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DMS-100 Family

ISDN BRI

ISDN BRI Maintenance Guide

CCM14 and up Standard 13.01 September 2000

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September 2000

CCM14 Standard 13.01

Added changes for feature 59013267

October 1999

CCM12 Standard 12.05

Added changes for features 59006435 and 59006381

August 1999

CCM12 Standard 12.01

Added logs ISDN311 and ISDN312

August 1999

CCM11 Standard 11.02

Removed Line120

March 1999

CCM11 Standard 11.01

Removed references to the nonexistent *Advanced Maintenance Guide*.

Added information on the REX TST ON, OFF commands for XLIUs to chapter 1.

Added note about obsolete BRAKS LTIDs to the List of Terms.

Added log ISDN313 and updated logs ISDN301, ISDN303, ISDN306, and ISDN307 in Table 4-1.

Added information on the DCH autoloader to chapter 1.

August 1998

CCM10 Standard 10.01

Added the NTAX78BA card description to Table 7-1.

Added log reports ISDN303, ISDN306, and ISDN307 to Table 4-1.

Updated log report ISDN301.

Updated Layer 2 and Layer 3 abnormality monitoring in chapter 9.

May 1998

CCM09 Standard 09.02

Added information on the DEFSVCCI tool to chapter 6.

February 1998

Added the following OM groups:

- OM group AUTSPID to table 5-1
- OM group TRMTFR2 to table 5-3

CCM09 Standard 09.01

Added log ISDN305 to the table 4-1.

November 1997

CCM08 Standard 08.02

Corrected description of layer 2 error counts.

September 1997

CCM08 Standard 08.01

- Added the following ISDN logs to table 4-1:
  - AUDT680
  - ISDN116
  - ISDN120
  - ISDN121
  - ISDN122
  - ISDN301
  - ISDN304
- Added the following commands to table 6-2:
  - L2LOGCTRL
  - L3LOGCTRL
- Added information for MP-EOC under commands L1BLMALM, RLAYER, and QLAYER.

  Added the following commands to table 6-3:

- QGRP
- QMADN
- QPHF ARA
- QPHF XSG

  Added the following information to chapter 1:

- provisioning backup D-channels for LGCI and LTCI
- backup D-channel provisioning procedure

June 1997

CCM07 Standard 07.02

Updated material for packet resource reassignment (PHRESREA) and automatic resource assignment (PHARA).

May 1997

CCM07 Standard 07.01

Created chapter 3, "Packet Resource Reassignment Tool," for the features packet resource reassignment (PHRESREA) and automatic resource assignment (PHARA).

September 1996

CCM06 Standard 06.01

Added line maintenance information about the Basic Rate Interface Verification-108 (BRIV-108) testline for Global ISDN (GISDN).

March 1996

CCM05 Standard 05.02

- added information on X.25/X.75 link interface unit (XLIU) congestion controls
- added information about the enhanced services test unit (ESTU) interface to chapter 8

December 1995

CCM05 Standard 05.01

Added information on generic services framework (GSF) call processing for ISDN.

August 1995

CCM04 Standard 04.02

Updated the 2B1Q U-type line card diagnostic tests section.

June 1995

CCM04 Standard 04.01

Released due to new base DRU numbering scheme.

September 1994

LET002, CDN002, LEC002 Standard 03.02

Re-released due to technical errors in front cover.

September 1994

LET002, CDN002, LEC002 Standard 03.01

- added information on line state DMBI
- added ESTU enhancements
- added information about ESTU ISDN test module (ITM)
- added new commands: LOADTE and CHG-PTRST
- added information on User Test capabilities
- added information on applying a patch on enhanced D-channel handler (EDCH)

December 1993

BCS36 and up Standard 02.02

- created chapter 8, "Protocols
- added information on the EDCH
- added an index

September 1993

BCS36 and up Preliminary 02.01

Added DMS packet handler maintenance information.

April 1993

BCS35 and up Preliminary 01.01 first release of this document

Contents

ISDN BRI Maintenance Guide

About this document

When to use this document

This document provides advanced maintenance and troubleshooting information for the integrated services digital network (ISDN) basic 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-10 and DMS-100 Family Product Documentation Directory*, 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
- *CallTrak User Guide*, TAM-1001-012
- *Card Replacement Procedures*
- *Display Call (DISPCALL) User Guide*, TAM-1001-003

- *DMS SuperNode Patching Procedures*, 297-5001-540
- *DMS-10 and DMS-100 Family Product Documentation Directory*, 297-1001-001
- *DMS-100 Family Commands Reference Manual*, 297-1001-822
- *DPN Alarm Console Indications*
- *Hardware Description Manual Reference Manual*
- *Log Report Reference Manual*
- *M5209T Installation Guide*
- *Maintenance and Operational Manual (MOM)*
- *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-I/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-I/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

