channel.

Alerting

The network sends ALERT message when it receives confirmation that user alerting has been initiated at the called address. At this time both the user and the network enter the Call Delivered state. If the bearer capability is speech or 3.1-kHz audio, then the network sends progress indicator 8—in-band information or appropriate pattern is now available.

Call connected

When the network receives confirmation that the call has been accepted (answered) it sends a connect (CONN) message to the user, and both user and network enter the Active state. This means the call is connected end-to-end.

Call rejection

When the network receives an indication that either the terminating network or the called user is unable to accept the call, the network initiates clearing at the user-network interface. The network uses the cause provided by the terminating network or the called user.

Call establishment at the destination interface

An incoming call is indicated by arrival of a SETUP message from the network. After sending the SETUP message, the network starts timer T303 and both user and network enter Call Present state. If the user does not respond before T303, expires the message is resent and T303 is restarted.

The user is responsible for determining bearer compatibility after receiving the SETUP message. If the offered compatibility is not acceptable, then the user responds with REL COM with cause 88—incompatible destination. Both user and network enter the Null state.

The network will also specify a particular B-channel in the SETUP message. There are no acceptable alternatives. If the B-channel indicated in the users first response is not the channel offered by the network, the network will clear the call by sending a REL message with cause 6—channel unacceptable. When the B-channel is accepted by the user, that channel may be connected by the user.

If the indicated B-channel is not available, the user returns REL COM with cause 44—requested channel not available, or if the maintenance state is manual busy, the user responds with cause 82—identified channel does not exist.

Call confirmation

Valid responses to the SETUP message are shown in table 7-9.

Table 7-9
Valid SETUP message response

Called user action	User send this message	User's cause	User's next state	User notes	Network notes
Accept immediately	CALL PROC		Incoming Call Proceeding		stop T303 start T310 enter state Incoming Call Proceeding
	ALERT		Call Received	start T301	stop T303 or T310 enter Call Received relay ALERT message to calling user

Table 7-9
Valid SETUP message response (continued)

Called user action	User send this message	User's cause	User's next state	User notes	Network notes
	CONN		Connect Request		
Delay	CALL PROC		Incoming Call Proceeding	stop T303	
Busy	REL COM	cause 17 user busy			stop T303 or T310 clear back to caller
Incompatible	REL COM	cause 88—incompatible destination			
Refuse	REL COM	cause 21—call rejected	Null		
—end—					

Call failure

If the user fails to respond to the SETUP message prior to expiry of the timer T303, the network initiates clearing procedures toward the calling user with cause 18—no user responding, and toward the called user with cause 102—recovery on timer expiry.

If the network receives a CALL PROC message, but does not receive an ALERT, CONN, or DISC message prior to expiry of T310, then the network initiates clearing toward the calling user with cause 18—no user responding, and towards the called user with cause 102—recovery on timer expiry.

If the called user is providing ringback and its timer T301 equivalent expires before the call is connected or cleared, then the called user initiates clearing toward the network with cause 19—no answer from user (user alerted).

Notification of interworking

It is the responsibility of the called user to notify the calling user if the call leaves the ISDN environment. The called user should send a PROG message with value 1—call is not end-to-end ISDN and further call progress information may be available in-band.

Call accept

An incoming call is accepted by sending a CONN message to the network and starting timer T313. If a call can be accepted using the B-channel indicated in the SETUP message, and no user alerting is required, a CONN message may be sent. If the CONN is the first response to the SETUP it must contain the channel.

Active indication

On receipt of the CONN message the network completes the B-channel path, sends a connect acknowledge (CONN ACK) to the user, dispatches a CONN message to the calling user, and enters the Active state.

If T313 expires prior to connect the called user initiates clearing with cause 1021—recovery on time expiry.

Call clearing

The following definitions are used in call clearing:

- A channel is connected when the channel is part of an established circuit switched ISDN connection.
- A channel is disconnected when it is no longer part of the circuit switched ISDN connect but is not yet available for a new connection.
- A channel is released when the channel is available for a new connection.

Normal clearing is initiated by either the user or the network sending a DISC message. Call clearing also occurs with one of the following actions:

- the user or network rejects a call by sending a REL COM message
- the B-channel selection procedure is unsuccessfully terminated and the network sends a REL message along with cause 6

Clearing by the user

The user initiates clearing by completing the following steps:

1 sending the DISC message

2 starting timer T305

3 disconnecting the B-channel

4 entering the Disconnect Request state

The network responds by performing the following sequence:

1 disconnecting the B-channel

2 entering the Disconnect Request state

3 initiate procedures for clearing network connection back to remote user

After disconnecting the B-channel, the network sends REL message back to user, starts T308, and enters the Release Request state. When the user receives the REL message from the network, the user

1 cancels timer T305

2 releases the B-channel

3 sends REL COM message

4 releases the call reference

5 enters the Null state

If a REL COM message is not received by the network before timer T308 expires the second time (the first time the network retransmits the REL message) the network

1 puts the B-channel in a maintenance condition

2 releases the call reference

3 returns to the Null state

If the user's timer T305 expires, the user

1 sends a REL message with cause that was in the DISC message

2 starts timer T308

3 enters the Release Request state

When the user's T308 expires for the first time, the user

1 retransmits the REL message

2 restarts the T308

When the T308 expires a second time, the user:

1 puts the B-channel in a maintenance condition

2 releases the call reference

3 returns to the Null state

Clearing by the network

There are two cases when the network clears a call: when tones are provided, and when tones are not provided.

When tones or announcements are provided in conjunction with call clearing, the network sends a PROG message.

When tones or announcements are not provided, the network

1 sends a DISC message

2 starts T308

3 enters Release Request state

When the user receives the DISC message, the network

1 disconnects the B-channel

2 sends a REL message

3 starts T308

4 enters Release Request state

When the network receives the REL message, the network

1 stops T305

2 releases the B-channel

3 sends REL COM message

4 releases the call reference

5 enters the Null state

If T305 expires, the network

1 sends REL message with the cause that was in the DISC message

2 starts T308

3 enters Release Request state

Completion of clearing

When the network receives the REL COM message, the network

1 stops T308

2 releases the B-channel

3 releases the call reference

4 enters the Null state

If the REL COM is not received by the network or the user before the second expiry of T308 (the first expiry simply causes retransmission of the message) the network or user should

1 put the B-channel in a maintenance condition

2 release the call reference

3 enter the Null state

Clear collisions

A clear collision occurs when both the user and the network attempt to clear the same call reference, in other words, both the user and the network receive a DISC message while in the Disconnect Indication state. In this case, both ends must perform the following sequence:

1 stop T305

2 send a REL message

3 start T308

4 enter Release Request state

In addition to the above steps, the user should disconnect the B-channel if it is not already disconnected.

Interworking with existing networks

It is always the responsibility of the interworking exchange (the interworking exchange is the exchange that must connect together the ISDN and non-ISDN circuits) to provide the PROG message with value 1—call is not end-to-end ISDN, and to monitor the non-ISDN circuit for answer and disconnect supervision.

Audible ringback

The terminating exchange (ISDN or non-ISDN) always generates ringback and maintains a T301 equivalent. ISDN exchanges also provide PROG and ALERT messages as required by the protocols. Specifically, the terminating exchange performs the following functions:

- determines if the end-point terminal is available
- alerts the end-user terminal, propagates the altering indicator back to the originating exchange with in-band ringback, and starts T301 equivalent
- sends CONN or other off-hook message, stops ringback, and stops the timer T301 when the terminal answers.

Busy tones

For an ISDN-to-ISDN network connection, the B-channel is disconnected using the REL protocol and the busy tone is generated locally. For a non-ISDN-to-ISDN network connection, the interworking exchange generates the busy signal. For an ISDN-to-non-ISDN network connection, the tone is generated by the terminating exchange. Note that a PROG message is sent with a progress indicator 1 from the user to the network to indicate that the call is not an end-to-end ISDN call and that call process information is only available in-band.

Announcements

Calls within an ISDN may still have treatments applied with in-band tones and voice announcements.

Restart procedure

The restart procedure is used to return channels and interfaces to an idle condition (the Null state). The procedure is invoked when one of the following conditions occurs:

- when data link is established
- following T308 expiry for the second time

To initiate the restart procedure the network performs the following steps:

1 sends the restart (REST) message

2 starts T316

3 waits for restart acknowledge (REST ACK) message

When REST ACK is received, the receiver performs the following steps:

1 stops T316

2 frees the channels and call reference values for reuse

3 enters the Null state

If the T316 expires, the procedure is repeated. If the procedure is still unsuccessful, the maintenance entity is notified. Restart attempts may continue, but the channel or interface is considered out-of-service. The receiver of the REST message performs the following steps:

1 enters the Restart state

2 starts T317

3 returns all channels to idle and call references to null

4 stops T317

5 sends REST ACK message

Digital test access

Digital test access (DTA) is an optional feature package, NTXS12AA. DTA is a digital monitoring method for PRI D-channels. DTA provides a refined method of accessing D-channel information. Instead of using a metallic path between the DS-1 and the test equipment, access is established by replicating the digital data streams on the channel.

DTA allows the following data on an ISDN PRI circuit to be monitored:

- D-channel

- backup D-channel

Two streams of digital data are monitored: the data flowing toward the subscriber (downstream data) and the data flowing away from the subscriber (upstream data). The monitoring capability provided by this feature is established by replicating the digital streams to and from the monitored point, and has no effect on the streams being monitored.