DANGER
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.
```

1 Maintenance overview

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

Functional description

A DMS-100 ISDN node consists of a DMS-100 circuit switch and a packet switch. The circuit switch is called the exchange termination and is a gateway to the circuit-switched (voice and data) network. The packet handler performs packet switching (data) operations and is a gateway to the packet-switched network.

Two types of packet handlers are supported by the DMS-100 ISDN node: the DPN packet handler and the DMS packet handler. Figure 1-1, "Key components of a DMS-100 ISDN node using a DPN packet handler" on page 1-3 shows the key components of a DMS-100 ISDN node with a DPN packet handler, and Figure 1-2, "Key components of a DMS-100 ISDN using a DMS packet handler" on page 1-4 shows the key components of a DMS-100 ISDN node with a DMS packet handler.

> ***Note:*** The DPN packet handler is not supported for generic services framework (GSF) call processing.

Purpose of ISDN BRI

BRI is typically used to connect groups of ISDN terminals on a customer's premises to an ISDN node. BRI provides end-to-end digital service access over existing telephone lines using a separate signaling channel.

The BRI interface consists of time-division multiplexed (TDM), bidirectional, digital channels known as B- and D-channels. BRI provides ISDN access over two B-channels and one D-channel.

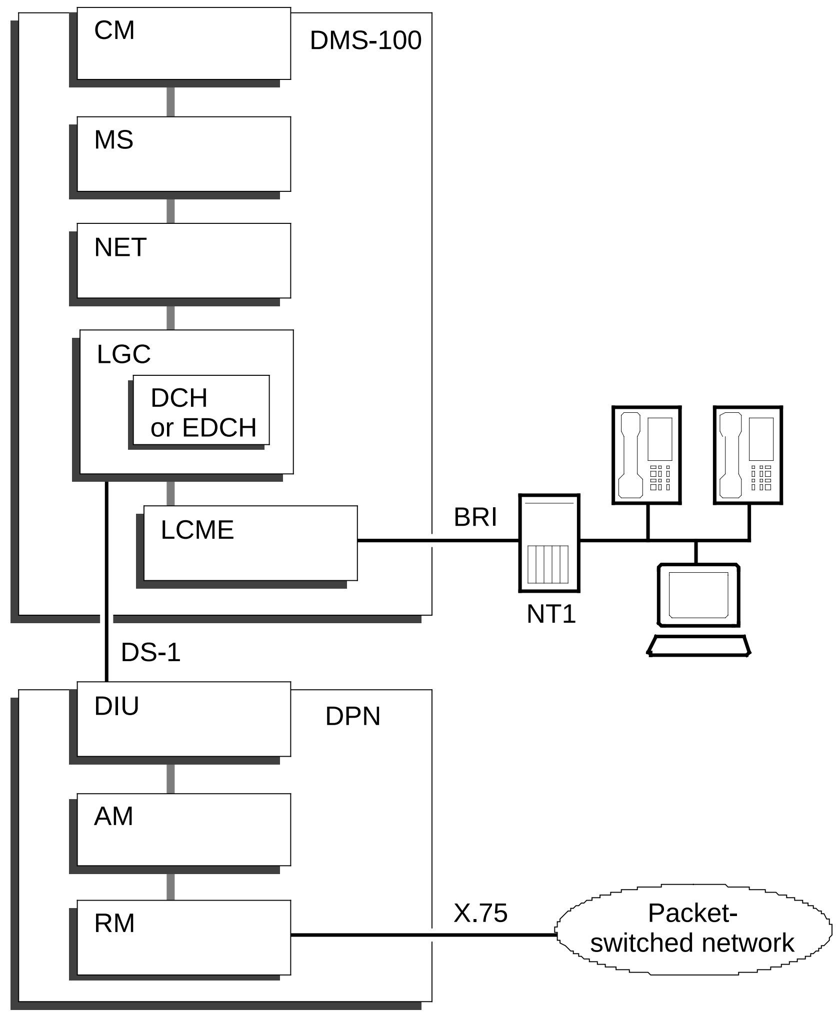
- B-channels operate at 64 kbit/s, and carry voice or data traffic
- D-channels operate at 16 kbit/s, and carry the signaling information required to establish calls on the B-channels, and also carry low speed packet data

ISDN BRI services

ISDN BRI provides access to the following services:

- circuit-switched voice and data services on the B-channel
- high-speed packet data services on a provisioned B-channel
- low-speed packet data services on the D-channel

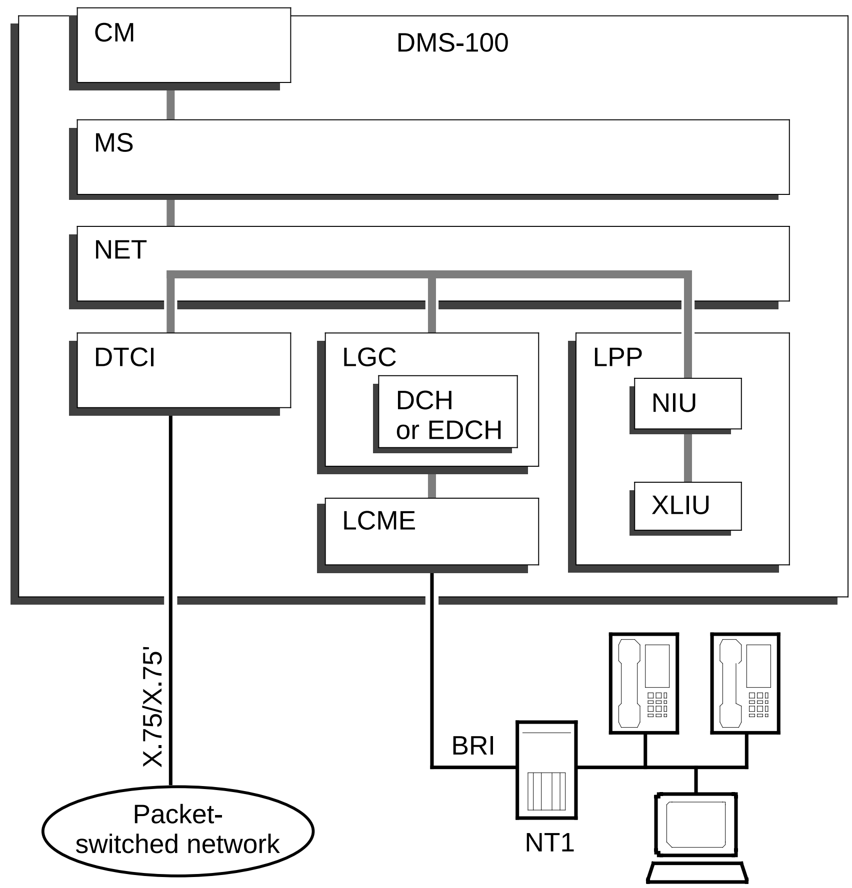
Figure 1-1 Key components of a DMS-100 ISDN node using a DPN packet handler



Legend:

AM	Access module	LGC	ISDN line group controller
CM	Computing module	MS	Message switch
DCH	D-channel handler	NET	Network
DIU	Digital interworking unit	NT1	Network termination 1
DPN	Data Packet Network	RM	Resource module
EDCH	Enhanced D-channel handler		
LCME	Enhanced ISDN line concentrating module		

Figure 1-2 Key components of a DMS-100 ISDN using a DMS packet handler



Legend:

CM	Computing module	LPP	Link peripheral processor
DCH	D-channel handler	MS	Message switch
DTCI	ISDN digital trunk controller	NET	Network
EDCH	Enhanced D-channel handler	NIU	Network interface unit
LCME	Enhanced ISDN line concentrating module	NT1	Network termination 1
LGC	ISDN line group controller	XLIU	X.25/X.75/X.75' link interface unit

Equipment inventory

The equipment required to provide BRI circuit-switched and packet-switched services are

- CM, MS, switching network, and supporting units
- LCME and LGC or LTC and their associated cards
- DS30A, DS30, and DS512 links
- DS-1, X.75, and X.75' trunks

- customer premises equipment
- the DMS packet handler or the DPN packet handler

ISDN BRI services and equipment are described in more detail in Section , "Circuit-switched voice and data service" on page 1-9 and in Section , "Packet-switched data service" on page 1-25.

ISDN BRI services and the various ISDN protocols are discussed in more detail in the next section.

OSI model and ISDN protocols

A set of protocols governs the exchange of data and control information between two ISDN terminals connected through various links to a communication network. These protocols are based on a model containing seven layers, called the open system interconnection (OSI) model. This OSI model has been used as the basis for building protocol structures for ISDN service.

This section briefly describes the OSI model, specifically layers 1 through 3, and ISDN protocols, Q.931, Q.921, and X.25. Layers 1 through 3 govern the setting up of connections and transmission of information between terminals on an ISDN line and the packet- and circuit-switched networks. Table 1-1 summarizes the ISDN call types and messaging formats.

Table 1-1 Summary of protocols for layers 1 through 3

	B-channel protocol			D-channel protocol		
Service	**Layer 1**	**Layer 2**	**Layer 3**	**Layer 1**	**Layer 2**	**Layer 3**
Circuit-switched voice and data	none	none	none	I.431	LAPD, Q.921	Q.931
High-speed B-channel packet	I.430	LAPB	X.25	none	none	none
Low speed D-channel packet	none	none	none	I.431 I.432	LAPD, Q.921	X.25

Note: I.430, I.431, and I.432 are CCITT specifications for the implementation of layer 1 interfaces for both B- and D-channel protocols. Q.921 is the specification for layer 2 of the D-channel protocol; and Q.931, the specification for layer 3.

Layer 1 (physical) protocol

Layer 1 provides the physical characteristics, which includes the physical wire connections, the transmission of electrical signals between endpoints, and the activation and deactivation of links. Layer 1 protocols depend on the type of interface used.

Layer 2 (data link) protocol

The data link layer provides the logical links between the customer premises equipment (CPE) and the exchange termination (ET). Different protocols apply to the B-channel and the D-channel.

D-channel For the D-channel, the layer 2 protocol is link access procedure D-channel (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

B-channel For the B-channels, the layer 2 protocol depends on the application and service provided. For links established on the B-channel, the type of protocol used is called link access procedure, balanced (LAPB). It supports only a single data link that operates with a fixed single-byte address convention between the terminal and the network. It uses the same interlayer communications and system parameters as LAPD (SAPI 16).

The protocol is user-selected and depends on the two terminals used. ISDN does not specify the protocol to be used, and layer 2 does not interpret the protocol. A link is established on the D-channel for a circuit-switched call, and that link is used to obtain access to a B-channel.

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

Layer 3 enables the ISDN node to establish an end-to-end circuit-switched connection between two CPE devices. The layer 3 protocol used depends on the channel carrying the information and on whether the information is packet switched or circuit switched.

The Q.931 protocol is used for call control messages on the D-channel. The X.25 protocol is used for all packet switching on the B-channels and D-channels.

Q.931 protocol

The Q.931 signaling protocol is used for call control. The protocol procedure is based on

- the setup and takedown of calls and features between the network and terminals
- address displays and progress indicators at the terminal and the 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.

X.25 protocol

X.25 is the international protocol for communicating over packet-switched networks for national, international, and private carriers. It provides the three layers of the OSI architecture for data communication. The X.25 protocol is not ISDN-specific.

Layer 1 (physical) level is a synchronous interface data circuit between data terminal equipment (DTE) and data communications equipment (DCE). It therefore defines the physical and electrical interface between the user's equipment and the node of a data packet network.

Layer 2 (frame) level defines the protocol for initiating and controlling error-free data transmission between a DTE and a DCE. Layer 3 (packet) level defines the packet formats and control procedures for the exchange of information between a DTE and the network. The packet format used depends on its function.

Provisioning backup D-channels for LGCI and LTCI

Provisioning backup D-channels is based on the normal availability of two D-channels, the primary and the backup D-channels. Each D-channel resides on the 24th channel of a separate DS-1 facility. These D-channels are limited within a single XPM.

Normally, one D-channel is only used to convey layer 3 call control signaling messages and the other is put in the standby state to act as a reserve. When the D-channel carrying the layer 3 call control signaling messages fails, the standby D-channel is activated. Thus a backup D-channel increases the reliability and guarantees continued PRI services between any switching nodes or networks that are using ISDN PRI.

Provisioning is the activity of inserting the data required to run the switch into the switch's database. The data is stored in a table format in the CM and a copy of these tables is also stored in the XPM in a more organized manner. The primary and backup D-channels are subscribed at pre-service provisioning time as D1 and D2 respectively.

The primary D-channel and the backup D-channel are assumed to have the same characteristics. The provisioning parameters for D-channel characteristics applies to both the primary D-channel and the backup D-channel.

Prior to NA008, when provisioning a backup D-channel both the primary and backup D-channels were placed in the Installation Busy (INB) state. In NA008, only the backup D-channel must be in the INB state while provisioning. If the primary D-channel is in-service while the backup D-channel is being updated, the static data is updated dynamically at the XMS-based peripheral module (XPM).

Backup D-channel provisioning procedure

The following steps allow provisioning of a backup D-channel, at the MAP terminal, without affecting the primary D-channel:

1 Execute these steps at the MAPCI;MTC;TRKS;TTP;PRADCH level.

- **a** Post the backup D-channel.
- **b** Set the backup D-channel to ManB.
- **c** Set the backup D-channel to INB.
- **d** Post the B-channel that will be used as the new D-channel.
- **e** Set the B-channel to ManB
- **f** Set the B-channel to INB.

2 Execute these steps from table control:

- **a** Delete the B-channel in table TRKMEM.
- **b** Provision the backup D-channel to the channel that was the old B-channel in table TRKSGRP.
- **c** Assign the old backup D-channel to a B-channel location in table TRKMEM.

3 Execute these steps at the MAPCI;MTC;TRKS;TTP;PRADCH level:

- **a** Post the new backup D-channel.
- **b** Set the new backup D-channel to in-service (InSv).
- **c** Post the new B-channel.

d Set the new B-channel to in-service (InSv).

Note: This procedure does not apply to provisioning the primary D-channel.

ISDN signaling methods

DMS-100 ISDN supports two signaling methods to communicate between the subscriber's terminal and the switch: functional (Bellcore) and stimulus (Meridian feature transparency [MFT]).

Call control signaling determines whether a terminal can support one or more calls per logical data link on the D-channel. Stimulus signaling allows only one call while functional signaling allows a maximum of five.

Functional (Bellcore) signaling

Functional signaling is based on a peer-to-peer exchange of information between an intelligent terminal and the network. This signaling method allows users to access new network features and services and facilitates ISDN standardization.

Stimulus (MFT) signaling

Stimulus signaling provides a master/slave relationship between the network and the user terminal. The terminal reports key activation to the network, and the network interprets the reports and returns such prompts as audible tones and indicator lamp states to the user terminal. With this type of signaling, only one call per logical data link is allowed on the D-channel.

MFT for BRI (BRAMFT) is an extended stimulus signaling protocol supported by M5317T, M5317TX, and M5317DX sets. It lets the M5317TX and M5317DX sets support all MDC features currently available on non-ISDN Meridian business sets.

Circuit-switched voice and data service

The following sections describe the components used for circuit-switched voice and data service. The components include the following:

- customer premises equipment
- enhanced line concentrating module
- ISDN line group controller
- ISDN line trunk controller
- links
- channels

Many of these same components are used for packet-switched data service described in Section , "Packet-switched data service" on page 1-25.

Customer premises equipment

Customer premises equipment (CPE) is located at the customer site and can consist of the following components:

- a network termination 1 (NT1), which provides the physical connection between the CPE and the exchange termination (ET)
- interfaces such as the S/T-bus and the U-loop
- ISDN telephones, which digitize voice for transmission over the circuit-switched network, and other terminals, such as personal computers, which provide circuit- and packet-switched data
- ISDN universal terminal adapters (TA), which allow non-ISDN CPE to connect to the ET and allow connection of up to eight devices to a single NT1 for BRI

S/T-bus

The S/T-bus is the electrical interface that connects the NT1 to ISDN telephones and TAs. The bus consists of a transmit and a receive pair and requires a bus termination either within the NT1 or connected to the bus, depending on the configuration.

Up to eight ISDN terminals or TAs, each programmed with its own TEI, can be connected to a series of connection points (access points) on the bus. Besides voice and data, the S/T-bus also carries maintenance messages.

U-loop

The U-loop is a two-wire connection between the U-line card on the ET and the NT1. It is also a transmission system carrying a 160-kbit/s signal (TDM information) across the connection. The signal is in the 2B+D configuration. An additional 8 kbit/s is used for maintenance, and another 8 kbit/s for framing.

Network termination 1