Monitoring is performed with a commercially available protocol analyzer. The monitoring point for the upstream data of the D channels is the timeswitch of the XPM. The downstream data is derived from the EISP in the XPM (refer to figure 7-3). Each of these streams is made available to the protocol analyzer through

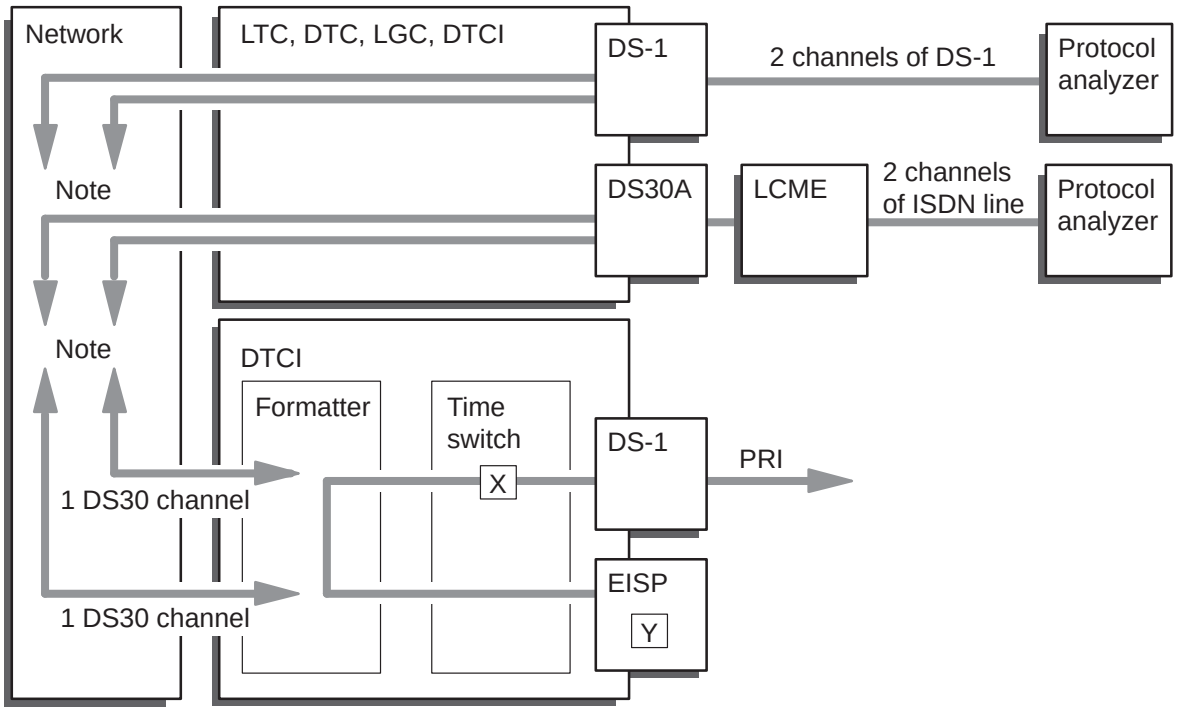
- two channels of a DS-1 interface supported by DTCI, LTC, DTC, or LGC provisioned for 64-kbit/s clear data transmission
- the B1 and B2 channels of an ISDN line card, if available

The DTA requires two XPM C-side channels to be available for the upstream or downstream connection to the protocol monitoring location. Since DS-1 trunks have fixed C-side channel allocations, there must be at least two unassigned channels to make a DTA connection on the DTCI.

The PRADCH level of the MAP display is used for all user interface with this feature. The DTA connection is established and may be removed by operating company personnel from the MAP display.

The protocol analyzer required for DTA must be capable of connecting to the DS-1 digital interface or an ISDN S/T loop interface, depending on the desired monitoring point. It must also be able to decode Q.921, Q.931, and X.25 protocols.

Figure 7-3
DTA access points–monitoring PRI D-channel



Legend:
X = DTA (upstream D-channel)
Y = DTA (downstream D-channel)

Note: DTA monitor connections are established through the network using the CONNECT command in the PRADCH level of the MAP display. Connections terminate at points X and Y.

DTA commands

Table 7-10 describes the MAP commands that enable DTA.

Table 7-10
DTA commands

Command	Description
PRADCH level	
CONNECT	Allows DTA to be performed on the PRI D channel being monitored.
EQUIP	Reserves DS-1 equipment or an ISDN line card (if available) for use in DTA monitoring. It also allows the reserved equipment to be queried and released.

Troubleshooting chart

This chapter contains a troubleshooting chart designed to let you find the possible causes and associated recommended actions for service-affecting troubles. The chart has a description of the problem in the first column, the meaning in the second column, and the recommended actions in the third column.

Table 8-1
ISDN troubleshooting

Problem	Meaning	Action
B-channel will not come into service		Refer to the section “Troubleshooting B- and D-channels” in the chapter “Advanced troubleshooting procedures.”
Calls will not complete		Refer to the section “Troubleshooting calls that will not complete” in the chapter “Advanced troubleshooting procedures.”
D-channel state is CFL	The carrier has failed.	Isolate the fault as described in *Alarm and Performance Monitoring Procedures*.
D-channel state is INB	The D-channel is installation busy.	Return the D-channel to service as described in *Trouble Locating and Clearing Procedures*.
D-channel state is INI	The D-channel is being initialized.	No action is required. The system will bring up the D-channel.

—continued—

Table 8-1
ISDN troubleshooting (continued)

Problem	Meaning	Action
D-channel state is LO	Locked out—the logical link has failed.	Enter table TRKSGRP and • Verify that the baud rate datafill matches that of the far-end DS-1. • Verify that the entry for field IFCLASS is NETWORK. At the DTCI, verify that the correct DS-1 (NT6X50AB) card is used. Verify that layer 1 attributes, such as frame format (standard or extended), match at both ends of the link. For more information, refer to *Trouble Locating and Clearing Procedures*.
D-channel state is MB	The D-channel is manual busy.	Return the D-channel to service as described in *Trouble Locating and Clearing Procedures*.
D-channel state is PMB	The DTCI is manual busy.	Isolate the fault as described in *Alarm and Performance Procedures*.
D-channel state is RNR	The remote far-end layer 3 is not responding.	For more information, refer to *Trouble Locating and Clearing Procedures*.
D-channel state is STB	Backup D-channel is in the standby mode	No action is required—the backup D-channel is available if a switchover occurs or is requested.
D-channel state is WAI	Backup D-channel is in the wait mode prior to switchover.	No action is required—the backup D-channel will be made active and placed in the INS state.
D-channel will not come into service		Refer to the section “Troubleshooting B- and D-channels” in the chapter “Advanced troubleshooting procedures.”

—continued—

Table 8-1
ISDN troubleshooting (continued)

Problem	Meaning	Action
Datafill problems		Refer to the section “Datafill issues” in the chapter “Trouble isolation and correction methods.”
DTCI is CBSY	The DTCI is C-side busy.	From the PM level of the MAP: • Post the DTCI. • Enter TRNSL C. • Diagnose the C-side links that are not in service.
DTCI is ISTB	The DTCI is in-service trouble.	From the PM level of the MAP: • Post the DTCI. • Enter QUERYPM FLT. • Diagnose the fault.
DTCI is MANB	The DTCI is manual busy.	From the PM level of the MAP: • Post the DTCI. • RTS the DTCI.
DTCI is SYSB	The DTCI is system busy due to a problem the system detected.	A system log is generated for the fault that occurred. Diagnose the problem. The system will return the DTCI to service if no fault is found.
DS-1 carrier is CBSY	The carrier is C-side busy.	From the CARRIER level of the MAP, diagnose the C-side links that are not in service.
DS-1 carrier is OFFL	The carrier is offline.	From the CARRIER level of the MAP, BSY and RTS the carrier.

—continued—

Table 8-1
ISDN troubleshooting (continued)

Problem	Meaning	Action
DS-1 carrier is MB	The carrier is manual busy.	From the CARRIER level of the MAP, RTS the carrier. Note the new carrier state.
DS-1 carrier is SYSB	The carrier is system busy.	From the CARRIER level of the MAP, diagnose the fault. Note the new carrier state.
DS-1 carrier problems		Refer to the section “DS-1 maintenance signaling notes” in the chapter “Trouble isolation and correction methods.”
Hardware problems		Refer to the section “Hardware model” in the chapter “Trouble isolation and correction methods.”
Initial installation troubles	A datafill or T–1 span problem exists.	Refer to the section “Initial installation troubles” in the chapter “Trouble isolation and correction methods.”
In-service troubles		Refer to the section “In-service troubles” in the chapter “Trouble isolation and correction methods.”
PM troubles		Refer to the section “PM troubleshooting notes” in the chapter “Trouble isolation and correction methods.”
PRI call processing troubles		Refer to the section “Troubleshooting PRI call processing” in the chapter “Trouble isolation and correction methods.”
Software problems		Refer to the section “Software model” in the chapter “Trouble isolation and correction methods.”
Trunk state is CFL	The carrier is out of service.	Isolate the fault as described in *Alarm and Performance Monitoring Procedures*.