When the subscriber loop terminates in a U-line card, the NT1 provides the interface between the central office equipment and the CPE. When the ISDN line terminates in an S/T-line card, the ISDN switch acts as the network termination.

At the physical layer, the NT1 provides the two-way conversion between the B- and D-channel information from the 2B1Q U-loop protocol on the network side and protocols suitable for the S/T-bus on the user side.

ISDN terminal adapter

The ISDN terminal adapter (TA) gives 64-kbit/s, clear, synchronous data access to a B-channel, and a non-ISDN terminal access to an ISDN line.

ISDN terminals

ISDN terminals include voice and data devices such as the M5317T and M5209T Meridian business sets.

Enhanced line concentrating module

The enhanced ISDN line concentrating module (LCME) is a dual-unit peripheral module (PM) that terminates the following line types:

- ISDN 2B1Q U-type
- ISDN S/T-type
- plain old telephone service (POTS)
- electronic business set (EBS)
- Datapath

It also provides access to the ISDN B-, D-, and M-channels. The LCME has the capacity for 480 U-type (single-slot) line cards or 240 S/T-type (double-slot) line cards. Alternatively, the LCME can support 480 POTS or EBS lines, or 240 Datapath lines.

DS30A links connect the C-side of the LCME to a controller PM. The controller PM is either an ISDN line group controller (LGC) or an ISDN line trunk controller (LTC). A maximum of 18 DS30A links provide non-limiting channel bandwidth for up to 239 ISDN lines, even during takeover configurations. On instruction from the LGC or LTC, the LCME associates a DS30A channel with a subscriber line to allow circuit-switched voice and data calls to be placed or received.

ISDN line group controller

The LGC is an XMS-based, dual-unit PM. It provides the following functions:

- D-channel handling and processing
- call processing for all different types of lines (ISDN, EBS, POTS, and Datapath), including Q.931 call processing
- maintenance and diagnostic capabilities

The LGC provides access to the circuit-switched network through one or more PMs, such as the LTC, and access to the public packet-switched network (PPSN) through one or more packet handlers.

The P-side interface of the LGC consists of DS30A links to the LCME and DS-1 links to the packet handler. The LGC provides a DS30 or DS512 interface on its C-side for links that carry information through both planes of the network modules to the DMS-core and to other local PMs, such as the LTC.

The ISDN LGC supports LCMEs. For ISDN basic rate interface (BRI), the LGC is configured with the LCME. If the LCME is fully configured for ISDN-only lines, one LGC supports up to

- one LCME (480 BRI loops) if 2B1Q U-type ISDN, POTS, or EBS line cards are equipped
- two LCMEs if only S/T-type line cards or Datapath line cards are equipped

ISDN line trunk controller

Like the LGC, the LTC is an XMS-based, dual-unit PM. The LTC equipped for ISDN performs similar functions to the ISDN LGC, including

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

In addition, the LTC can function identically to the ISDN digital trunk controller (DTCI), providing primary rate interface (PRI) call processing.

ISDN cards

For more specific information on cards and shelf layouts, refer to the "Cards" chapter.

Links

BRI uses links to establish connections between ISDN components. Depending on the components being connected, the links can be the S/T-bus or the U-loop, the DS30, DS512, DS30A, or DS-1 links, or the V.24 cables. All these links have their respective interface card in the component at which they terminate.

S/T-bus

An S/T-bus is an 8-wire transmission link on the CPE side of an NT1 or S/T line card to which terminals directly or indirectly (using terminal adapters) connect to the ISDN BRI.

U-loop

A U-loop is a two-wire full duplex transmission link between an NT1 and exchange termination (ET). It is also referred to as the BRI line.

DS30

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

A DS30 consists of thirty-two 64-kbit/s channels. Two of the channels are used for signaling. The remaining 30 channels carry various types of information, such as digitized voice and circuit-switched data.

DS512

A DS512 is a fiber optic transmission link used within the DMS-100 switch to connect PMs 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.

DS30A

A DS30A is a four-wire transmission link used within the DMS-100. For ISDN, it is used to connect LCMEs to an LGC over distances of up to 15 m (50 ft).

A DS30A link is similar in channel and signal structure to a DS30 link. However, in addition to digitized voice and circuit-switched data, a DS30A link carries D-channel information and packet-switched data.

DS-1

A DS-1 is an industry standard, 4-wire transmission link used to connect digital systems over distances of up to 160 km (100 mi). It is also referred to as a T1 carrier. It consists of twenty-four 64-bit/s TDM information channels.

For BRI, DS-1 links connect LGC/LTC to a digital interworking units (DIU) providing the physical connection between the ET and the DPN packet handler.

V.24 cables

V.24 cables connect DIU to access modules (AM) and also AMs to resource modules (RM). V.24 cables are also referred to as RS-232 cables.

Channels for BRI

BRI provides the following channels for call placement, control, and maintenance:

- two bidirectional 64-kbit/s B-channels
- one bidirectional 16-kbit/s D-channel
- one bidirectional 8-kbit/s M-channel
- one one-way 800-bit/s Q-channel
- one one-way 800-bit/s S-channel

The subscriber's access to ISDN determines how these channels are used.

B-channels

The B-channel is a full-duplex, synchronous, clear path for carrying voice or data. Each B-channel can be used to carry one of the following:

- circuit-switched (CS) voice and data
- provisioned high-speed packet data (referred to as a Bb channel)

A circuit-switched voice or data call requires the use of both a B-channel and a D-channel. To make such a call, a terminal first communicates with the ET through the D-channel to obtain use of a B-channel for a call.

B-packet (Bb) data is a 64-kbit/s stream of high-speed packet data between a terminal on the line and

- a terminal or computer in a packet-switched network, or
- a terminal or computer of similar capability located on an ISDN line or a DS-1 channel

The D-channel is not required for B-packet calls, because B-packet service is provided by permanently assigning the service to one of the B-channels on a line and to a terminal on that line.

D-channel

BRI uses a single D-channel. Bits on the D-channel are multiplexed into frames. Each of these frames can be used for carrying one of the following signals

- D-call control messages associated with B-channel CS voice and data
- low-speed D-packet signals and associated signaling

D-call control messages flow between ISDN switching equipment and terminals on the ISDN line. Multiplexed low-speed D-packet data flows from a terminal on the line to a terminal in a packet-switched network or to another ISDN line.

Each type of message (call-control and D-packet) is carried in a different frame, allowing the D-channel to carry both types at the same time. The D-channel carries 4:1 multiplexed D-channel information from the LCME through the DS30A card to the D-channel handler (DCH) or enhanced D-channel handler (EDCH). The D-channel from the DS30A card to the DCH or EDCH is often referred to as a Dd channel.

At the DCH or EDCH, the low-speed D-channel packet data is multiplexed and carried by a high-speed 64-kbit/s channel to the packet handler. This channel is referred to as a Bd channel.

Limitations GSF call processing supports the EDCH, but not the DCH.

M-channel

The M-channel is an 8-kbit/s maintenance channel. It uses overhead bits M1 and M6 in each U-loop interface frame in both directions for passing maintenance information between line cards and network termination 1 (NT1). The information includes

- embedded operations-channel lower-level functions
- data transparency status
- NT1 power supply status
- NT1 test mode status
- warm-start capabilities
- results of CRC
- NT1 detection of far end block errors (FEBE) in its receiving frame

Q/S channel

The Q-channel is an 800-bit/s channel that runs from the ISDN terminals to the NT1. The S-channel is composed of five 800-bit/s channels. The first of the S-channels (S1) forms the counterpart of the Q-channel and runs in the opposite direction, that is, from the NT1 to the ISDN terminals.

The Q-channel and the S-channels are commonly discussed together as a single entity, the Q/S channel. The Q/S channel is used for terminal-initiated maintenance purposes on that portion of the line between the terminal and the NT1.

Circuit-switched voice and data call routing

Table 1-2 provides a simplified description of call routing for circuit- switched voice and data calls through the ISDN node and figure 1-3 illustrates this call path. This table and diagram provide a quick review of the ISDN components and their functions.

Table 1-2 Circuit-switched voice and data call routing (Sheet 1 of 2)

Component	Function
U-loop	transports B- and D- data to LCME
LCME	receives BRI 2B+D information through U-loop
2B1Q line card	sends data through L-bus to the BIC
BIC	multiplexes four 16 kbit/s D-channels onto one 64 kbit/s digroup channel

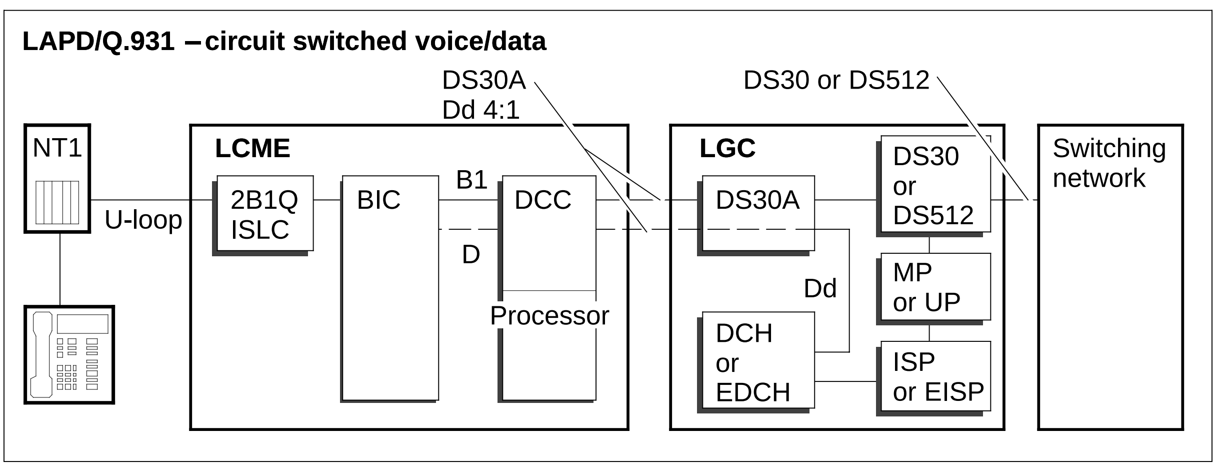
Note: GSF call processing supports the EDCH, but not the DCH.

Table 1-2 Circuit-switched voice and data call routing (Sheet 2 of 2)

Component	Function
DCC	provides the B- and D-channel connection to DS30A link
LCME processor card	monitors line cards and BICs and controls DCC DS30A channel allocation
DS30A link	transports B- and TDM D-channel information to DS30A card
DS30A card	sends circuit-switched B-channel information to DS30 or DS512 card sends TDM D-channel information to DCH or EDCH (Dd)
DCH or EDCH	routes Q.931 messages to the ISP or EISP
ISP or EISP	processes Q.931 messages
MP/SP or UP	allocates the B-channel path between DS30A card and DS30 or DS512 card
DS30 or DS512 card	receives B-channel circuit-switched information

Note: GSF call processing supports the EDCH, but not the DCH.

Figure 1-3 Circuit-switched voice and data call routing



Fault conditions

This section describes the faults that cause ISDN components to fail or to operate at less than optimal efficiency.

ISDN line faults

The following faults can cause an ISDN line to go into a trouble state:

- a cut line, defective ground, or an open pair
- a faulty NT1 (either it is not powered up or has a faulty power supply)
- noise or poor transmission quality
- high protocol abnormalities and errors (2B1Q)
- a faulty or overloaded LCME or LGC
- a faulty or overloaded DCH, EDCH or ISDN service group (ISG)
- incorrect or missing datafill
- faulty or overloaded line cards
- improper S/T-bus termination
- an overloaded line card not reported as an incoming message overload (ICMO) line

LCME faults

An LCME fault can be caused by the following conditions:

- a faulty line drawer—a BIC or line card is faulty which results in the line drawer being faulty
- a faulty shelf circuit pack—a power converter card (PUPS), digroup controller card, or LCME processor card is defective
- faulty line cards—a line card is defective
- faulty DS30A links—C-side links to LGC or LTC are faulty
- a load file mismatch—a load in the LCME does not match the load file in table LCMINV
- an overload LCME—overutilized LCME processor caused by high traffic levels

LGC or LTC faults

An LGC or LTC fault can be caused by the following conditions:

- an overloaded LGC or LTC—high traffic causes a shortage of the following resources: processor real time, P-side or C-side links, messaging buffers, or call processing blocks
- DS30 or DS512 links out of service—faulty C-side links to the network cause a disruption of messaging from the CC
- DS30A links out of service—faulty P-side links to LCME make channels unavailable to process subscriber calls

- DS-1 links out of service—faulty DS-1 links to the DPN packet handler make channels unavailable to handle B-channel packet or D-packet calls
- faulty cards in LGC or LTC—caused by hardware or software problems
- an overloaded ISP, EISP, DCH or EDCH—caused by an overload of SAPI 16 data
- a mismatch (incorrect datafill)—the table data in the PM and CC do not match
- a data mismatch—the inactive unit does not have the same data as the active unit
- parity errors—a hard, soft, or intermittent parity fault

DCH or EDCH faults

A DCH or EDCH fault can be caused by the following conditions:

- a faulty circuit card—the DCH or EDCH card is defective
- a faulty LGC or LTC—the C-side peripheral (LGC or LTC) is overloaded or is out of service
- an overloaded DCH or EDCH—the DCH or EDCH is incapable of processing all the data it receives in a finite time period. High-volume traffic in a DCH or EDCH is generally caused by SAPI 16 (packet-switched) service. Generally, DCH or EDCH overload control balances the traffic load when the DCH or EDCH enters the congestion state.
- a command protocol violation, a problem with sparing, an incorrect PEC, a loadname mismatch, incorrect datafill, or out-of-service ISG channels

Limitations GSF call processing supports the EDCH, but not the DCH.

ISG faults

An ISDN service group (ISG) defines the services that a DCH or EDCH provides. The ISG assigns channels to the services, for example, channel 1 for BRA and channel 30 for Bd. An ISG is a service group that can move from one DCH or EDCH to another DCH or EDCH, that is, it is hardware independent. Each ISG contains 32 communications channels that operate at 64-kbit/s. Channel 0 is reserved for communication with the ISP or EISP card, located in the LGC.

An ISG can have the following faults:

- a faulty LGC or LTC—the C-side peripheral (LGC or LTC) is overloaded or is out of service
- faulty DCH or EDCH—overloaded or faulty circuit card
- datafill problems

DS30A link faults

A DS30A link can have the following fault conditions:

- a faulty DS30A card
- a defective speech or message link
- a fault in the LGC, LTC or LCME

DS30 link faults

A DS30 link can have the following faults:

- a faulty DS30 card
- a faulty message or speech channel
- a fault in the PM or DMS packet handler
- a fault in the network

DS-1 link faults

A DS-1 link can have the following faults:

- frame losses, slips, and bipolar violations
- faulty DS-1 card
- faulty PM or DPN packet handler

Faults on customer premise equipment

The following faults are associated with CPE equipment:

- incorrect programming
- loss of power
- defective equipment
- incompatible bearer capability
- duplicate TEIs
- problems with features

These faults generally cause the ISDN service to the CPE to be disrupted for some or all call processing. These faults do not affect the ISDN line state.

Faults on NT1

The following faults are associated with the NT1:

- no power or faulty power supply
- defective hardware

These faults generally cause the ISDN line to go into a lockout (LO) state.

ISDN automatic maintenance

Some ISDN fault conditions are identified by automatic maintenance. Automatic maintenance is the combination of fault detection and fault correction. Fault detection is made possible by a combination of hardware and software functions.

Once a fault is detected, a number of strategies can be employed in the DMS-100 switch for automatic fault correction:

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

The following sections describe ISDN automatic maintenance, which includes

- ISDN line maintenance
  - automatic line testing (ALT)
  - automatic line diagnostics (shower queue)
- ISDN PM maintenance
  - switch of activity (SWACT)
  - routine exercise (REx) testing
  - DCH autoloader

This section covers those aspects of line and peripheral module (PM) maintenance that are specific to ISDN. Automatic maintenance employed for lines and PMs in general, for example REx testing and SWACTs, also applies to ISDN.

Automatic line testing

Automatic line testing (ALT) tests subscriber lines without manual intervention by maintenance personnel. Logs ALT101, ALT108, ALT109, ALT110, and ALT111 are used to display test results.

The LINETYPE option in the DEFINE command specifies the type of lines that ALT is to test. The choices for LINETYPE are STANDARD, ISDN, and ALL:

- STANDARD tests only non-ISDN lines
- ISDN tests only ISDN lines
- ALL tests all lines

If all the lines in an LCME are ISDN, the option lineTYPE ISDN is used to test the LCME. This allows more efficient utilization of test equipment.

Automatic line testing skips lines on which

- a loopback is set
- BERT is running
- TSTSGNL is running

Automatic line testing also skips ISDN lines that are babbling or that are in the shower queue.

ALT tests ISDN lines in the following states:

- maintenance busy (MB), unless the line is also seized
- lock-out (LO)
- hardware assigned software unassigned (HASU), but only the line card is diagnosed
- D-channel maintenance busy (DMB)

The extended diagnostics test (DIAG) and the line insulation test (LIT) tests ISDN lines in which the CO relay at the line card is operated. The short diagnostics test (SDIAG) does not tests these ISDN lines. The ALT test skips ISDN lines in which the line card cut-off (CO) relay is operated.

Automatic line testing performs the following tests:

- extended diagnostics (DIAG)
- short diagnostics (SDIAG)
- line insulation test (LIT)
- keyset line circuit test (CKTTST)

The diagnostics run by ALT are the same as the ones available at the line test position (LTP) level of the MAP.

Tests DIAG and SDIAG are used to determine if a fault exists on a line. The DIAG tests for ISDN lines affect service, while the SDIAG tests do not affect service.

The diagnostic tests run if a DCH or EDCH and a network termination 1 (NT1) are on the line. For example, the continuity test to the ISLC in the extended diagnostics does not run if the associated DCH or EDCH is unavailable. A DIAG test fails if the NT1 is missing on an ISDN line.

LIT detects foreign potential and inadequate conductor leakage resistance on a subscriber loop. It is similar to the command LNTST at the LTPLTA level of the MAP.

The LIT runs on the U-ISLC, but not on the S/T-ISLC (BX26AA). When you perform the LIT on an ISDN line, the cutoff relay on the line card is operated. This means that service is affected.

The capacitance test in LIT requires that the cutoff relay on the line card be operated. This causes a one-minute service outage.

The command DEFINE at the ALTLIT sublevel of the MAP can be used with ISDN 2B1Q lines. Refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822.

The default values for the LIT parameters are supplemented for ISDN lines as follows:

- The ALTLIT MAP display is modified so that only user-supplied values for the LIT parameters are displayed.
- Table ALTSCHED is modified so that only user-supplied values for the LIT parameters are stored.
- Command LITINFO at the LIT level of the MAP is used to display the system default values for the LIT parameters.

The CKTTST test is used on keyset lines, including ISDN 2B1Q lines. The test sends messages out toward the subscriber terminal. The messages are looped back at the line card or at the subscriber terminal, and the returned messages are compared with the transmitted messages.

The DEFINE command at the ALTCKTTST sublevel of the MAP can be used with ISDN 2B1Q lines. Refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Automatic line diagnostics

Automatic line diagnostics tests check the loop components to determine if a fault exists in

- the line card
- the NT1
- the loop
- the D-channel path

Line diagnostics can be invoked from the LTP level of the MAP by issuing the command DIAG and from the shower queue. Lines are sent to the shower queue because of trouble reports from the peripherals, or because of two successive failures to terminate a call on the line. Without taking the line out of service, a limited diagnostic is performed on the line registered in the shower queue.

Limitations GSF call processing does not support the shower queue. ISDN ICMO lines do not require a full diagnostic. An automatic three-stage ISDN ICMO diagnostic sequence is used to troubleshoot an ICMO lines. The tests are the following:

- line card reset
- diagnostic on line card only
- full diagnostics

For more information on the diagnostics tests performed on the line cards, see the chapter "Troubleshooting" in this document.

ISDN PM maintenance

The DMS-100 has many self-checking features for PM automatic maintenance. These features include the following:

- switch of activity (SWACT)
- routine exercise (REx) test
- DCH autoloader

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) or warm (established calls are maintained but calls in a transient state are dropped)
- controlled (requested by system or operating company personnel) or uncontrolled (unit stops responding)

Routine exercise test (REx) A REx test includes a series of tests performed on an XPM unit, ideally initiated on a daily basis by the system scheduler or manually by operating company personnel. The REx test combines the diagnostic and functional routines available on XPMs. Results of the REx test can be divided into four classes:

- not performed
- passed
- failed
- aborted by manual action (that is, maintenance action with the FORCE parameter or with the ABTK command from another MAP terminal with the XPM posted).

All four classes output a log or display a message at the MAP terminal. Only passed and failed REx tests are stored in the maintenance record. Failure reasons are available for failed REx tests.

DCH autoloader The DCH autoloader loads and returns to service a DCH after any of the following:

- a power loss to a DCH
- the DCH card is removed from its shelf
- the DCH load becomes corrupt

The loader services one card at a time. The system records the serviced DCHs in log DCH604. The operating company might decide to abort the autoloader process and manually load multiple DCHs in parallel to save time.

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 operational measurements (OM) 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.

Trouble tests

Trouble tests are conducted manually to locate faults that are identified by the following sources:

- subscriber reports
- call processing test reports
- ALT reports or failures
- routine maintenance

Most of the trouble tests are conducted from the LTP level or PM level and from the following subtending levels:

- LTPLTA
- LTPMAN
- LTPDATA
- LTPISDN
- LGC/LTC
- DCH
- ISG
- LCME

Commands for most of the tests are included in menus at each level, together with commands for maintenance actions used in conducting the tests. The commands for these tests are described in the chapter "User interface." Also refer to the chapter "Troubleshooting" for a description of the test tools and test configurations used.

Packet-switched data service

D-channel and B-channel X.25 packets that come into a DMS-100 over an ISDN line are processed by either the DMS packet handler or the DPN packet handler. The DMS packet handler, illustrated in figure 1-4, is an integrated peripheral of the DMS-100 switch. The DPN packet handler is an external node that is connected to the DMS switch by a DS-1 trunk.

Limitations

The DPN packet handler is not supported for GSF call processing.

DMS packet handler

The DMS packet handler uses the existing DMS switch operations, administration, maintenance (OA), and provisioning systems.

XLIU maintenance

DMS PH X.25/X.75/X.75′ link interface unit (XLIU) maintenance is performed at the PM level of the MAP terminal. Integrated processor and F-bus interface (IPF) and high-speed data link control frame processor (HFP) maintenance is performed remotely through the IPF/HFP maintenance interface. Maintenance tools available through this interface include

- local DMS PH application maintenance
- local XLIU maintenance
- local NIU maintenance
- link maintenance
- layer 1 and layer 2 provisioning

Routine exercise tests Routine exercise (REX) tests are automatic tests performed at regular intervals on switch hardware equipment (spare or otherwise) by internal software. For example, REX tests run on the CM, the MS, and spare XLIUs. These tests determine the health of a piece of hardware. For example, all spare XLIUs run REX tests regularly to detect faults. A failing XLIU (an XLIU on which a fault is detected when the REX is running on it) is made system busy, and will not be used for sparing until it is recovered and put back into service.

You can suspend REX testing on an XLIU in two ways: by setting AUTO_SPARABLE to N in table LIUINV, or by issuing the TST REX OFF menu command at the MAPCI level. The following messages can result from the TST REX ON (or OFF) command at the MAPCI level.

Table 1-3 TST REX ON and OFF command messages

Message	Meaning
`WARNING: REX test should not be disabled on an auto-sparable spare XLIU. Do you wish to continue?`	You tried to disable REX testing on an auto-sparable spare XLIU. REX tests should run on all spare XLIUs regularly to detect faults. If the REX test is disabled on an auto-sparable spare XLIU for a long time, the health of the XLIU is not known during that time. Log IOAU 112, which indicates the number of days during which the equipment has not been REXed, will be generated. Answer Y to continue. A QUERYPM shows that the test is disabled.
`REX test on XLIU cannot be enabled: non auto-sparable.`	You tried to enable a REX test on a non auto-sparable XLIU. To correct, set AUTO_SPARABLE in table LIUINV to Y.
`REX test on XLIU cannot be enabled: XSG is assigned.`	You tried to enable a REX test on an XLIU on which an X.25 service group (XSG) is assigned. To correct, delete the XSG mappings.
`REX test on XLIU is enabled: thru map.`	You tried to re-enable a REX test. The REX test is automatically enabled when AUTO_SPARABLE in table LIUINV is set to Y.

XLIU overload and congestion controls

The XLIU monitors itself for overload and congestion as an activity of automatic local maintenance. There are five possible ISTb conditions that can be activated. The reasons for the ISTb conditions are issued in a PM181 log report. Control algorithms in the XLIU restrict traffic to the XLIU during these conditions, which are described in the following list:

- When there are excessive packets within the XLIU, new incoming packets to the XLIU are dropped. This causes the XLIU to change to ISTb with the reason `Packet drop threshold reached`. The XLIU returns to InSv when incoming packets are no longer dropped.
- When the buffer management system (BMS) free buffer pool is depleted below the mild congestion level due to high levels of traffic, the dynamic window (DW) algorithm takes effect to decrease the Layer 3 flow-control window in order to limit the XLIU data traffic flow. This causes the XLIU

to change to ISTb with the reason `BMS DW congestion threshold reached`. The XLIU state returns to InSv when the BMS free buffer pool recovers above the mild congestion level.

- When the HDLC frame processor (HFP) buffer management (HBM) free buffer pool is depleted below the mild congestion level due to high levels of traffic, the DW algorithm takes effect to decrease the Layer 3 flow-control window in order to limit the XLIU data traffic flow. This causes the XLIU to change to ISTb with the reason `HBM DW congestion threshold reached`. The XLIU state returns to InSv when the HBM free buffer pool recovers above the mild congestion level.