—continued—

Table 8-1
ISDN troubleshooting (continued)

Problem	Meaning	Action
Trunk state is DFL	D-channel has failed.	Isolate the fault as described in *Trouble Locating and Clearing Procedures*.
Trunk state is DMB	D-channel is manual busy.	Isolate the fault as described in *Trouble Locating and Clearing Procedures*.
Trunk state is INB	The trunk is installation busy.	Return the trunk to service as described in *Trouble Locating and Clearing Procedures*.
Trunk state is LO	The D-channel is locked out and cannot communicate with layer 3.	Isolate the fault as described in *Trouble Locating and Clearing Procedures*.
Trunk state is MB	The trunk is manual busy.	Return the trunk to service as described in *Trouble Locating and Clearing Procedures*.
Trunk state is PMB	The DTCI is manual busy.	Isolate the fault as described in the *Alarm and Performance Monitoring Procedures*.
Trunk state is SB	The PRI circuit is system busy.	The system will return the trunk to service after testing is complete.
—end—		

Advanced troubleshooting procedures

This chapter contains advanced troubleshooting procedures that are referenced from the troubleshooting table in the ‘‘Troubleshooting chart’’ chapter.

When peforming troubleshooting procedures for major failure or potential failures, it is crucial to coordinate local and regional control centers.

To find the procedure you need, look for its title in the following list and go to the page number indicated.

For more information about general PRI troubleshooting, refer to the chapter “Trouble isolation and correction methods.” For more information about PRI translations, refer to the *Translations Guide*.

Troubleshooting B- and D-channels

Application

Use this procedure to troubleshoot B- and D-channels that will not come into service.

This procedure contains several steps which require that datafill be checked. For further information about ISDN PRI datafill, refer to the *Translations Guide*.

For more information about what type of B- and D-channel problems occur, refer to tables 5–4 and 5–5 “DS-1 trunk states” and “D-channel states,” and the chapters “Trouble isolation and correction methods” and “Troubleshooting chart” in this document.

1 Review maintenance actions taken to date. This includes verifying physical spans for wiring and continuity, and using BERT to groom the trunks. Repeat any of these maintenance actions if necessary.

Refer to the section “Some notes on troubleshooting” in the chapter “Trouble isolation and correction methods” in this document for more information about basic troubleshooting.

If the B- or D-channel problem	Do
still exists	step 2
no longer exists	step 12

2 Verify that the peripherals used for the PRI trunks have the correct datafill. In table LTCINV ensure that

- Field EXECTAB (executive table) subfield TRMTYPE (terminal type) is datafilled with PRAB
- Field EXECTAB subfield EXEX (executive program) is datafilled with DTCEX
- Field OPTCARD (optional card) is datafilled with ISP16

If the B- or D-channel problem	Do
still exists	step 3
no longer exists	step 12

Troubleshooting B- and D-channels (continued)

3 Verify that the frame format and the line coding scheme used in the DS-1 link is compatible with the far-end equipment. In table CARRMTC field ATTR (attributes) verify that

- Subfield FF (frame format) matches the far-end equipment. The frame type is ESF for extended superframe and SF for superframe.
- Subfield ZLG (line coding scheme) matches the far-end equipment. The entry should be B8ZS for 64-kbit/s clear communication or ZCS for 56-kbit/s restricted information.
- Subfield BERB (bit error rate base) matches the entry in FF. The entry should be BPV when subfield FF is SF, and CRC when subfield FF is ESF.

If the B- or D-channel problem	Do
still exists	step 4
no longer exists	step 12

Note: Feature package NTX143 and the NT6X50AB cards are required to run ESF.

4 Verify the P-side link assignments for the DTCI in table LTCPSINV. Table LTCPSINV contains an entry for each DTCI.

Verify that field PSLNKTAB (p-side link table) data is correct. Pay special attention to the contents of subfield IID (interface identifier).

Each P-side link has an associated IID which must match the far-end. In general, if there is more than one P-side link in a trunk group, the IID for each link should be unique and datafilled in ascending sequential order. The IID may need to be set to a specific value depending on the number of P-side links, the D-channel configuration, and the far-end equipment.

Number of P-side links

If there are several P-side links in a trunk group, the datafilled IID values must be in ascending consecutive order. For example, if there are four P-side links in a trunk group the datafilled IID values should be 0, 1, 2, and 3. The links do not need to be in consecutive order, but they must be in ascending order. For example, a trunk group in table LTCPINV can be datafilled with P-side link values 3, 6, 8, 11, and 15—but the associated IIDs must be datafilled as 0, 1, 2, 3, and 4.

DMS/SL-1 configuration

The D-channel configuration (single or backup) affects required IID values. A P-side link with

- a primary D-channel must have an IID of 0
- a backup D-channel must have an IID of 1

Troubleshooting B- and D-channels (continued)

The number of links also affects IID values in a DMS/SL-1 configuration. If there is more that one link in a trunk group without a backup D-channel, and the D-channel is on the first P-side link, the IIDs must be datafilled with the values 0, 2, and 3.

DMS/SL-100 configuration

5 In the DMS/SL-100 configuration, the D-channel configuration (single or backup) does not affect required IID values.

If the B- or D-channel problem	Do
still exists	step 5
no longer exists	step 12

Verify the D-channels for the trunk group in table TRKSGRP. In field SGRPVAR (Subgroup variable refinement) verify that

- Subfield IFCLASS (interface class) is datafilled with the value NETWORK or USER. This must be coordinated with the far-end as one end must be NETWORK and the other end must be USER.
- L1FLAGS is only valid on TDM/XPMs. If the far-end equipment is a Nortel product, L1FLAGS should be datafilled with N. If the far-end equipment is not manufactured by Nortel, datafill L1FLAGS with Y. Y means means that the D-channel idle code is 7E. N means that the idle code can be 7E or other value, such as 7F.

  See NIS-A211-1 (Standard release 08.01, August 1998), section 4.5 and NIS-A233-1 (Standard release 05.01, April, 1999), section 4.5 for more information about the idle codes.
- Subfield DCHNL (D-channel) is datafilled with the primary and backup D-channel to be used for the PRI interface.
- Subfield DCHRATE (D-channel rate) is datafilled with the correct data rate of the D-channel. This field must be compatible with subfield ZLG in table CARRMTC. If subfield ZLG is set to ZCS, DCHRATE must be 56K; if ZLG is B8ZS, DCHRATE must be 56 or 64K. Make sure the value is the same as the far end.
- Subfield HDLCTYPE (high level data link type) is datafilled correctly, and matches the nearest equipment.

If the B- or D-channel problem	Do
still exists	step 6
no longer exists	step 12

6

Verify the following information on B-channels in table TRKMEM:

- Field EXTRKNM (external trunk name) is datafilled with an external number to identify the trunk number.

- Field SGRP (subgroup) is datafilled with the value 0.
- Field MEMVAR (member variables) is datafilled for DTCI or LTC.

Ensure that the DS-1 circuit numbers and B-channel time slot numbers are in ascending sequential order.

If the B- or D-channel problem	Do
still exists	step 7
no longer exists	step 12

7 Verify the datafill in table PRIPROF to ensure that the protocol variant and issue are defined. Verify that field VARINFO (variant information)

- Subfield VARIANT is datafilled correctly for the type of protocol variant being used
- Subfield ISSUE is datafilled with V1

If the B- or D-channel problem	Do
still exists	step 8
no longer exists	step 12

8 Verify the PRI trunk group is assigned an LTID (logical terminal identifier) and access privileges. Table LTDEF identifies logical terminals and privileges. Verify that field CLASSREF subfield PROFNAME (profile name) is datafilled with the same name as in table PRIPROF fields PROFNAME and VARINFO.

If the B- or D-channel problem	Do
still exists	step 9
no longer exists	step 12

9 Attempt to bring the B- or D-channel back to service.

If the channel will	Do
not return to service	step 10
return to service	step 12

Troubleshooting B- and D-channels (end)

10 Gather relevant logs including TRK, PM, and ISDN logs and perform a protocol trace. For more information about priority logs refer to the chapter “Logs” in this document.

11 For further assistance, contact the personnel responsible for the next level of support.

12 You have completed this procedure.

Troubleshooting calls that will not complete

Application

Use this procedure to troubleshoot your equipment when calls will not complete.

Definition

Some of the symptoms that indicate a problem with call completion include:

- subscriber complaints
- no circuit available announcement
- negative test call results

1 Review maintenance actions taken to date. Refer to table 7-1 in this document for information about basic troubleshooting steps.

If the problem	Do
still exists	step 2
no longer exists	step 20

2 Verify that the DMS switch is loaded with the correct feature packages.

The following packages are **required** for PRI:

Package number	Package name
NTX750AD	ISDN Basic Access
NTX790AC	ISDN–Primary Rate Access Base

The following packages are **optional** for PRI:

Package number	Package name
NTX142AA	DS-1 64 Kbps Clear
NTX143AA	DS-1—ESF
NTX767AA	TR-448 ISDN Digit Analysis Compliance—End Office
NTX768AA	TR-448 ISDN Digit Analysis Compliance—Toll
NTX791AA	ISDN PRA: Network Ring Again

Troubleshooting calls that will not complete (continued)

Package number	Package name
NTX792AA	ISDN PRA: Network Name Display
NTX793AA	PRA Integrated Services Access
NTX794AA	PRA CCS7 Interworking
NTX795AA	INFO+ Enhanced Number Delivery—Primary Rate Interface
NTX797AA	PRI Message Waiting Indication
NTXE64AA	#4ESS AT&T Interworking
NTXJ43AA	#5ESS AT&T Interworking
NTXJ55AA	ISDNAP
NTXK55AA	Emergency Services Over ISDN
NTXN14AA	Trunks as SCAI ACD Agents
NTXN53AA	Enhanced PRA Maintenance
NTXN67AA	Meridian Automatic Route Selection
NTXQ74AA	NSS Customer Group Transport for PRI
NTXR34AA	XPM Plus (Product Line Upgrade Stategy) Basic
NTXR49AA	Dialable Wide Band Service PRI
NTXR65AA	Flexible DWS Access
NTXR66AA	DWS ATC ISUP
NTXS28AA	DWS Intertoll ISUP
NTXS36AA	XPM+ on DTCI

3 Determine if problem is resolved.

If the problem is	Do
not resolved	step 4
resolved	step 20

4 Verify that the far-end equipment has the necessary software to support the service being provided.

Troubleshooting calls that will not complete (continued)

5 Determine if the problem is resolved.

If the problem is	Do
not resolved	step 6
resolved	step 20

6 Verify the datafill in table TRKSGRP, field SGRPVAR, subfield CRLENGTH (call reference length). The CRLENGTH must match the far-end.

7 Determine what type of information should be in a layer 3 Q.931 protocol trace by determining the type of service being provided. The most vital information to check is the the number of called digits and the call type. The call type is determined by the values of the NSF (network specific facilities) if the call is ISA (integrated service access), and the NPI (numbering plan indicator). This information must match the far-end.

Refer to the “ISA troubleshooting” section in the chapter “Trouble isolation and correction methods” for more information about NSF, ISA, and the NPI.

If there is	call type
no NSF	value of NPI
an NSF	value of NSF

8 Perform a layer 3 (Q.931) protocol trace of the failed call to determine what messages are actually being sent.

9 Determine if the call that does not complete is an outgoing or incoming call.

If the call is	Do
outgoing	step 10
incoming	step 14

10 Verify the outgoing setup message including the values of the NSF, the NPI, and the called digits. Further information about the call can be obtained using TRAVER.

Troubleshooting calls that will not complete (continued)

Refer to table 7–9 for more information about setup messages.

If the setup message is	Do
correct	step 11
incorrect	step 12

11 Modifications must be made at the far-end equipment to accept the call. When modifications at the far-end are complete, test that the call will complete.

If the call	Do
completes	step 20
dows not complete	step 19

12 Modify the incorrect translations. Refer to the *Translations Guide*.

13 Perform a TRAVER and protocol trace to determine if calls will complete and that datafill is correct.

If data fill is correct and	Do
call completes	step 20
call does not complete	step 19

14 Verify the incoming setup message including the values of the NSF, the NPI, the called digits, and the bearer capability. Further information about the call can be obtained using TRAVER.

Refer to table 7-9 for more information about setup messages.

If the setup message is	Do
correct	step 16
incorrect	step 15

Troubleshooting calls that will not complete (end)

15 Make modifications at the far-end equipment to ensure that the proper information is received. When modifications at the far-end are complete, test that the call will complete.

If the call	Do
completes	step 20
does not complete	step 16

16 Verify that translations are correct by issuing the proper TRAVER based on the NPI and NSF of the incoming setup message.

If datafill is	Do
incorrect	step 17
correct	step 19

17 Modify the incorrect translations. Refer to the *Translations Guide*.

18 Determine if the call will complete.

If the call	Do
completes	step 20
does not complete	step 19

19 For further assistance, contact the personnel responsible for the next level of support.

20 You have completed this procedure.

Appendix A: Cause values

Mapping cause values to treatments

The cause information element describes the reason for generating certain messages, provides diagnostic information in the event of procedural errors, and indicates the location of the cause originator.

Table 10-1 contains cause values that are mapped to DMS-100 in-band treatments. The bracketed number beside the treatment indicates the type of extended treatments defined in the DMS-100. (Cause values not in table 10-1 are reserved).

Table 10-1
Mapping cause values to treatments

Cause value and name	Treatment
Normal event class	
1. unallocated (unassigned) number	BLDN (6)
2. no route to specified transit network	CACE (79)
3. no route to destination	RODR (25)
6. channel unacceptable	CHNF (160)
7. call awarded and being delivered in an established channel	RODR (25)
16. normal call clearing	none
17. user busy	BUSY (19)
18. no user responding	NTRS (133)
19. no answer from user (user alerted)	RODR (25)
21. call rejected	CREJ (134)
Note: * Reroute generally means that a protocol error has occurred on the selected channel. Another trunk termination is attempted. If the attempt is unsuccessful, then treatment GNCT (34) is applied.	

—continued—

Table 10-1
Mapping cause values to treatments (continued)

Cause value and name	Treatment
22. number changed	CNAC (113)
26. non-selected user clearing	RODR (25)
27. destination out of order	RODR (25)
28. invalid number format (incomplete number)	PDIL (2)
29. facility rejected	NACK (78)
30. response to STATUS ENQUIRY	none
31. normal, unspecified	RODR (25)
Resource unavailable class	
34. no circuit/channel available	NCRT (24)
38. network out of order	SYFL (14)
41. temporary failure	CHNF (160)
42. switching equipment congestion	NBLH (9)
43. access information discarded	reroute to next B–channel*
44. requested circuit/channel not available	Reroute to next B–channel*
47. resources unavailable, unspecified	NOSR (93)
Service not available class	
50. requested facility not subscribed	FNAL (68)
54. incoming calls barred	DTNR (33)
57. bearer capability not authorized	CNAC (113)
58. bearer capability not presently available	CNAC (113)
63. service or option not available, unspecified	NACK (78)
Service not implemented class	

Note: * Reroute generally means that a protocol error has occurred on the selected channel. Another trunk termination is attempted. If the attempt is unsuccessful, then treatment GNCT (34) is applied.

—continued—

Table 10-1
Mapping cause values to treatments (continued)

Cause value and name	Treatment
65. bearer capability not implemented	BCNI (161)
66. channel type not implemented	CONP (98)
69. requested facility not implemented	RODR (25)
70. only restricted digital information bearer capability is available	CNAC (113)
79. service or option not implemented, unspecified	FNAL (68)
Invalid message class	
81. invalid call reference value	CHNF
82. identified channel does not exist	CHNF
83. a suspended call exists, but the call identity does not	RODR (25)
84. call identity in use	RODR (25)
85. no call suspended	RODR (25)
86. call having the requested call identity has been cleared	RODR (25)
88. incompatible destination	CNAC (113)
95. invalid message, unspecified	RODR (25)
Protocol error class (message not recognized)	
96. mandatory information element is missing	CHNF
97. message type non-existent or not implemented	CHNF
98. message not compatible with call state, or message type non-existent or not implemented	CHNF
99. information element non-existent or not implemented	CHNF
100. invalid information element contents	CHNF
101. message not compatible with call state	CHNF
102. recovery on timer expiry	CHNF
111. protocol error, unspecified	CHNF

Note: * Reroute generally means that a protocol error has occurred on the selected channel. Another trunk termination is attempted. If the attempt is unsuccessful, then treatment GNCT (34) is applied.

—continued—

Table 10-1
Mapping cause values to treatments (continued)

Cause value and name	Treatment
Interworking class	
127. interworking, unspecified	none
Note: * Reroute generally means that a protocol error has occurred on the selected channel. Another trunk termination is attempted. If the attempt is unsuccessful, then treatment GNCT (34) is applied.	
—end—	

Mapping treatments to cause values

When the DMS-100 routes a call to treatment, a message with a cause value is sent to the user indicating why the call went to treatment.

More than one treatment may generate a specific cause value. In addition, only a small number of the existing treatments map to meaningful cause values. All remaining treatments map to the cause value of 127, and the treatment is applied in-band.

Table 10-2 contains the treatments and the corresponding cause values to which they map. For definitions of the treatments, refer to the data schema section of the *Translations Guide*.

Table 10-2
Mapping treatments to cause values

Treatment	Cause value
ATBS (attendant busy)	31
BCNI (bearer capability not implemented)	65
BLDN (blank directory number)	1
BUSY (busy line)	17
CACE (carrier access code error)	2
CHNF (channel negotiation failure	41
CNAC (call not accepted)	88
—continued—	

Table 10-2
Mapping treatments to cause values (continued)

Treatment	Cause value
CONF (confirm tone)	31
CONP (connection not possible)	66
CREJ (call rejected)	21
DNTR (denied termination)	54
FNAL (feature not allowed)	50
GNCT (generalized no circuit)	34
MHLD (music on hold)	31
NACK (feature action not acknowledged)	29
NBLH (network blockage heavy traffic)	42
NBLN (network blockage normal traffic)	34
NCRT (no circuit)	34
NOSC (no service circuit)	34
NOSR (no software resource)	47
NTRS (no terminal responding)	18
PDIL (parital dial)	28
PSIG (permanent signal)	90
RODR (reorder)	28
SYFL (system fail)	41
TRBL (trouble intercept)	27
UNDN (unassigned directory number)	1
VACT (vacant code)	1

—end—

Appendix B: Troubleshooting example

This appendix shows a sample troubleshooting session for a PRI call that fails. This example shows an abbreviated version of the steps listed in the troubleshooting procedure "Troubleshooting when calls will not complete" in the chapter "Advanced troubleshooting procedures" in this NTP as well as the actual TRAVER and PMDEBUG data.

The call is an incoming 7-digit call is whose call type is unknown.

Procedure 11-1
Troubleshooting calls that will not complete

At your current location

1 Review maintenance actions taken to date. Refer to table 7-1 in this document for information about basic troubleshooting steps.