- When the BMS free buffer pool is depleted below the severe congestion level due to overloaded traffic, the receiver not ready (RNR) algorithm takes effect to send Layer 2 RNRs to the affected DTEs in order to stop input data traffic. This causes the XLIU to change to the ISTb state with the reason `BMS RNR@L2 threshold reached`. The XLIU state returns to InSv when the BMS free buffer pool recovers above the severe congestion level.
- When the HBM free buffer pool is depleted below the severe congestion level due to overloaded traffic, the RNR algorithm takes effect to send Layer 2 RNRs to the affected DTEs in order to stop input data traffic. This causes the XLIU to change to ISTb with the reason `HBM RNR@L2 threshold reached`. The XLIU state returns to InSv when the HBM free buffer pool recovers above the severe congestion level.

NIU maintenance

The network interface unit (NIU) provides the XLIU with channelized access to the enhanced network (ENET) or junctored network (JNET). The NIU and the C-bus ports are maintained at the PM and DEVICES levels of the MAP terminal.

LIM and F-bus maintenance

DMS messaging to and from the XLIU is routed by the link interface module (LIM). The LIM and F-bus are maintained at the LIM and FBUS levels of the MAP terminal.

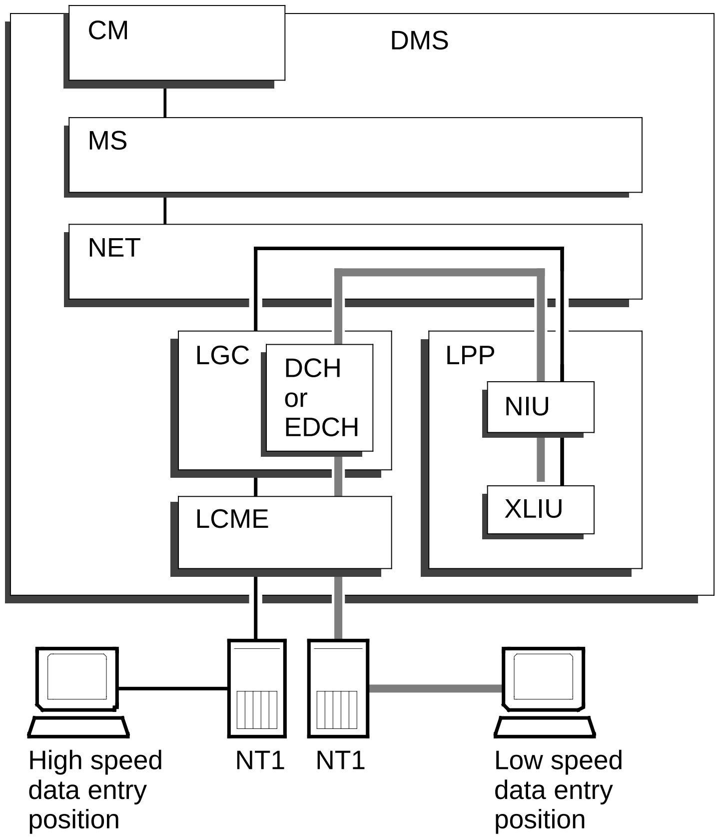
Line maintenance

DMS PH B- and D-channels on ISDN lines are maintained using the LTP, LTPDATA, and LTPISDN levels of the MAP terminal.

Trunk maintenance

DMS PH X.75 and X.75′ trunks are maintained using the TTP, CARRIER, and X75TTP levels of the MAP terminal.

Figure 1-4 DMS packet handler X.25 packet processing



Legend:

CM	Computing module	MS	Message switch
DCH	D-channel handler	NET	Network--JNET or ENET
EDCH	Enhanced D-channel handler	NIU	Network interface unit
LCME	Enhanced ISDN line concentrating module	NT1	Network termination 1
LGC	ISDN line group controller	XLIU	X.25/X.75 link interface unit
LPP	Link peripheral processor		

B-channel access has a dedicated path through the network to the XLIU.
The D-channel terminates at the DCH, where packets are processed by the DCH and forwarded to the XLIU.

D-channel maintenance

DMS PH D-channels are maintained at the ISG and DCH levels of the MAP.

Protocol monitoring

DMS PH X.25 protocol can be monitored at the DMS using the following tools:

- the QCOUNTS command (layers 1, 2, and 3)
- digital test access (DTA) and a protocol analyzer

DMS PH X.75/X.75′ protocol can be monitored at the DMS using the following tools:

- the QCOUNTS command (layers 1, 2, and 3)
- a protocol analyzer attached to the trunk PM

Troubleshooting tools

DMS PH related troubleshooting tools include

- query commands
- CallTrak
- PMDEBUG
- DISPCALL
- PMIST/XPMIST

Provisioning

The table editor provides the interface to datafill X.75/X.75′ trunks, XLIUs, and all hardware and access resources to the XLIUs. The Service Order System (SERVORD) provides the interface to define logical terminals, services, and packet service parameters.

Provisioning for GSF call processing utilizes TR199, which replaces the table editor and SERVORD. Datafilling X.75/X.75′ trunks, XLIUs, and all hardware and access resources to the XLIUs, and packet service parameters uses a TR199. Logical terminals are not supported for GSF call processing.

Table 1-4 lists the DMS PH related tables that are datafilled using these two tools.

Table 1-4 DMS PH-related tables (Sheet 1 of 2)

Tables datafilled by the table editor		Tables datafilled by SERVORD	
ISDN lines	**X.75 trunks**	**ISDN lines**	**X.75 trunks**
CARRMTC	CLLI	CUGINFO	none
DCHINV	CUGINFO	DNCHNL	
ISGDEF	LIUINV	DNCTINFO	
LCMINV	NIUINV	HUNTGRP	
LIUINV	OFCENG	HUNTMEM	
LNINV	PVCINFO	KSETINV	

Table 1-4 DMS PH-related tables (Sheet 2 of 2)

Tables datafilled by the table editor		Tables datafilled by SERVORD	
ISDN lines	**X.75 trunks**	**ISDN lines**	**X.75 trunks**
LTCINV	SPECCONN	KSETLINE	
LTCPSINV	SUSHELF	LTDEF	
LTPGRP	SVCDATA	LTMAP	
NIUINV	SVCRATE	PVCINFO	
OFCENG	TRKGRP	SPECCONN	
SPECCONN	TRKMEM		
SUSHELF	TRKSGRP		
SVCDATA	XSGDEF		
SVCRATE	X75INFO		

DPN packet handler

DPN packet handler maintenance is performed through an an external OAM processor. DPN packet maintenance is described in the 241-1001 and 241-2001 layers of Northern Telecom (Nortel) publications (NTP).

Limitations

The DPN packet handler is not supported for GSF call processing.

2 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 (MMMR)
- switch performance and monitoring systems (SPMS)
- routine exercise (REx) testing
- network maintenance
- line maintenance
- focused maintenance
- operational measurements (OM)
- routine maintenance

These maintenance processes are applied to the following integrated services digital network (ISDN) basic rate interface (BRI) components:

- customer premises equipment (CPE)
- BRI access lines
- exchange termination (ET)

- DMS packet handler
- ISDN signaling and trunks

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

- network and PM integrity parity maintenance
- DS-1 carrier maintenance
- TTP and LTP functions
- routine maintenance (BERP, NETFAB)

Maintenance manager's morning report

The maintenance manager's morning report (MMMR) is a switch management tool 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
    - XPM switch-of-activity (SWACT) information

- scheduled test results including
  - scheduled line maintenance using automatic line testing (ALT)
  - scheduled trunk maintenance using automatic trunk testing (ATT)
- switch operations including
  - image dump results
  - patch summary
  - outage indicators
  - table data integrity check
  - unscheduled XPM REx test

Switch performance monitoring system

The switch performance monitoring system (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

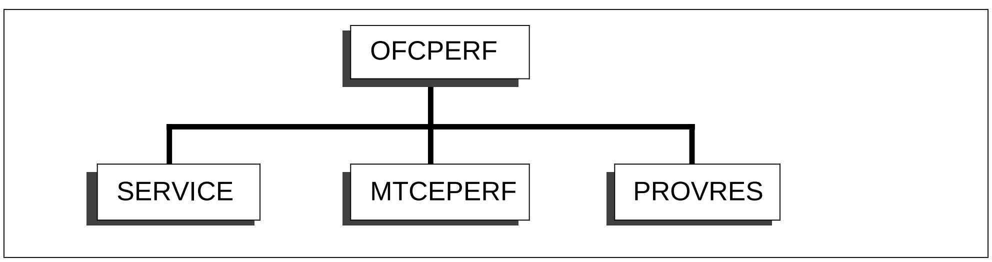


Table 2-1 SPMS indexes (Sheet 1 of 2)

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.

Table 2-1 SPMS indexes (Sheet 2 of 2)

Level	Description
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 Table 2-2.

Table 2-2 SPMS index performance ratings

Index result	Performance rating
100	perfect
96-99	above average
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.

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 line test (ALT) 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 could 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 can 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 BRI peripheral modules. 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 PMs using the TST REX ON or the TST REX OFF command after posting the PM.

For more information on the office parameter NODEREXCONTROL, refer to the *Office Parameters Reference Manual*. For information on the TST REx ON/OFF command, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

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 PM

Logs PM131, PM128, and PM181 are suppressed when a REx test fails and the log PM600 is generated. For more information on BRI logs, refer to chapter 4, "Logs" on page -1.

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 PM 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:

- For offices that have a NT40 switch, the system REx (SREx) controller runs REx tests on one XPM at a time. For offices that have a DMS SuperNode switch, concurrent REx tests can occur on up to ten XPMs, if the XPMs have the same REx test class.
- 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.

After successful completion of a REx test, the PM has a new active unit because of the SWACT. In addition to the above restrictions, the following notes 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 can be due to either a system or a 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 software release applications.

Network maintenance

For the network to function properly, a low bit error rate (BER) must be maintained. Table Test tools available for network maintenance 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. The test consists of sending a stream of known data over a specified B-channel of an ISDN line, and with loopback points selected on the ISDN line card or on the NT1, comparing the returned signals. The test, with the loopback points, also allows line faults to be isolated.

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

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 testing feature (NETFAB)	Identifies network problems by automatically integrating its testing procedure with that of ICTS.
XPM bit error rate testing (XPM/LCME XBERT)	Detects BER errors in the XPM/LCME 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.

For more information on the commands used with network maintenance tools, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Line maintenance

Tests for ISDN line cards include the following:

- DC metallic testing from the LTP through the MTU and ISDN line circuit
- BERT testing from the LTP on a B-channel using an appropriate loopback point to give a measure of transmission and service quality and a means to isolate sources of fault
- loopbacks set to test the continuity of the D-channel to the P-side of the line card, the C-side of the line card, and the T-interface at the NT1

- diagnostic line card testing invoked manually by a command or initiated by the shower queue
- BERT testing from the customer premises equipment (CPE) without maintenance staff support at the central office. The Basic Rate Interface Verification-108 (BRIV-108) testline is valid only for use by Circuit-Switched BRI calls. Maintenance staff are able to access dialable loopback on a BRI B-channel and then perform a BERT test using an external third-party test box.

NT1 and U-loop testing

Maintenance and diagnostic testing on the U-loop and NT1 are conducted from the LTP level of the MAP display.

NT1 testing

The tests to the NT1 include

- B-channel loopback at the T-interface, where the loopback is toward the network or toward the terminal, or toward both
- full-frame analog loopback at the T-bus connector of the NT1

These tests can be used for quick verification of the transmission link by reading from or writing to the registers from the network through M-channel messages. The errored seconds counter is one such register. An excessive errored second count indicates the need for maintenance action.

The status of the NT1 parameters, for example, U-SYNC and T-SYNC, can be queried by the maintenance software in the DMS-100 and the M-channel read-bit and write-bit messages.

U-loop testing

The line card contains a cut-off relay that can open the U-loop to the network to facilitate analog and digital loop testing. The relay is operated through an M-channel message and is automatically released after a timeout.

A B-channel loopback toward the NT1 can be set by dialing the 108 test code from a device on the loop. This enables loop testing from the customer premises equipment without using the MAP terminal.

Focused maintenance

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

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 and FM101 for LCD 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, LNSTRBL or 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 in 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 2,000 OMs organized into approximately 150 OM groups. OMs provide the single 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 the past few minutes (real-time analysis).

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

Routine maintenance

On-going maintenance aims to sustain the network and PMs 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 (Sheet 1 of 2)

Procedure	Interval
ALT analysis	Daily
ATT analysis	Daily
Automatic BIC relay test	Weekly
BERP	Daily
Circuit test	Daily

Table 2-4 Recommended routine maintenance procedures (Sheet 2 of 2)

Procedure	Interval
Extended diagnostics	Daily
IBERT	Daily
ICTS	Determined by operating 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
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/LCME XBERT	Determined by operating company personnel

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

3 Packet Resource Reassignment tool

This chapter describes the Packet Resource Reassignment (PHRRCI) tool for integrated services digital network (ISDN) basic rate interface (BRI). It includes information on

- PHRRCI's position in the MAP level hierarchy
- description of PHRRCI functionality
- PHRRCI commands
- component interworking
- PHRRCI error messages and error recovery

Description of PHRRCI functionality

The PHRRCI tool simplifies the load-balancing activities that the technician performs. It allows the technician to

- move a B-packet terminal to another XSG/XLIU
- move a D-packet terminal between Bd channels
- move a Bd channel to another XSG/XLIU

The technician can specify the destination resource using command line parameters. Alternately, the technician can omit the destination parameter and let the automatic resource assignment feature choose the destination. There is also a FORCE option that lets the technician force release active calls on the resource to be moved.

The PHRRCI tool is designed with simplicity in mind. Manual load balancing involves a series of actions and requires that the technician find or keep track of any LTIDs affected and find a destination resource for the entity being moved. PHRRCI completes the series of actions through a single command.

Starting with NA014, the PHRRCI tool can be used to move all of the Bb and Bd channels associated with an LTID that supports DN(s) with the On-demand B-channel (ODB) option from one XSG to another. The following example shows an example of the PHRRCI MOVE command used to move all of the Bd channels for LTID NI2 100 from XSG 102 to XSG 101.

Figure 3-1 Example of MAP display for PHRRCI MOVE command where XSG channels are for LTID supporting DNs with ODB option