2 Verify that the DMS switch is loaded with the correct feature packages.

3 Verify that the far-end equipment has the necessary software to support the service being provided.

4 Verify the datafill in table TRKSGRP, field SGRPVAR, subfield CRLENGTH (call reference length). The CRLENGTH must match the far-end.

After the first four steps the call still fails. In this example, the call type is incorrectly assumed to be a public call. The following TRAVER is issued and indicates that the call should complete, but the call still fails.

>traver tr pratest2 6753002 b

```
TABLE TRKGRP
PRATEST2 PRA 0 NPDGP NCRT ASEQ N (ISDN 1001) $
TABLE LTCALLS
ISDN 1001 PUB XLAIBN 0 BNR 00 $
TABLE LINEATTR
0 1FR NONE NT NSCR 0 619 P351 NLCA RTE4 0 NIL NILSFC
NILLATA 0 NIL NIL 00 Y POTS
LCABILL OFF – BILLING DONE ON BASIS OF CALLTYPE
TABLE STDPRTCT
P351 ( 1) ( 0) 0
   . SUBTABLE STDPRT
WARNING: CHANGES IN TABLE STDPRT MAY ALTER OFFICE
BILLING.  CALL TYPE DEFAULT IS NP.  PLEASE REFER TO
DOCUMENTATION.
   . 67 810 N NP 0 NA
   . SUBTABLE AMAPRT
   . KEY NOT FOUND
   . DEFAULT VALUE IS:  NONE OVRNONE N
TABLE HNPACONT
619 127 8 ( 26) ( 1) ( 0) ( 0) 0
   . SUBTABLE HNPACODE
   . 675 675 DN 619 675
TABLE TOFCNAME
619 675
TABLE DNINV
619 675 3002 L HOST 00 0 02 16

+++ TRAVER: SUCCESSFUL CALL TRACE +++

DIGIT TRANSLATION ROUTES
1 LINE              6196753002  ST

TREATMENT ROUTES.  TREATMENT IS: GNCT
1 NCRTANNC
2 T120

+++ TRAVER: SUCCESSFUL CALL TRACE +++
```

5 Determine what type of information should be in a layer 3 Q.931 protocol trace by determining the type of service being provided. The most vital information to check is the number of called digits and the call type. The call type is determined by the values of the NSF (network specific facilities) if the call is ISA (integrated service access), and the NPI (numbering plan indicator). This information must match the far-end.

Refer to the “ISA troubleshooting” section in the chapter “Trouble isolation and correction methods” for more information about NSF, ISA, and the NPI.

6 Perform a layer 3 (Q.931) protocol trace of the failed call to determine what messages are actually being sent.

PMDEBUG data

```
<== Q931: SETUP:    from S[7051] L[1,90,0]
E[72,89,0]
CR: 0,02 0B
BC: speech
   64 kbit/s
   circuit mode
   mu-law speech
CID:Slot Map/CH#: 81
NSF:private
00
CGN:e164
   national_number
   network_provided
   presentation_allowed
   6196753000
CDN:e164
   local_directory_number
   6753002

==> Q931: REL COM:  to S[7051] L[1,90,0]
E[72,89,0]
CR: 1,02 0B
CSE: user
    incoming_calls_barred
```

This protocol trace shows that the NSF is private, the NPI is public, the bearer capability is speech, and seven digits are received as part of the setup message.

7 Verify the incoming setup message including the values of the NSF, the NPI, the called digits, and the bearer capability. Further information about the call can be obtained using TRAVER.

Refer to table 7-9 for more information about setup messages.

If the setup message is	Do
correct	step 9
incorrect	step 8

8 Make modifications at the far-end equipment to ensure that the proper information is received. When modifications at the far-end are complete, test that the call will complete.

If the call	Do
completes	step13
does not complete	step 9

9 Verify that translations are correct by issuing the proper TRAVER based on the NPI and NSF of the incoming setup message.

Analysis of the protocol trace showed that the correct information was received based on the call being private. At this point, a TRAVER with options set for private calls can be issued. Note the difference in the following TRAVER command and the first one that was issued.

>traver tr pratest2 n cdn e164 l 6753002 pvt 0 b

```
Warning:    Routing characteristics are present.
        Originator must be able to send in
        characteristics specified.
INVALID DATA IN TABLE LTCALLS

+++ TRAVER: CALL TRACE TERMINATED DUE TO DATA
TROUBLE +++

INVALID DATA IN TABLE LTCALLS

+++ TRAVER: CALL TRACE TERMINATED DUE TO DATA
TROUBLE +++
```

If datafill is	Do
incorrect	step10
correct	step12

10 Modify the incorrect translations. Refer to the *Translations Guide*.

In this example, there are missing translations; a tuple in table LTCALLS must be added.

11 Determine if the call will complete.

If the call	Do
completed	step13
does not complete	step12

```
>traver tr pratest2 n cdn e164 l 6753002 prvt 0 b
   Warning:    Routing characteristics are present.
               Originator must be able to send in
               characteristics specified.
   TABLE TRKGRP
   PRATEST2 PRA 0 NPDGP NCRT ASEQ N (ISDN 1001) $
   TABLE LTCALLS
   ISDN 1001 PVT XLAIBN 0 BNR 00 $
   TABLE LINEATTR
   0 1FR NONE NT NSCR 0 619 P351 NLCA RTE4 0 NIL NILSFC
   NILLATA 0 NIL NIL 00 Y
   LCABILL OFF – BILLING DONE ON BASIS OF CALLTYPE
   TABLE STDPRTCT
   P351 ( 1) ( 0) 0
      . SUBTABLE STDPRT
   WARNING: CHANGES IN TABLE STDPRT MAY ALTER OFFICE
   BILLING.  CALL TYPE DEFAULT IS NP.  PLEASE REFER TO
   DOCUMENTATION.
      . 67 810 N NP 0 NA
      . SUBTABLE AMAPRT
      . KEY NOT FOUND
      . DEFAULT VALUE IS:  NONE OVRNONE N
   TABLE HNPACONT
   619 127 8 ( 26) ( 1) ( 0) ( 0) 0
      . SUBTABLE HNPACODE
      . 675 675 DN 619 675
   TABLE TOFCNAME
   619 675
   TABLE DNINV
   619 675 3002 L HOST 00 0 02 16

   +++ TRAVER: SUCCESSFUL CALL TRACE +++

   DIGIT TRANSLATION ROUTES

   1 LINE              6196753002  ST

   TREATMENT ROUTES.  TREATMENT IS: GNCT
   1 NCRTANNC
   2 T120

   +++ TRAVER: SUCCESSFUL CALL TRACE +++
```

A test call confirms that the call does complete, and the following PMDEBUG data is the trace.

```
<== Q931: SETUP:  from S[7051] L[1,90,0] E[72,89,0]
CR: 0,02 0D
BC: speech
    64 kbit/s
    circuit mode
    mu-law speech
CID:Slot Map/CH#: 81
NSF:private
00
CGN:e164
    national_number
    network_provided
    presentation_allowed
    6196753000
CDN:e164
    local_directory_number
    6753002

==> Q931: CALL PROC:  to S[7051] L[1,90,0] E[72,89,0]
CR: 1,02 0D
CID:Slot Map/CH#: 81

==> Q931: ALERT:      to S[7051] L[1,90,0] E[72,89,0]
CR: 1,02 0D
PI  :user
    in_band_info_or_pattern_now_avail

==> Q931: CONN:       to S[7051] L[1,90,0] E[72,89,0]
CR: 1,02 0D

==> Q931: CONN ACK:   to S[7051] L[1,90,0] E[72,89,0]
CR: 0,02 0D

==> Q931: DISC:       to S[7051] L[1,90,0] E[72,89,0]
CR: 1,02 0D
CSE:user
    normal_call_clearing

<== Q931: REL:        to S[7051] L[1,90,0] E[72,89,0]
CR: 0,02 0D

<== Q931: REL COM:         to S[7051] L[1,90,0] E[72,89,0]
CR: 1,02 0D
```

12 For further assistance, contact the personnel responsible for the next level of support.

13 You have completed this procedure.

List of terms

2B1Q

Two binary one quaternary. The interface standard for ISDN basic rate interface (BRI) transmission between the network and the network termination 1 (NT1) as defined by the American National Standards Institute (ANSI).

access module (AM)

The unit that provides access to the network modules (NM) of a digital packet network switching system from a local end user packet data line or the digital interworking unit (DIU).

access privilege (AP)

A term used to define bearer services for an ISDN logical terminal. Northern Telecom currently defines four APs: B (circuit-switched voice and data), D (low-speed packet data), PB (high-speed packet-switched data), and BD (circuit-switched voice and low-speed packed-switched data).

access termination (AT)

The functional term to describe the part of the exchange termination which terminates the access interfaces (BRI and PRI). It defines the access privileges of the terminals on an interface, and provides the terminals on an interface with access to ISDN circuit- and packet-switching services.

agent

See telephony agent.

AM

See access module (AM).

AMA

See automatic message accounting (AMA).

AP

See access privilege (AP).

Automatic message accounting (AMA)

An automatic recording system that documents all the necessary billing data of end user-defined long distance calls.

basic rate access functional set (BRAFS)

An ISDN set that uses functional signaling. The Meridian M5317T is the BRAFS for Northern Telecom. *See also* functional signaling.

basic rate access key set (BRAKS)

An ISDN set that uses stimulus signaling. The Meridian M2317T is the BRAKS for Northern Telecom. *See also* functional signaling, stimulus signaling.

Note: In the NA011 release, obsolete BRAKS types of ISDN BRI have been removed. Obsolete BRAKS LTIDs that were present have been changed to default BRAFS LTIDs by a reformat. These default LTIDs can be removed or reused.

basic rate interface (BRI)

A type of access to ISDN service provided by a set of time-division multiplexed digital channels of information, including two B-channels, one D-channel, and one or more maintenance channels, often described as 2B (channels) + D (channel). A BRI is typically used on lines between customer premises and a central office switch. Formerly known as basic rate interface (BRA).

BC

See bearer capability (BC).

B-channel

A 64-kbit/s digital bidirectional channel used by ISDN for carrying either circuit-switched voice or data, or packet-switched data.

Bb

A B sub-b channel. A 64-kbit/s channel carrying multiplexed B-channel data packets to the packet handler. *See also* B-channel.

Bd

A B sub-d channel. A DS-0 channel that carries low-speed, packet-switched data statistically multiplexed from up to 64 different sources. Bd is one of 24 channels on a DS-1 facility between the ET and the PH.

bearer capability (BC)

A characteristic associated with a directory number (DN) to indicate the type of call (voice or data) and the rate of transmission that is allowed. Bearer

capability is also an information element that is carried in the setup message for functional signaling to indicate the type of call (voice or data) and the rate of transmission required (for ISDN). *See also* authorized call type, bearer services.

bearer services

Characteristic that is associated with a logical terminal (service profile) in functional signaling. It offers a pool of bearer capabilities to a logical terminal. Also called authorized call type.

Bell Communications Research (Bellcore)

A group responsible for coordinating Bell operating company projects and setting guidelines for a switching system.

Bellcore

See Bell Communications Research (Bellcore).

BIC

See bus interface card (BIC).

B-packet

Packet data that is transmitted over a B-channel.

BRAFS

See basic rate access functional signalling (BRAFS).

BRAKS

See basic rate access key set (BRAKS).

BRAMFT

basic rate access Meridian functional signalling (BRAMFT).

BRI

See basic rate interface (BRI).

bus interface card (BIC)

A hardware interface that connects two 32-channel digroups to a maximum of 64 line cards. This card is located in the drawer of the line concentrating module (LCM).

B-voice

A pulse code modulated voice signal carried on a B-channel.

calling line identification (CLI)

In data transmission, a feature provided by the network that allows a called terminal to be notified by the network of the address from which the call has originated. Screening of CLI is performed during call setup only.

call processing

The software that handles the processes involved in setting up connections through the DMS-100 Family network between calling and called parties.

call reference

This identifies the call on the local ISDN interface to which the message applies. Stimulus call control messages have dummy call references because the network controls the call. Functional call control messages are used by the ISDN terminal to distinguish between call appearances of the same directory number, and to selectively control a number of simultaneous calls (for example, an active call, calls on hold, calls waiting).

call type

See authorized call type *and* bearer services.

CCC

See central control complex (CCC).

CCITT

See Consultative Committee on International Telephony and Telegraphy (CCITT).

CCS7

See Common Channel Signaling 7 (CCS7).

central control complex (CCC)

The part of the DMS-100 Family switch that contains all the current control (CC) functions including the central message controller (CMC), CPU, program store (PS), and data store (DS).

central office (CO)

A switching office (SO) arranged for terminating end user lines and provided with switching equipment and trunks for establishing connections to and from other SOs. Also known as a local office.

CLI

See calling line identification (CLI).

Common Channel Signaling 7 (CCS7)

A digital message-based network signaling standard, defined by the CCITT, that separates call signaling information from voice channels so that interoffice signaling is exchanged over a separate signaling link.

CDTE

ISDN cabinetized digital trunk equipment

central side (C-side)

The side of a node that faces away from the peripheral modules (PM) and toward the central control (CC). Also known as control side. *See also* peripheral side (P-side).

channel supervision message (CSM)

A message received and transmitted continuously on each connected voice channel of a peripheral module. The CSM contains a connection data byte, which includes the channel supervision bit, and an integrity byte, which issues call path integrity.

circuit-switched network

Synonym for the telephone network.

CLGE

ISDN cabinetized line group equipment

CLMI

Cabinetized line module ISDN

CO

See central office (CO).

Consultative Committee on International Telephony and Telegraphy (CCITT)

The CCITT is one of the four permanent groups within the International Telecommunication Union (ITU). The CCITT is responsible for studying technical, operating, and tariff questions. This organization also prepares recommendations relating to telephony and telegraphy, including data and program services.

CPE

See customer premises equipment (CPE).

CS-data

Circuit-switched data carried on B-channel

C-side

See central side (C-side).

CSM

See channel supervision message (CSM).

customer premises equipment (CPE)

Equipment, such as ISDN terminals, that is located on the customer's premises.

data link layer

Layer 2 in the open systems interconnection (OSI) model that is used to create logical links between ISDN terminals and the services they access. The datalink layer provides error-free, sequenced messaging over a channel.

data network address (DNA)

A number that accesses a terminal on the packet-switched network.

data network identification code (DNIC)

For ISDN, a code that is used in packet switching to identify the network being addressed.

data packet network (DPN)

A packet-switched networking system that is manufactured by Northern Telecom.

data store (DS)

One of the two distinct elements of a DMS-100 memory, DS is part of the central control complex (CCC). It contains transient information for each call as well as customer data and office parameters. The other main element of a DMS-100 memory is program store (PS). *See also* program store (PS), protected store (PROT).

D-call control

Call control information that is carried on the D-channel and used to establish, maintain, or clear a voice or circuit-switched data call on a B-channel of an ISDN.

DCC

See digroup control card (DCC).

DCH

See D-channel handler (DCH).

D-channel

For BRI, the D-channel is a 16 kbit/s, bi-directional channel. A D-channel carries call control messages between a terminal on an ISDN interface and the exchange termination. These call control messages are used to set up, maintain, or clear a circuit-switched call on a B-channel. The D-channel also carries low-speed packet data between a terminal on an ISDN interface and a terminal in the packet data network. For PRI, the D-channel is a 64 kbit/s, bi-directional channel. *See also* Bd channel, BRI, PRI.

D-channel handler (DCH)

A card in an ISDN line group controller (LGCI) or in an ISDN line trunk controller (LTCI) that provides the primary interface to all D-channels. The DCH also performs Q.921 LAPD layer 2 processing. The DCH is assigned to an ISDN loop and receives or sends messages on the signaling/packet data channel.

digital interworking unit (DIU)

The unit in a digital packet network switch that converts B-channel and D-channel data packets received in a DS-1 format from the ISDN access controller to a VR-35 format that is suitable for the access module. For packets being sent in the opposite direction, the DIU performs the reverse conversion.

digroup control card (DCC)

A circuit that makes up part of the line concentrating module (LCM) unit control complex. DCC provides eight DS30A ports for connection to the network in the host LCM or to the host interface equipment (HIE) shelf in the remote line concentrating module (RLCM).

direct memory access (DMA)

A device for moving blocks of continuous data to and from memory at a high rate.

directory number (DN)

The full complement of digits required to designate a end user's station within one numbering plan area (NPA)—usually a three-digit central office code followed by a four-digit station number.

DIU

See digital interworking unit (DIU).

DMA

See direct memory access (DMA).

DMS PH

DMS packet handler

DN

See directory number (DN).

DNA

See data network address (DNA).

DNIC

See data network identification code (DNIC).

D-packet

Packet data carried on the D-channel between the packet handler and an ISDN terminal.

DPN

See data packet network (DPN).

DS

See data store (DS).

DS-0

A protocol for data transmission that is used to represent one channel in a 24-channel DS-1 trunk.

DS-1

A closely specified bipolar pulse stream with a bit rate of 1.544 Mbit/s. It is the standard signal used to interconnect Northern Telecom digital systems. The DS-1 signal carries 24 DS-0 information channels of 64 kbit/s each.

DS30 link

1. A 10-bit, 32-channel, 2.048-Mbit/s speech-signaling and message-signaling link as used in the DMS-100 Family. 2. The protocol by which DS30 links communicate.

DS30A link

A 32-channel transmission link between the line concentrating module and controllers in the DMS-100 Family. DS30A is similar to DS30, though intended for use over shorter distances.

DTCI

See ISDN digital trunk controller (DTCI).

DTCOi

See ISDN digital trunk controller offshore (DTCOi).

DTEI

See ISDN digital trunk equipment frame (DTEI).

E.164

The public network numbering plan in accordance with CCITT Recommendation E.164.

EAEO

See equal access end office.

EISP

See enhanced ISDN signaling preprocessor (EISP).

EKTS

See electronic key telephone service (EKTS).

electronic key telephone service (EKTS)

A set of services for ISDN voice terminals on a basic rate interface. EKTS provides shared directory numbers (DN), multiple DNs for each service profile, and conference and intercom calling.

end office (EO)

A switching office (SO) arranged for terminating end user lines and provided with trunks for establishing connections to and from other SOs. *See also* central office (CO).

enhanced ISDN signaling preprocessor (EISP)

Provides call control messaging and D-channel handler maintenance functions, similar to the ISP, but with memory upgrade from 1 Mbyte to 4 Mbyte, clock speed upgrade from 16 MHz to 20 MHz, and data bus upgrade from a 16 bit width to 32 bits.

enhanced line concentrating module (LCME)

A dual-unit peripheral module that terminates ISDN 2B1Q U-type lines, ISDN S/T-type lines, plain ordinary telephone service (POTS), electronic business sets (EBS), and Datapath lines. LCME also provides access to the ISDN B-, D-, and M-channels. The LCME supports 480 POTS, EBS, or ISDN U– lines, or 240 Datapath or S/T- lines.

enhanced service provider (ESP)

A third-party vendor that supplies value-added services to the end user.

enhanced services test unit (ESTU)

A stand-alone test unit that performs metallic and digital line tests at remote or host sites for ISDN services.