```
>PHRRCI
PHRRCI Packet Resource Reassignment Tool:
>MOVE NI2 100
Request Queued at position 1
Processing Started on Request 1
INFO-Current LTMAP entry has been removed (NI2 100)
INFO-This LTID consists of ODB DNs
INFO-New LTMAP entry for ODB has been successfully created
RESULT-LTID (NI2 100) successfully moved from XSG 102 to XSG 101
Done
```

If the LTID is provisioned with D packet DNs along with the ODB DNs, the PHRRCI MOVE command must be used to move the Bd channels on the LTID to a new location. The following example shows the PHRRCI MOVE command used to move the LTID NI2 100 Bd channel from Bd channel 30 to Bd channel 31.

Figure 3-2 Example of MAP display for PHRRCI MOVE command where Bd channels support D packet DNs

```
>PHRRCI
PHRRCI Packet Resource Reassignment Tool:
>MOVE NI2 100 Bd 31
Request Queued at position 1
Processing Started on Request 1.
INFO-Current LTMAP entry has been removed (NI2 100)
INFO-Previous LTMAP entry has been restored (NI2 100)
RESULT-LTID (NI2 100) successfully moved from Bd 30 to Bd 31
Done
```

Multi-user protection

The tool is designed such that multiple tool users can not affect the same resource simultaneously. Also, users can perform service moves much faster than a user manually at table control, thus further reducing the likelihood of problems arising during service moves.

Error recovery

On errors, the PHRRCI attempts some form of recovery action. In most cases, the system attempts to return resources to their initial configuration.

After the SPECCONN is moved for a Bd channel, the system attempts to place all LTIDs that are on the initial Bd channel onto the new Bd channel. Any LTIDs that do not properly attach to the destination channel are noted in a message to the user but no further action is taken. This action is analogous to the way in which an individual technician manually performs the action through table control.

Similarly, if any of the maintenance commands used return terminals to service fail, then a message is issued to the user and no further action is taken. In all cases where errors occur (whether it results in a back-out or an ignore), the user receives a message explaining what went wrong.

Restart recovery

The PHRRCI tool is also designed so that service moves that are interrupted by restarts are continued once the restart is complete. Any unacknowledged requests are discarded and any moves that undergo a restart recovery produce a log entry in the resource reassignment log.

Limitations

The PHRRCI is designed as a “macro” type of CI command which transparently performs all of the required steps for the user. In this way, the CI tool is vulnerable to many of the same problems as manual table control. At this time, there is no guarantee that the technician has exclusive access to the resources in question during moves. Just as a second technician might create problems for a technician manually performing moves, it can potentially create problems for the PHRRCI tool.

Commands

This section lists and describes PHRRCI commands. Table 3-1 describes the commands.

Table 3-1 PHRRCI commands

Command	Level	Description
PHRRCI	CI	Opens the PHRRCI directory.
MOVE	PHRRCI	The primary command that allows the technician to perform resource moves
QUIT	PHRRCI	Exits the PHRRCI directory and returns the technician to the CI level.
HELP	PHRRCI	Provides on-line help for the PHRRCI MOVE command.

The MOVE command parameters are shown in Figure 3-3.

Figure 3-3 MAP level hierarchy