EO

See end office (EO).

equal access end office

A central office that provides access to several long distance carriers.

ESP

See enhanced service provider (ESP).

ESTU

See enhanced services test unit (ESTU).

ET

See exchange termination (ET).

ETSI

European Telecommunications Standards Institute

exchange termination (ET)

The functional name for the component of the ISDN that serves as the access termination for BRI and PRI interfaces, and provides circuit-switched services to the ISDN switch.

F-bus

See frame transport bus.

feature indicator (FI)

A device that indicates the state or condition of a call when using a supplementary service on an ISDN stimulus terminal with circuit-switched service.

FI

See feature indicator (FI).

foreign exchange (FX)

A service that allows a telephone or a PBX to be served by a distant central office (CO), rather than by the CO in the immediate geographical area.

frame transport bus (F-bus)

An eight-bit bus that provides data communications between a local message switch (LMS) and the link interface units that are provisioned in a link

peripheral processor (LPP). To ensure readability, two load-sharing F-buses are provided in an LPP. Each F-bus is dedicated to one of the two LMSs. *See also* link interface module.

functional signaling

An intelligent terminal in which call control functions are shared between the switch and the terminal.

FX

See foreign exchange (FX).

HFP

HDLC frame processor

HIE

See host interface equipment (HIE).

high-level data link control

The channel by which high-level control messages from the central control are carried between the digital carrier module and remote line modules.

host interface equipment (HIE) shelf

In the remote line concentrating module (RLCM) frame, this shelf provides interface circuits between the host office and the RLCM.

IBERT

See integrated bit error rate test (IBERT).

IEC

Inter-exchange carrier

initial program load (IPL)

The initialization procedure that causes a computer operating system to start operation.

integrated bit error rate test (IBERT)

A test that a MAP operator uses with an IBERT card to test the transmission quality of a selected data line. The card resides in the line drawer of a line concentrating module and generates the bit stream for an IBERT.

integrated services access (ISA)

Uses call setup messages and dialed digits to permit access to public and private network services through one bidirectional common access facility. ISA provides the capability to support multiple call types (such as PUBLIC, PRIVATE, OUTWATS, INWATS, FX, and TIE) on a single trunk.

integrated services digital network (ISDN)

A set of standards proposed by the CCITT to establish compatibility between the telephone network and various data terminals and devices. ISDN is a communications network that provides access to voice, data, and imaging services from a single type of connector.

inter-LATA

Telecommunications services, revenues, and functions that originate in one local access and transport area (LATA) and terminate either outside that LATA or inside another LATA.

International Standards Organization (ISO)

The organization responsible for creating a seven-layer protocol model for a data communications network.

intra-LATA

Telecommunication services, revenues, and functions that originate in one local access and transport area (LATA) and terminate either outside that LATA or inside another LATA.

IPL

See initial program load.

ISA

See integrated services access (ISA).

ISDN

See integrated services digital network (ISDN).

ISDN access controller

A frame used to support ISDN access between a DMS and voice and packet services.

ISDN digital trunk controller (DTCI)

A dual-unit peripheral module that provides access for ISDN primary rate interface to a digital private branch exchange (PBX). The DTCI provides call control for PRI functional signaling, and performs functions similar to the LGC, including D-channel handling and processing, and maintenance and diagnostics.

ISDN digital trunk controller offshore (DTCOi)

A peripheral module (PM) that connects DS30 links from the network with digital trunk circuits with ISDN.

ISDN digital trunk equipment (DTEI) frame

A frame containing up to two dual-shelf ISDN digital trunk controllers.

ISDN line

The physical part of a basic rate interface (BRI) that connects the terminals to the network termination (NT1).

ISDN line concentrating array (LCAI)

A shelf in the ISDN line concentrating module (LCME). It contains four physical line drawers. The LCME consists of two line concentrating arrays, which operate in a load sharing mode with mutual takeover capability.

ISDN line concentrating equipment (LCEI)

A single-bay equipment frame containing two LCMEs.

ISDN line group controller (LGCI)

A peripheral module that connects DS30 links from the network.

ISDN line trunk controller (LTCI)

A peripheral module that is a combination of the line group controller and the digital trunk controller, and provides all of the services offered by both.

ISDN service group (ISG)

Defines the services that a D-channel handler (DCH) provides and their allocation to the channels within the DCH. ISG allows hardware-independent access to service-related functions at the MAP. The ISG MAP level provides a view of the services and the DCH MAP level provides a view of the hardware.

ISDN signaling preprocessor (ISP)

Provides call control messaging and D-channel handler maintenance functions.

ISDN switch

A DMS switch configured to provide ISDN services. Its main functional components are the exchange termination and the packet handler.

ISDN terminal

A digital telephone or personal computer that is connected to a customer premises loop which forms part of a BRI.

ISDN U-line card (U-ISLC)

An ISDN line card which terminates the U-loop in the enhanced line concentration module (LCME). When a U-ISLC is used, the network

termination 1 (NT1) situated on customer premises acts as the network termination. Synonymous with ISLC and U-line card.

ISDN user part (ISUP)

A CCS7 message-based signaling protocol which acts as a transport carrier for ISDN services. The ISUP provides the functionality within a CCS7 network for voice and data services.

ISG

See ISDN service group (ISG).

ISLC

See ISDN U-line card (ISLC).

ISO

See International Standards Organization (ISO).

ISP

See ISDN signaling preprocessor (ISP).

ISUP

See ISDN user part (ISUP).

kbit/s

See kilobits per second (kbit/s).

kilobits per second (kbit/s)

A bit rate expressed in thousands of bits per second.

LAPB

See link access procedure balanced (LAPB).

LAPD

See link access procedure on the D-channel (LAPD).

LATA

See local access and transport area (LATA).

L-bus

A bi-directional link that acts as the interface between the bus interface card and the line card in an enhanced line concentrating module (LCME).

LC

See line circuit (LC).

LCAI

See ISDN line concentrating array (LCAI).

LCC

See Line Class Code (LCC).

LCEI

See ISDN line concentrating equipment (LCEI).

LCM

See line concentrating module (LCM).

LCME

See enhanced line concentrating module (LCME).

LD

See line drawer (LD).

LEN

See line equipment number (LEN).

LGC

See line group controller (LGC).

LGCI

See ISDN line group controller (LGCI).

LIM

See link interface module.

line circuit (LC)

A hardware device that provides an interface between end user lines and the digital switch. Each end user line has a dedicated line circuit. *See also* line drawer (LD).

Line Class Code (LCC)

An alphanumeric code that identifies the class of service assigned to a line.

line concentrating module (LCM)

A peripheral module which interfaces the line trunk controller or line group controller and up to 640 end user lines, using two to six DS30A links.

line drawer (LD)

A hardware entity located in the LCME that contains line circuit cards.

line equipment number (LEN)

A seven-digit function-reference used to identify line circuits.

line group controller (LGC)

A peripheral module that connects DS30 links from the network to the LCME.

line trunk controller (LTC)

A peripheral module that is a combination of the line group controller and the digital trunk controller, and provides all the services offered by both.

link access procedure balanced (LAPB)

ISDN access protocol that is used with links established on a B-channel. LAPB supports a single data link that operates with a fixed, single-byte address convention between the ISDN terminal and the network.

link access procedure on the D-channel (LAPD)

ISDN access protocol that is used with links established on a D-channel.

link interface module (LIM)

A peripheral module that controls messaging between link interface units (LIU) in a link peripheral processor (LPP). The LIM also controls messages between the LPP and the DMS-bus. An LIM consists of two local message switches (LMS) and two frame transport buses (F-bus). One LMS normally operates in a load sharing mode with the other LMS. This ensures LIM reliability in the event of an LMS failure because each LMS has adequate capacity to carry the full message load of an LPP. Each LMS uses a dedicated F-bus to communicate with the LIUs in the LPP.

link interface unit (LIU)

A peripheral module that processes messages entering and leaving a link peripheral processor through an individual signaling data link. *See also* CCS7 link interface unit 7.

link peripheral processor (LPP)

The DMS SuperNode equipment frame for DMS-STP that contains two types of peripheral modules: an LIM and an LIU. For DMS-STP applications, CCS7 link interface units 7 (LIU7) are used in the LPP. *See also* link interface module.

LIU

See link interface unit (LIU).

local access and transport area (LATA)

A geographic area within which an operating company may offer telecommunications-related services. *See also* inter-LATA and intra-LATA.

logical terminal (LT)

The datafilled instance of an abstract terminal that is provided with a subset of the features and services (service profile) datafilled in the access termination for the abstract terminal.

logical terminal identifier (LTID)

The unique identifier that is assigned to a logical terminal when it is datafilled in the ISDN access termination.

LPP

See link peripheral processor (LPP).

LTC

See line trunk controller (LTC).

LTCI

See ISDN line trunk controller (LTCI).

LTID

See logical terminal identifier (LTID).

maintenance trunk module (MTM)

In a trunk module equipment (TME) frame, a peripheral module (PM) that is equipped with test and service circuit cards and contains special buses to accommodate test cards for maintenance. The MTM provides an interface between the DMS-100 Family digital network and the test and service circuits.

MAP

The maintenance and administration position. MAP is a group of components that provides a user interface between operating company personnel and the DMS-100 Family systems. A MAP consists of a visual display unit and keyboard, a voice communications module, test facilities, and MAP furniture. MAP is a trademark of Northern Telecom.

Mbit/s

See megabits per second (Mbit/s).

M-channel

A 16-kbit/s, bi-directional, U-loop channel used to transfer maintenance information between the NT1 and the exchange termination.

megabits per second (Mbit/s)

Expresses the rate of transmission of serial data bits in a time-division multiplexed frame format.

MTM

See maintenance trunk module (MTM).

NAS

See network administration system (NAS).

network administration system (NAS)

A stand-alone computer that is involved in operation, administration, and maintenance for integrated services digital network (ISDN) services. The NAS uses data on service and system operation to generate files that contain information on alarms, accounting, billing, and network operation.

network interface unit

A DMS SuperNode application specific unit (ASU) that provides channelized access for F-bus resident link interface units (LIU) using a channel bus (C-bus). The NIU resides in a link peripheral processor (LPP) frame.

network layer

Layer 3 in the OSI model. In ISDN, the network layer is used to send call control messages.

network modules (NM)

The basic building block of the DMS-100 Family switches. The NM accepts incoming calls and uses connection instructions from the central control complex (CCC) to connect the incoming calls to the appropriate outgoing channels. Network module controllers control the activities in the NM.

network termination 1 (NT1)

Access point for basic rate interface to ISDN. This component is situated on customer premises and is typically located between the terminals and the exchange termination. An NT1 is required when ISDN lines are terminated by U-line cards.

NIU

See network interface unit.

NT1

See network termination 1 (NT1).

NTP

Northern Telecom Publication

open system interconnection (OSI)

A 7-layer protocol model for communications networks developed by the International Standards Organization and adopted by the Consultative Committee on International Telephony and Telegraphy (CCITT) for an Integrated Services Digital Network (ISDN).

OSI

See open system interconnection (OSI).

packet handler (PH)

The CCITT term for the component of an ISDN switch that provides packet switching services.

PCM

See pulse code modulation (PCM).

PCM30 digital trunk controller (PDTC)

A digital trunk interface that has the hardware configuration of an international digital trunk controller (IDTC) but runs the software of a digital trunk controller (DTC).

PCM30

A 32-channel 2.048-Mbit/s speech-signaling and message-signaling link used in international trunks.

PDTC

See PCM30 digital trunk controller (PDTC).

peripheral module (PM)

A generic term referring to all hardware modules of DMS-100 Family systems that provide interfaces with external line, trunk, or service facilities. A PM contains peripheral processors, which perform local routines, thus relieving the load on the central processing unit.

peripheral side (P-side)

The side of a node facing away from the central control and towards the peripheral modules. *See also* central side (C-side).

permanent virtual circuit (PVC)

A continuously available virtual path between remote applications and DMS applications. The PVC eliminates the need to establish a circuit on an each call basis.

per trunk signaling (PTS)

Conventional telephony method, which multiplexes a call's control signals with voice or data over the same trunk.

PH

See packet handler (PH).

PM

See peripheral module (PM).

point-of-use power supply (PUPS)

The type of power supply used for an enhanced line concentrating module (LCME). It provides 5V power supply for ISDN line cards. There is one PUPs for each line drawer.

PPSN

See public packet-switched network (PPSN).

PRI

See primary rate interface (PRI).

primary rate interface (PRI)

An interface that carries nB+D channels over a PCM30 digital facility (generally 30B+D for ETSI PRI). PRI is used to link private networking facilities, such as private branch exchanges (PBX), local area networks (LAN), and host computers with a standardized architecture acting as the bridge between private switching equipment and the public network. Formerly known as primary rate access (PRA).

product engineering code

An 8-character code that provides a unique identification for each marketable product manufactured by Northern Telecom.

program store (PS)

In a DMS-100 switch, programmed instructions for the various procedures required to perform processing, administration, and maintenance. Program store is one of the two distinct elements of a DMS-100 memory. The other main element is data store. See also data store (DS), protected store (PROT).

PROT

See protected store (PROT).

protected store (PROT)

In a DMS-100 switch, store type (program or data) that must be explicitly unprotected before any write operation and protected again afterward. This type of store remains allocated and its contents remain intact over all restarts except initial program load (IPL). Protected store is used to hold the office database and translation data equipment configurations. *See also* data store (DS), program store (PS).

PS

See program store (PS).

PSDS

See public switched data service (PSDS).

P-side

See peripheral side (P-side).

PTS

See per trunk signaling (PTS).

public packet switched network (PPSN)

Any common carrier network designed to carry data in the form of packets between public users.

public switched data service (PSDS)

Any common carrier network designed to switch data, not necessarily in packet form, between public users.

pulse code modulation (PCM)

Representation of an analog waveform by coding and quantizing periodic samples of the signal, so that each element of information consists of a binary number representing the value of the sample.

PUPS

See point-of-use power supply (PUPS).

PVC

See permanent virtual circuit (PVC).

Q.921

The CCITT recommendation that defines protocols at the datalink layer.

Q.931

The CCITT recommendation that defines protocols for circuit-switched call control at the network layer.

remote line concentrating module (RLCM)

An equipment frame that provides an interface between two to six DS-1 links (from the line group controller LGC) at the host office) and up to 640 end user lines (connected locally). An RLCM is equipped with one line concentrating module (LCM), a remote maintenance module (RMM), and a host interface equipment (HIE) shelf.

remote maintenance module (RMM)

A peripheral module (PM) with a configuration similar to that of the maintenance trunk module (MTM). An RMM accommodates up to 12 service and test cards.

RLCM

See remote line concentrating module (RLCM).

RMM

See remote maintenance module (RMM).

SAPI

See service access point identifier (SAPI).

service access point identifier (SAPI)

Identifier that is used by datalink layer (layer 2) protocol to define the type of service allowed to an ISDN terminal.

signaling processor (SP)

The interface between a master processor and the control circuits in the line-side of a line module. Through the SP, the line circuits, ringing multiplexers, programmable ringing generators, and the activity circuit are controlled, and their status reported.

SO

See switching office (SO).

SP

See signaling processor (SP).

S/T bus

An eight-wire bus (of which only four wires are used to transmit and receive messages) that connects terminals to the NT1 for access to the ISDN. Also known as an S/T-interface and an S/T-loop. Formerly known as a T-bus.

stimulus signaling

For ISDN call control, stimulus signaling mode messages for call control are sent by the terminal to the network as a direct result of actions by the

terminal user. Terminals that use stimulus signaling have little local intelligence and are driven by the network. These terminals do not keep records of call states. *See also* functional signaling.

S/T-interface

CCITT name for the S/T-bus.

S/T-line card

An ISDN line card that terminates the S/T-bus in the LCME. When S/T-line cards are used, the U-interface and the NT1 are not required. The exchange termination acts as a network termination. *See also* U-line card.

switching office (SO)

A node in the Common Channel Signaling 7 (CCS7) network that originates and terminates signaling messages related to the set up and take down of associated ISDN user part (ISUP) trunks.

TA

See terminal adapter (TA).

telephony agent

Any kind of line, trunk, or special service circuit that performs a telephony function. *See also* agent.

terminal adapter

A device with associated software that allows a personal computer to connect to a Northern Telecom ISDN.

TME

See trunk module equipment (TME) frame.

trunk module equipment (TME) frame

A frame containing one or more trunk modules (TM), maintenance trunk modules (MTM), or office alarm units (OAU).

U-interface

The CCITT term for a U-loop. *See also* U-loop.

U-line card

ISDN line card that terminates the U-loop in the LCME. When U-line cards are used, the NT1, situated on customer premises, acts as the network termination.

U-loop

The portion of a BRI that connects an NT1 to an ISDN line concentrating module or an enhanced line concentrating module (LCME). *See also* U-interface.

unified processor (UP)

A processor that replaces the master processor (MP), signaling processor (SP), and the memory cards associated with these processors.

universal terminal adapter (UTA)

A device with associated software that allows non-ISDN devices such as personal computers to connect to a Northern Telecom ISDN line.

UP

See unified processor.

VC

See virtual circuit.

virtual circuit

In packet switching, a network facility used for transferring data between those data stations emulating physically-connected stations.

X.31

CCITT recommendation for support of terminal equipment by ISDN

X.121

CCITT standard for data network address

XMS-based peripheral module (XPM)

The generic name for peripheral modules (PM) that use the Motorola 68000 microprocessor. An XPM has two processors in a hot-standby configuration: a master processor (MP) and a signaling processor (SP).

XPM

See XMS-based peripheral module (XPM).

XPM Plus

XMS-based peripheral module that uses enhanced hardware and software

DMS-100 Family

Integrated Services Digital Network Primary Rate Interface

Maintenance Guide

Product Documentation–Dept 3423
Northern Telecom
P.O. Box 13010
RTP, NC 27709–3010
1-877-662-5669, Option 4 + 1

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant.This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense. This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules.

Publication number: 297-2401-502
Product release: CCM12
Document release: Standard 07.01
Date: November 1999
Printed in the United States of America

NORTEL NETWORKS™

How the world shares ideas.