```
MOVE  [ <ltid_grp1> <ltid_#1>       ]  [ TO Bd <channel1>  ]  FORCE

      [ <ltid_grp2> <ltid_#2>       ]  [ TO XSG <xsg_#>    ]
      [                             ]  [ TO XLIU <xliu_#>  ]

      [ DCH <dch_#> <channel2>      ]  [ TO XSG <xsg_#>    ]
      [ ISG <isg_#> <channel2>      ]  [ TO XLIU <xliu_#>  ]
```

Table 3-2 describes the parameters for the MOVE command.

Table 3-2 MOVE command parameters

Parameter	Value	Definition
ltid_grp1	the LTID group name	D-packet terminal group identifier
ltid_#1	1 - 1022	
		D-packet terminal identifier
channel1	1 - 31	Bd-channel number
ltid_grp2	the LTID group name	B-packet terminal group identifier
ltid_#2	1 - 1022	B-packet terminal identifier
xsg_#	0 - 749	XSG identifier
xliu_#	0 - 749	XLIU identifier
channel2	<1 - 31>	DCH or ISG channel number

FORCE option

The resource reassignment tool moves terminals between network hardware resources. This kind of move can potentially cause a loss of service. To avoid affecting calls, the PHRRCI tool ensures that calls are never dropped without warning.

If the technician requests a move for a terminal that has active calls, then the system issues a warning message and rejects the MOVE command. This safety mechanism ensures that the technician does not unintentionally affect in progress calls when moving resources. The warning message gives the technician the opportunity to check with the next level of support.

If the operating situation requires that the technician move the resources and drop the calls, the FORCE option is available as an override to this safety feature. The FORCE option may be needed if PVCs exist on the resource that is being moved.

Automatic resource assignment

The automatic resource assignment (ARA) algorithm balances the service assignments among available XSGs. In this way, the PHRRCI MOVE command chooses an XSG with the least services and the most available resources. This choice is based on a calculation of the expected average throughput per XSG. Refer to *Integrated Service Digital Network Service Orders for ISDN Terminals*, 297-2401-310.

Component interaction

This section describes the algorithms for each for the MOVE commands described in the previous section.

Moving a B-packet terminal to a another XSG/XLIU

The following steps describe how the system moves a B-packet terminal to another XSG/XLIU.

1 The system checks the status of the destination XSG/XLIU, including its maintenance state and capacity.

2 If calls exist on the link, then the command fails unless the command line includes the “FORCE” option, in which case the link involved is force released.

3 The system removes the current LTMAP entry.

4 The system uses ARA to select a destination XSG/XLIU if the command line does not include the destination parameter.

5 The system removes the current (ISLC to XSG) SPECCONN entry.

6 The system creates the new SPECCONN entry.

7 The system creates a new LTMAP entry.

8 The system attempts to return the link to service.

Moving a Bd channel to a another XSG/XLIU

The following steps describe how the system moves a Bd channel to another XSG/XLIU.

1 The system checks the status of the destination XSG/XLIU, including its maintenance state and capacity.

2 The system finds all links (that is, LTIDs) on the Bd channel.

3 The system uses ARA to select a destination XSG/XLIU if the command line does not include the destination parameter.

4 If calls exist on any of the links then the command fail unless the command line includes the “FORCE” option, in which case the links involved are force released.

5 The system removes the LTMAP entry for each D-packet terminal.

6 The system removes the current (DCHCHNL to XSG) SPECCONN entry.

7 The system creates the new SPECCONN entry.

8 The system recreates the LTMAP entry for each D-packet terminal.

9 The system attempts to return the Bd channel to service.

Moving a D-packet terminal to a new Bd channel

The following steps describe how the system moves a D-packet terminal to another Bd channel.

1 The system checks the status of the destination Bd channel, including its maintenance state and capacity.

2 The system uses the least LTIDs algorithm (as in the SERVORD SLT ATT command) to select a destination Bd Channel if the command line does not include the destination parameter.

3 If calls exist on the link, then the command fails unless the command line includes the “FORCE” option, in which case the link involved is force released.

4 The system removes the current LTMAP entry.

5 The system creates a new LTMAP entry.

6 The system attempts to return the link to service.

PHRRCI error messages and recovery

This section describes the error messages that can appear on the MAP display when using PHRRCI. The error messages include the following information:

- an explanation of the system error
- the action that the system has taken
- the action that the technician can take to correct or bypass the error

Refer to these messages when using the PHRRCI tool in the routine maintenance procedures in this chapter.

Entering the CI

Message 1

SYSTEM ERROR - Not enough free resources to execute command

Explanation: Too many CI levels or the system is overloaded.

System action: The system rejects entry into the PHRRCI command.

User action: Exit all CI levels, or try the command later if this message is produced when there are no other CI directories active at the MAP.

Starting a move

Message 2

ERROR - There are too many waiting requests for this tool, please try your resource move later

Explanation: The maximum number of waiting requests has been reached, and the current request cannot be added.

System action: The system rejects the MOVE command.

User action: Try the command later, after the system has processed some of the current waiting requests.

System problems

Message 3

SYSTEM ERROR - Unable to allocate memory.

SYSTEM ERROR - Unable to deallocate memory.

SYSTEM ERROR - Unable to deallocate memory for request.

Explanation: The system is overloaded or there is not enough memory to complete the current command.

System action: The system rejects the PHRRCI command, and initiates clean-up if possible.

User action: Try the command later. If there is enough memory available on the switch then this message may indicate more severe problems. Refer to the troubleshooting chapters of this document.

Message 4

SYSTEM ERROR - Image dump in progress.

Explanation: The tool cannot write to protected store because there is an image dump in progress.

System action: The system rejects the PHRRCI command, and initiates clean-up if possible.

User action: Try the command after the image dump is finished.

Message 5

SYSTEM ERROR - Could not get a <read/write> sema.

Explanation: The tool attempted to grab the semaphore as a reader or writer but was unsuccessful.

System action: The system rejects the PHRRCI command, and initiates clean-up if possible.

User action: Try the command later.

Message 6

SYSTEM ERROR - Could not put back sema.

Explanation: The tool attempted to release the semaphore for others but was unsuccessful.

System action: The system rejects the PHRRCI command, and initiates clean-up if possible.

User action: Try the MOVE command later.

Message 7

ERROR - TIMEOUT - retrying.

ERROR - unknown response.

Explanation: The messaging system is overloaded, and the CI process has stopped receiving messages.

System action: The CI continues waiting for a valid response until too many errors have occurred. (see the next messages)

User action: Wait.

Message 8

ERROR - Too many timeouts - MOVE command has failed.

Explanation: The messaging system is overloaded, and the system cannot communicate with the CI process.

System action: The system has not acknowledge the request and removes it from the request queue.

User action: Try the MOVE command later.

Message 9

ERROR - Too many errors - check logs for traps or move completion.

Explanation: The messaging system is overloaded, and the CI process cannot communicate with the system.

System action: The system acknowledges the request and begins processing so that the request runs to completion without communicating with the CI.

User action: Check the Resource Reassignment Log for the status of the move.

Message 10

ERROR - Could not send message to process request - aborting.

Explanation: A message was sent but the send operation failed. This is likely due to system overload.

System action: The system rejects the MOVE command.

User action: Try the command later.

Message 11

ERROR - MOVE command has been rejected.

Explanation: The system removed a MOVE command from the queue without executing it.

System action: The system has removed the command from the queue without executing it.

User action: Try the MOVE command again.

Message 12

WARNING - Journal entry failed <journal_failure_explanation>.

Explanation: The system attempted to record a table control operation into a journal file and failed.

System action: Processing continues on the current request.

User action: Journal file integrity should be checked.

Invalid input - source

Message 13

ERROR - <lt_group><lt_num> is not a valid LTID.

Explanation: The user attempted a move on an invalid LTID.

System action: The system rejects the MOVE command.

User action: Ensure that the LTID is valid and defined for packet service.

Message 14

ERROR - <lt_group><lt_num> is not a packet LTID.

Explanation: The user attempted a move on an LTID that is not valid for packet service.

System action: The system rejects the MOVE command.

User action: Ensure that the LTID is valid and defined for packet service.

Message 15

ERROR - LTMAP entry could not be found (<lt_group><lt_num>).

Explanation: The user attempted a move on an LTID that is not in table LTMAP.

System action: The system rejects the MOVE command.

User action: Check that the LTID entered is valid and exists in table LTMAP.

Message 16

ERROR - LTID <lt_group><lt_num> has no LTMAP entry.

Explanation: The user attempted a move on an LTID that is not in table LTMAP.

System action: The system rejects the MOVE command.

User action: Check that the LTID entered is valid and exists in table LTMAP.

Message 17

ERROR - Cannot find SPECCONN for <LTID> <lt_group><lt_num>.

ERROR - Cannot find SPECCONN for <ISG><isg_num><channel>.

Explanation: The user attempted a move on an LTID or Bd channel that is not in table SPECCONN.

System action: The system rejects the MOVE command.

User action: Check that the LTID or Bd channel entered is valid and has an entry in table SPECCONN.

Message 18

ERROR - DCH <dch_number> is not datafilled in DCHINV.

Explanation: The user selected an invalid DCH for a MOVE command.

System action: The system rejects the MOVE command.

User action: Check that the DCH number is valid.

Message 19

ERROR - DCH <number> is a spare and cannot be moved.

Explanation: The user selected a spared DCH for a MOVE command but a spare cannot be datafilled and therefore cannot have its channels moved.

System action: The system rejects the MOVE command.

User action: Specify a valid DCH number which is not a spare.

Message 20

ERROR - The specified <LTID/Bd channel> is currently being moved by another user.

Explanation: Only one user can perform MOVE commands on a resource at a time.

System action: The system rejects the MOVE command.

User action: Try the MOVE command later.

Message 21

ERROR - <ISGNO> is not a valid ISG number.

Explanation: The user selected an invalid ISG for a MOVE command.

System action: The system rejects the MOVE command.

User action: Check that the ISG number is valid.

Message 22

ERROR - The assigned ISG is not provisioned for Bd channels.

Explanation: The user attempted a move on an ISG that is not valid for Bd channels.

System action: The system rejects the MOVE command.

User action: Check that the ISG number is valid and provisioned for Bd channels.

Invalid input - destination

Message 23

ERROR - XLIU <xliu_number> is not defined in table LIUINV.

Explanation: The XLIU does not exist.

System action: The system rejects the MOVE command.

User action: Check that the XLIU number specified as a destination is valid. Try the MOVE command again but specify a destination which is valid.

Message 24

ERROR - XLIU <xliu_num> is a spare.

Explanation: A spare cannot be datafilled therefore it is not a valid destination.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but specify a valid XLIU which is not a spare.

Message 25

ERROR - XSG <xsg_number> is not datafilled in table XSGDEF.

Explanation: An XSG which is not datafilled cannot be a valid destination for a MOVE command.

System action: The system rejects the MOVE command.

User action: Check that the XSG number specified as a destination is valid. Try the MOVE command again but specify a destination which is valid.

Message 26

ERROR - Channel <channel> is not a valid Bd Channel.

Explanation: The selected channel is not a valid Bd channel.

System action: The system rejects the MOVE command.

User action: Provide a valid Bd channel or use the automatic Bd selection algorithm by not specifying a destination.

Message 27

ERROR - 'Bd' is an invalid destination type for a B-Packet LTID.

ERROR - 'XSG' is an invalid destination type for a D-Packet LTID.

ERROR -'Bd' is an invalid destination type for a Bd Channel.

ERROR -'XLIU' is an invalid destination type for a D-Packet LTID.

Explanation: The destination specified for the MOVE command is not valid for the resource being moved.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but select a valid destination for the resource which is being moved or let automatic resource assignment choose the destination. Valid combinations are: a B-packet terminal to an XSG/XLIU, a D-packet terminal to a Bd channel, and a Bd channel to an XSG/XLIU.

Message 28

ERROR - The specified LTID is already using Bd channel <number>.

Explanation: A move cannot be performed if the LTID is already assigned to this Bd channel.

System action: The system rejects the MOVE command.

User action: Select a destination other than the Bd channel to which the LTID is currently assigned.

Message 29

ERROR - The specified resource is already using XSG <xsg_num> (XLIU <xliu_num>).

Explanation: A move cannot be performed if the resource is already assigned to this XLIU/XSG.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but specify a different valid XLIU/XSG for the destination.

Message 30

ERROR - Bd channel <channel> has no free space.

Explanation: The selected Bd channel has no free resources.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but select a destination which has free space.

Message 31

ERROR - XSG <xsg_num> (XLIU <xliu_num>) has no free channels.

Explanation: The selected destination XSG has no free resources.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but select a destination which has free channels.

Message 32

ERROR - Pending MOVE commands will use all of the resources on the specified destination. Choose a new destination for the move.

Explanation: Other MOVE commands that are waiting or being processed use all of the resources on the specified destination.

System action: The system rejects the MOVE command.

User action: Try the MOVE command again but select a different destination.

Automatic destination selection

Message 33

ERROR - No valid destination XSGs could be found.

Explanation: The automatic XSG selection algorithm could not find any XSGs that were available for ARA, and were not in use by the resource being moved.

System action: The system rejects the MOVE command and does not make datafill changes. Any resources that were force released are returned to service. Further messages indicate the success of the return to service attempt.

User action: Refer to ARA documentation for instructions on making XSGs available for selection.

Message 34

ERROR - ISG <isg_number> has no valid destination Bd channels for LTID <lt_group><lt_num>.

Explanation: The automatic Bd selection algorithm has found that all of the Bd channels for the LTID being moved are full, with the possible exception of the channel the LTID is currently using

System action: The system rejects the MOVE command. The tool attempts to return the LTID to service. Further messages indicate the result of this attempt

User action: This LTID cannot be moved to another Bd channel on this ISG.

Processing errors

Message 35

ERROR - Inconsistent data in table <table_name>

Explanation: A table associated with the resource currently being moved contains data that is no longer what the tool expected it to be.

System action: The system rejects the MOVE command, and a clean-up attempt is initiated. Further messages indicate the result of the clean-up attempt.

User action: Check the table mentioned in the message for data corruption. Check that no other users are modifying this table.

Message 36

ERROR - Manually add LTID <lt_group><lt_num> to table LTMAP.

Explanation: Attempt to restore a previously deleted tuple to table LTMAP has failed.

System action: The LTID is left unmapped, this message indicates a clean-up attempt has failed.

User action: Check integrity of table LTMAP, and manually add back the tuple as suggested.

Message 37

ERROR - LTMAP entry could not be removed for LTID <lt_group><lt_num>.

Explanation: Attempt to remove a tuple from table LTMAP has failed.

System action: A clean-up attempt is initiated. Further messages indicate the result of the clean-up attempt.

User action: Check integrity of table LTMAP, and the specified LTID. Check that no other users are modifying this LTID.

Message 38

ERROR - The following LTIDs could not be added to LTMAP: <LTID><LTID><LTID><LTID>. Please choose a destination and manually add the entries to table LTMAP.

Explanation: The specified LTIDs could not be added to table LTMAP.

System action: This message is indicating a failure in a recovery attempt. Further recovery continues on the remaining LTIDs.

User action: Manually add the listed LTIDs. Check that no other users are modifying these LTIDs or modifying the Bd channel that these LTIDs should be using.

Message 39

ERROR - Old SPECCONN entry to (XSG <xsg_num>/LEN <len_number>) could not be restored. Manual intervention required.

Explanation: Attempt to add a previously deleted tuple to table SPECCONN has failed.

System action: This message indicates that a clean-up attempt has failed. Further messages are produced to indicate which LTIDs are affected.

User action: Check integrity of table SPECCONN. Check that no other users are modifying the endpoints quoted in the error message. The SPECCONN needs to be manually restored and any affected LTIDs must be manually restored.

Message 40

ERROR - Addition of new SPECCONN entry has failed.

Explanation: Attempt to add a tuple to table SPECCONN has failed.

System action: The system initiates a recovery attempt. Further messages indicate the result of the recovery attempt.

User action: Check integrity of table SPECCONN. Check that no other users are modifying the resources involved in the current move.

Message 41

ERROR - Cannot delete current SPECCONN entry.

Explanation: Attempt to remove a tuple from table SPECCONN has failed.

System action: The system initiates a recovery attempt. Further messages indicate the result of the recovery attempt.

User action: Check integrity of table SPECCONN. Check that no other users are modifying the resources involved in the current move.

Maintenance problems

Message 42

ERROR - Calls are up on this <Bd channel/LTID> - Command rejected.

Explanation: The user attempted a move on a terminal which has active calls and no force option was specified.

System action: The system rejects the MOVE command.

User action: If the user wants to override this safety feature and bring down any calls that exist on a particular terminal, use of the FORCE option allows the service move to be completed. Otherwise, try later when no calls are active.

Message 43

ERROR - Unable to force release the <channel/link>.

Explanation: A force release request for a channel or link failed.

System action: The system rejects the MOVE command. No datafill changes have been made, so no recovery is required.

User action: Check the XLIU to make sure that it is not SYSB or overloaded. Check the terminal to ensure it is plugged in. Check the XPM to ensure that it is in service. Attempt the MOVE command again later.

Message 44

WARNING - The <Bd channel/LTID> may not have returned to service successfully. Manual intervention may be required.

Explanation: A return to service request for a channel or link failed.

System action: No action taken. All datafill changes for the current request have already been performed, so no recovery is required.

User action: A manual return to service should be attempted.

Informative responses

All responses presented in this section are informative messages which require no user action.

Message 45

INFO - PHRRCI is unavailable. Option NI000050 must be turned on.

Explanation: Software optionality control (SOC) is turned off for this command.

System action: The system rejects entry into the PHRRCI command directory.

User action: This response is informative. No action is required from the user.

Message 46

INFO - PHRRCI is unavailable. SOC option must be turned on.

Explanation: SOC is turned off.

System action: The system rejects entry into the PHRRCI command directory.

User action: This response is informative. No action is required from the user.

Message 47

INFO - MOVE is unavailable. Option NI000050 must be turned on.

Explanation: SOC is turned off for this command.

System action: The system rejects MOVE commands until option NI000050 is turned on.

User action: This response is informative. No action is required from the user.

Message 48

INFO - MOVE is unavailable. SOC option must be turned on.

Explanation: SOC is turned off.

System action: The system rejects MOVE commands until the SOC option is turned on.

User action: This response is informative. No action is required from the user.

Message 49

INFO - Request Queued at position <number>.

Explanation: The static checks on the command were successful.

System action: The command has been added to the queue, and is processed once the commands ahead of it have been executed.

User action: This response is informative. No action is required from the user.

Message 50

INFO - Processing Started on Request <number>.

Explanation: The command is being processed.

System action: The command has been removed from the queue. If it passes the dynamic checks, it is executed. This message indicates an acknowledgment of the MOVE command. Any subsequent time-out of the CI process has no effect on the processing of the move, and causes the move to generate a log indicating its status.

User action: This response is informative. No action is required from the user.

Message 51

Request <number> has been removed.

Explanation: The command has been removed from the queue without being executed.

System action: The command has been removed from the queue. Clean-up is attempted if possible.

User action: This response is informative. No action is required from the user.

Message 52

INFO - Previous SPECCONN entry has been restored.

Explanation: Restoration of tuple to table SPECCONN was successful. This is an error recovery message that indicates table SPECCONN has been restored to its previous state.

System action: A previously deleted tuple has been added to table SPECCONN. Further messages indicates the results of the rest of the recovery attempt.

User action: This response is informative. No action is required from the user.

Message 53

INFO - New SPECCONN entry has been added.

Explanation: A tuple has been added to table SPECCONN. This message is produced in the regular operation of the tool to indicate its progress.

System action: Addition of tuple to table SPECCONN was successful.

User action: This response is informative. No action is required from the user.

Message 54

INFO - Previous LTMAP entry has been restored (<lt_group> <lt_num>).

Explanation: Restoration of a tuple to table LTMAP was successful. This message occurs either during normal tool operation, or during a recovery attempt, whenever the LTMAP tuple is successfully restored to its original state.

System action: Added a previously deleted tuple to table LTMAP.

User action: This response is informative. No action is required from the user.

Message 55

INFO - Current LTMAP entry has been removed (<lt_group> <lt_num>).

Explanation: Removal of tuple from table LTMAP was successful. This message is produced in the regular operation of the tool to indicate its progress.

System action: Deleted a tuple from table LTMAP.

User action: This response is informative. No action is required from the user.

Message 56

INFO - New LTMAP entry has been successfully created (<lt_group> <lt_num>) <lt_num>).

Explanation: Addition of tuple to table LTMAP was successful. This message is produced in the regular operation of the tool to indicate its progress.

System action: Added a new tuple to table LTMAP.

User action: This response is informative. No action is required from ¿ the user.

Message 57

INFO - All LTIDs successfully removed.

Explanation: The LTIDs were successfully removed from table LTMAP. This message occurs during normal tool operation.

System action: No action.

User action: This response is informative. No action is required from ¿ the user.

Message 58

INFO - All LTIDs successfully restored.

Explanation: The LTIDs were successfully restored in table LTMAP. This message occurs either during normal tool operation, or during a recovery attempt, whenever all the LTMAP tuples are successfully restored to their original state.

System action: No action.

User action: This response is informative. No action is required from ¿ the user.

Result messages

Message 59

RESULT - LTID (<lt_group> <lt_num>) successfully moved from XSG <xsg_num> to XSG <xsg_num>.

RESULT - Bd channel (ISG <isg_num> <channel>) successfully moved from XSG <xsg_num> to XSG <xsg_num>.

RESULT - LTID (<lt_group> <lt_num>) successfully moved from Bd <channel> to Bd <channel>.

Explanation: The MOVE command was successfully executed. This is the final response issued after a successful MOVE command.

System action: No action.

User action: This response is informative. No action is required from the user.

Message 60

RESULT - Command aborted. Incorrect datafill.

Explanation: Tool was unable to clean up the table entries after previous errors.

System action: None, this is a message indicating that a clean-up attempt failed.

User action: Check the affected tables to verify their integrity. See previous error messages. Manual intervention may be required to repair the datafill.

Message 61

RESULT - Aborting with no change.

Explanation: The MOVE command has failed. No resources have been reassigned.

System action: Clean-up was successful for any previous errors that occurred.

User action: Examine the previous messages to determine what failed in the MOVE command.

Message 62

RESULT - LTID <lt_group> <lt_num> has no SPECCONN entry.

RESULT - ISG <isg_num> <channel> has no SPECCONN entry.

Explanation: The MOVE command has failed. Resources are currently unassigned.

System action: No action.

User action: Examine the previous messages to determine what failed in the MOVE command.

Message 63

RESULT - LTID <lt_group> <lt_num> is now connected to XSG <xsg_num>.

RESULT - ISG <isg_num> <channel> is now connected to XSG <xsg_num>.

Explanation: The MOVE command has failed. Resources have been reassigned.

System action: No action.

User action: Examine the previous messages to determine what failed in the MOVE command.

Message 64

RESULT - LTID <lt_group> <lt_num> is still connected to XSG <xsg_num>.

RESULT - ISG <isg_num> <channel> is still connected to XSG <xsg_num>.

Explanation: The MOVE command has failed. No resources have been reassigned.

System action: No action.

User action: Examine the previous messages to determine what failed in the MOVE command.

Moving a B-packet terminal to a different XSG/XLIU

Application

Use this procedure to move a B-packet terminal from one XSG/XLIU to another.

Interval

Perform this procedure whenever resource reassignment is necessary for load balancing.

For example, this procedure may be required if a particular packet terminal has an unusually high load.

Common procedures

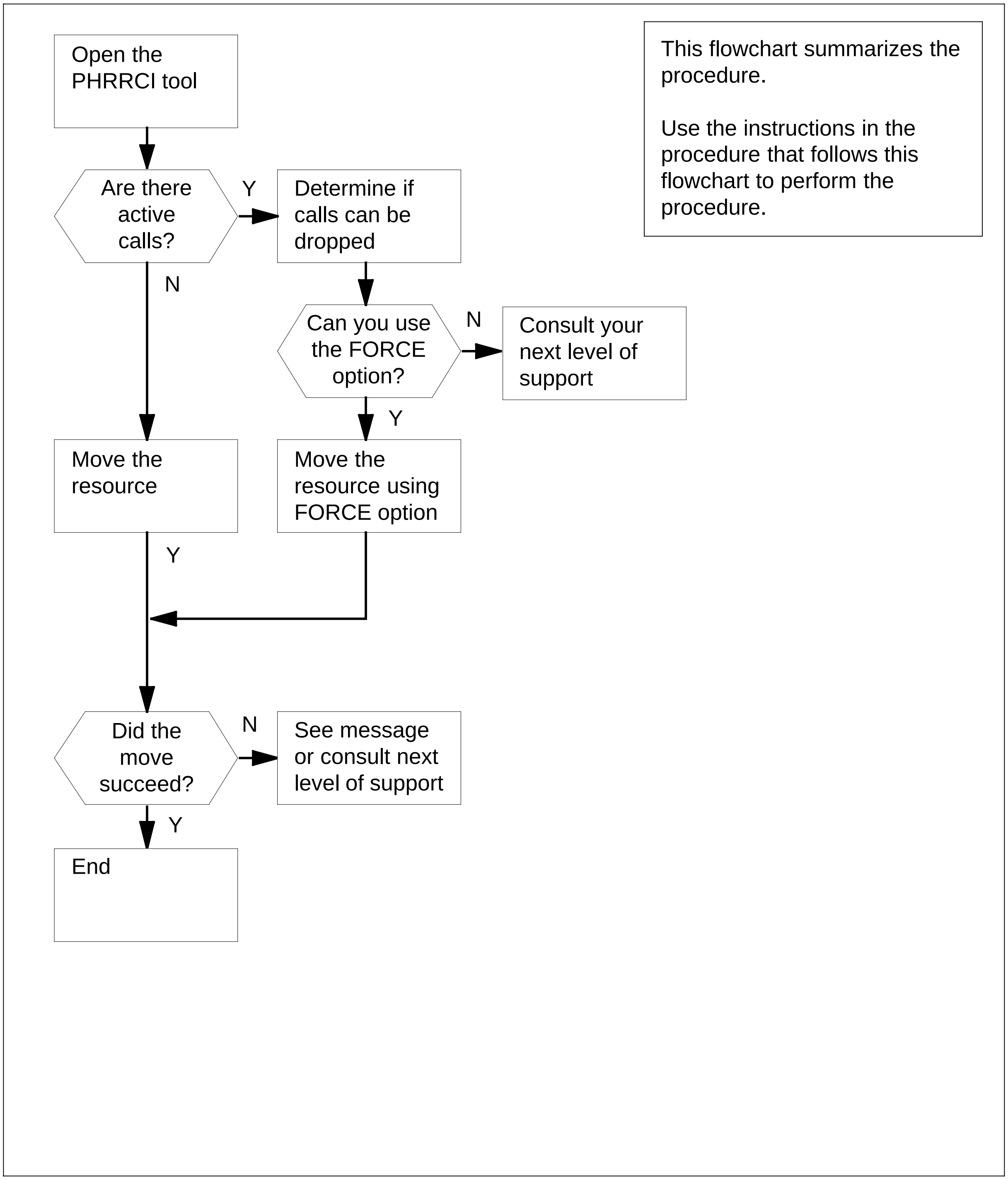
None.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Moving a B-packet terminal to a different XSG/XLIU (continued)

Summary of Moving a B-packet terminal to a different XSG/XLIU



Moving a B-packet terminal to a different XSG/XLIU (continued)

Moving a B-packet terminal to a different XSG/XLIU

At the MAP

1 Return to the CI level.

2 Open the PHRRCI tool by typing

>PHRRCI

If the command is	Do
successful	Step 5
unsuccessful because there are not enough free resources	Step 3
unsuccessful because there are too many waiting requests for the tool	Step 11
unsuccessful for any other reason	Step 12

3 There are too many CI levels open, or system resources are overloaded. Close as many CI levels as you can and then retry the PHRRCI tool. If you get this message again, contact the personnel responsible for the next level of support.

4 Go to Step 1.

5 Obtain information on the LTID identifier, the target XSG or XLIU identifier, and if the LTID has active calls.

If the LTID	Do
has active calls	Step 6
does not have active calls	Step 8

6 Check with your next level of support to make certain that it is permitted to drop active calls when you move the B-packet terminal.

If active calls	Do
can be dropped	Step 7
cannot be dropped	Step 12

7 Move the B-packet terminal to a different XSG or XLIU by typing

>MOVE [TO] FORCE

where

ltid
is the identifier for the LTID

type
is either XSG or XLIU

Moving a B-packet terminal to a different XSG/XLIU (continued)

dest
is the numeric identifier for the XSG or XLIU

Example input

>MOVE PKT 224 TO XSG 307 FORCE

Example of a MAP display:

```
>MOVE  PKT  224  TO  XSG  307  FORCE
Request Queues at position 1
Processing Started on Request 1
WARNING - 2 SVC and 10 PVC calls were FRLSed
INFO - Current LTMAP entry has been removed (PKT 224)
INFO - New SPECCONN entry has been added
INFO - Previous LTMAP entry has been restored (PKT 224)
RESULT - LTID (PKT 224) sucessfully moved from XSG 335 to XSG 307
Done.
>
```

Note: This example of a MAP display shows an example of output where there are active calls on the LTID.

If the move is	Do
successful	Step 13
unsuccessful	Step 9

8 Move the B-packet terminal to a different XSG or XLIU by typing

>MOVE <ltid> [TO <type> <dest>]

where

ltid
is the identifier for the LTID

type
is either XSG or XLIU

dest
is the numeric identifier for the XSG or XLIU

Example input

>MOVE PKT 226 TO XSG 302

Example of a MAP display:

```
MOVE  PKT  226  TO  XSG  302
Request Queues at position 1
Processing Started on Request 1
INFO - Corrent LTMAP entry has been removed  (PKT 226)
INFO - New SPECCONN entry has been added
INFO - Previous LTMAP entry has been restored (PKT 226)
RESULT - LTID  (PKT 226) sucessfully moved from XSG 309 to XSG 335
Done.
>
```

Moving a B-packet terminal to a different XSG/XLIU (end)

Note: This example of a MAP display shows an example of output where there are no active calls on the LTID.

If the move is	Do
successful	Step 13
unsuccesful	Step 9

9 Take note of the error message. Refer to chapter 3, "Packet Resource Reassignment tool" on page -1 for an explanation of the message and the further action required.

10 Go to Step 13.

11 Try the command later when there is less competition for system resources.

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

13 You have completed this procedure.

Moving a D-packet terminal to a different Bd channel

Application

Use this procedure to move a D-packet terminal from one Bd channel to another on the same ISG (that is, the same DCH).

Interval

Perform this procedure whenever resource reassignment is necessary for load balancing.

For example, this procedure may be required if a particular packet terminal has an unusually high load.

Common procedures

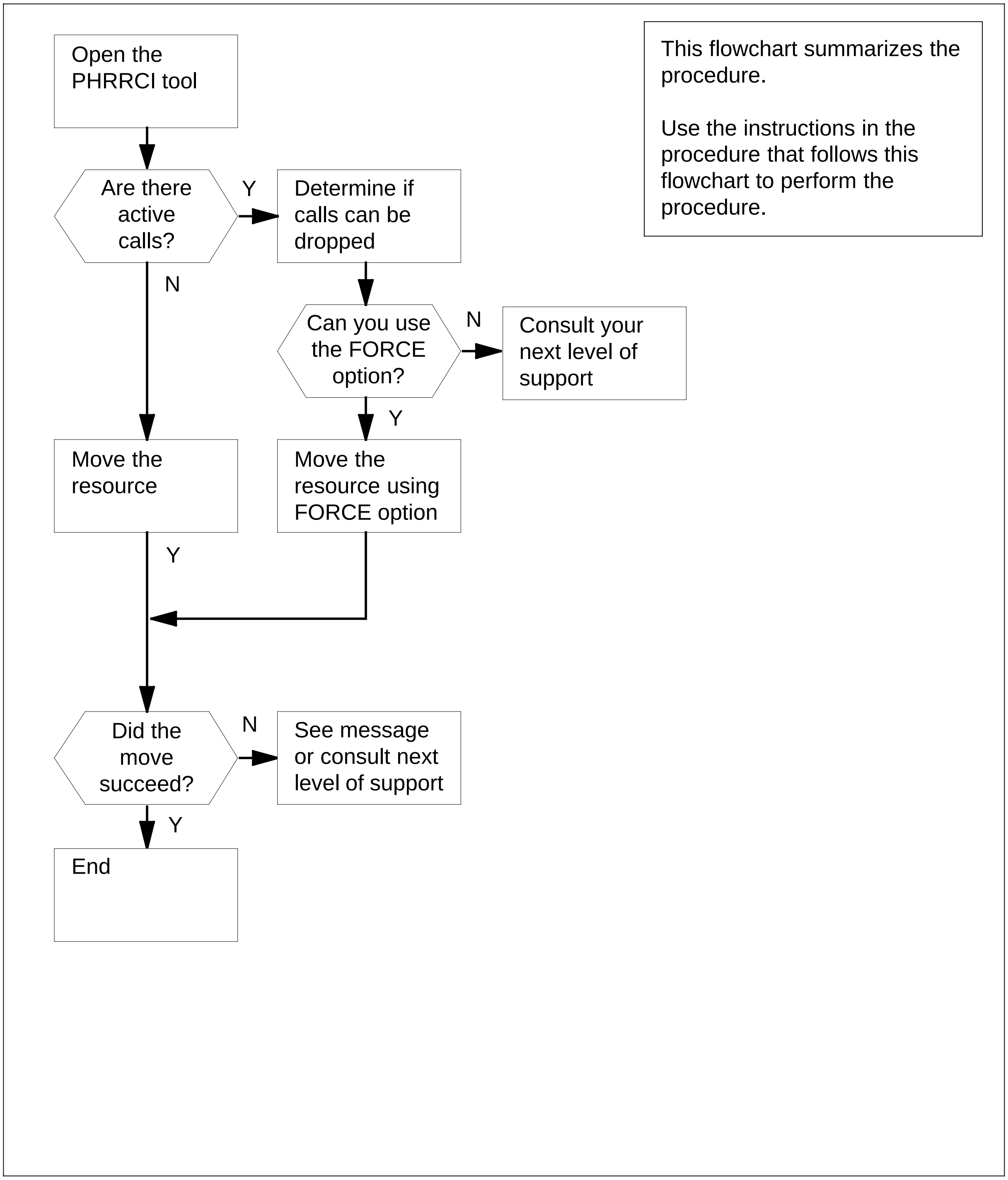
None.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Moving a D-packet terminal to a different Bd channel (continued)

Summary of Moving a D-packet terminal to a different Bd channel



Moving a D-packet terminal to a different Bd channel (continued)

Moving a D-packet terminal to a different Bd channel

At the MAP

1 Return to the CI level.

2 Open the PHRRCI tool by typing

>PHRRCI

If the command is	Do
successful	Step 5
unsuccessful because there are not enough free resources	Step 3
unsuccessful because there are too many waiting requests for the tool	Step 11
unsuccessful for any other reason	Step 12

3 There are too many CI levels open, or system resources are overloaded. Close as many CI levels as you can and then retry the PHRRCI tool. If you get this message again, contact the personnel responsible for the next level of support.

4 Go to Step 1.

5 Obtain information on the LTID identifier, the target Bd channel identifier, and if the LTID has active calls.

If the LTID	Do
has active calls	Step 6
does not have active calls	Step 8

6 Check with your next level of support to make certain that it is permitted to drop active calls when you move the D-packet terminal.

If active calls	Do
can be dropped	Step 7
cannot be dropped	Step 12

7 Move the D-packet terminal to a different Bd channel by typing

>MOVE <ltid> [TO BD <dest>] FORCE

where

ltid
is the identifier for the LTID

dest
is the Bd channel number

Moving a D-packet terminal to a different Bd channel (continued)

Example input

>MOVE PKT 407 TO BD 24 FORCE

Example of a MAP display:

```
>MOVE PKT 407 TO BD 24 FORCE
Request Queues at position 1
Processing Started on Request 1.
WARNING - 3 SVC and 2 PVC calls were FRLSed
INFO - Current LTMAP entry has been removed (PKT 407)
INFO - Previous LTMAP entry has been restored (PKT 407)
RESULT - LTID (PKT 407) successfully moved from Bd 25 to
Bd 24
Done.
>
```

Note: This example of a MAP display shows an example of output where there are active calls on the LTID.

If the move is	Do
successful	Step 13
unsuccessful	Step 9

8 Move the D-packet terminal to a different Bd channel by typing

>MOVE <ltid> [TO BD <dest>]

where

ltid
is the identifier for the LTID

dest
is the Bd channel number

Example input

>MOVE PKT 401 TO BD 30

Example of a MAP display:

```
>MOVE PKT 401 to BD 30
Request Queues at position 1
Processing Started on Request 1.
INFO - Current LTMAP entry has been removed (PKT 401)
INFO - Previous LTMAP entry has been restored (PKT 401)
RESULT - LTID (PKT 401) successfully moved from Bd 25 to
Bd 30
Done.
>
```

Moving a D-packet terminal to a different Bd channel (end)

Note: This example of a MAP display shows an example of output where there are active calls on the LTID.

If the move is	Do
successful	Step 13
unsuccesful	Step 9

9 Take note of the error message. Refer to chapter 3, "Packet Resource Reassignment tool" on page -1 t for an explanation of the message and the further action required.

10 Go to Step 13.

11 Try the command later when there is less competition for system resources.

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

13 You have completed this procedure.

Moving a Bd channel to a different XSG/XLIU

Application

Use this procedure to move a Bd channel from one XSG/XLIU to another.

Interval

Perform this procedure whenever resource reassignment is necessary for load balancing.

For example, this procedure may be required if a particular packet terminal has an unusually high load.

Common procedures

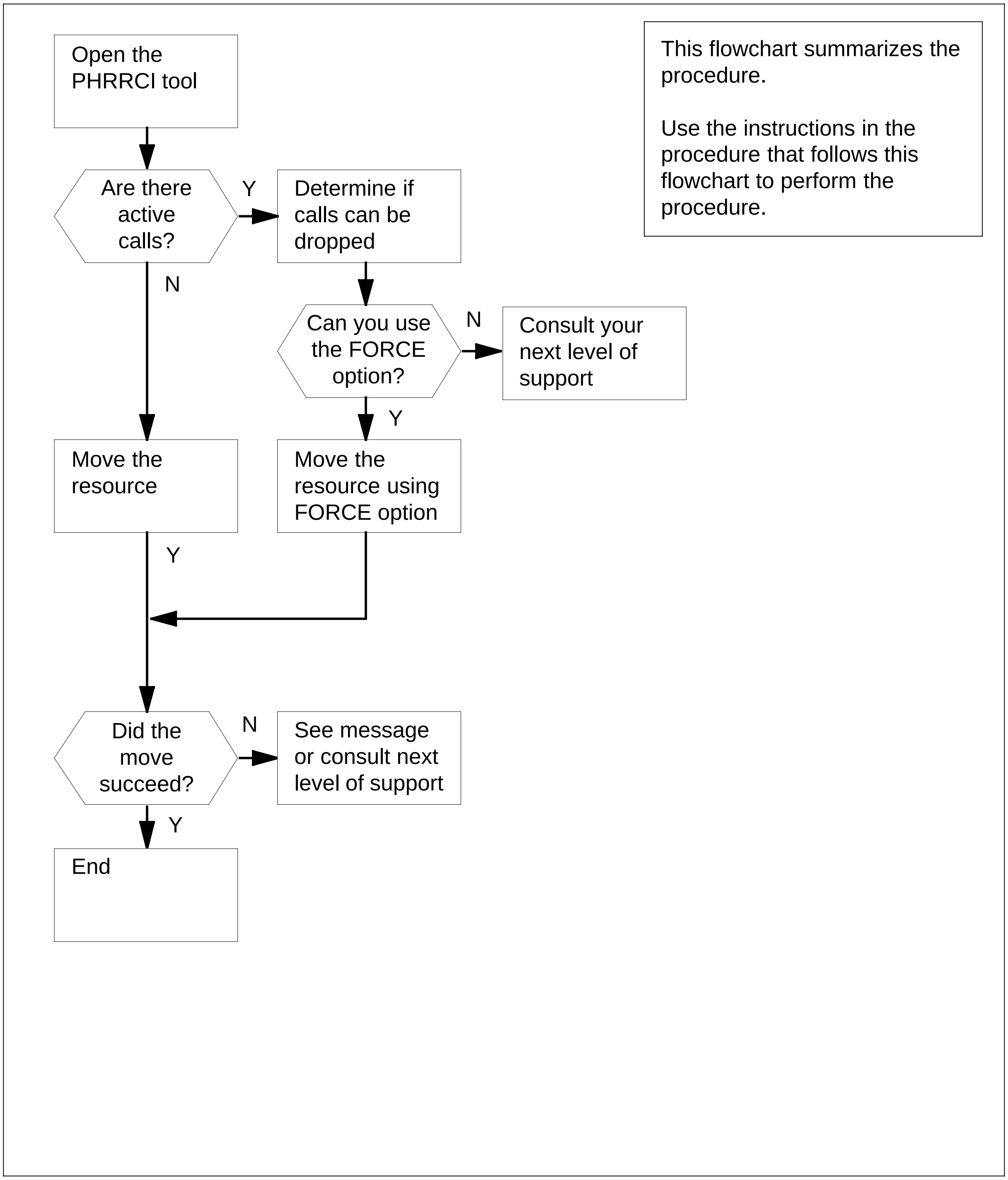
None.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Moving a Bd channel to a different XSG/XLIU (continued)

Summary of Moving a Bd channel to a different XSG/XLIU



Moving a Bd channel to a different XSG/XLIU (continued)

Moving a Bd channel to a different XSG/XLIU

At the MAP

1 Return to the CI level.

2 Open the PHRRCI tool by typing

>PHRRCI

If the command is	Do
successful	Step 5
unsuccessful because there are not enough free resources	Step 3
unsuccessful because there are too many waiting requests for the tool	Step 11
unsuccessful for any other reason	Step 12

3 There are too many CI levels open, or system resources are overloaded. Close as many CI levels as you can and then retry the PHRRCI tool. If you get this message again, contact the personnel responsible for the next level of support.

4 Go to Step 1.

5 Obtain information on the channel type, the channel identifier, the identifier of the target XSG or XLIU, and if the channel has active calls.

If the channel	Do
has active calls	Step 6
does not have active calls	Step 8

6 Check with your next level of support to make certain that it is permitted to drop active calls when you move the Bd channel.

If active calls	Do
can be dropped	Step 7
cannot be dropped	Step 12

7 Move the Bd channel to a different XSG or XLIU by typing

>MOVE <ch_type> <type_#> <chan_#> [TO <t _type> <dest>] FORCE

where

ch_type
is either DCH or ISG

Moving a Bd channel to a different XSG/XLIU (continued)

type_#
is the numeric identifier for the channel type

chan_#
is the DCH/ISG number

t_type
is either XSG or XLIU

dest
is the numeric identifier for the XSG or XLIU

Example input

`>MOVE DCH 202 26 TO XSG 303 FORCE`

Example of a MAP display:

```
>MOVE DCH 202 26 TO XSG 303 FORCE
Request Queues at position 2
Processing Started on Request 2.
WARNING - 4 SVC and 3 PVC calls were FRLSed
INFO - All LTIDs successfully removed
INFO - New SPECCONN entry has been added
INFO - All LTIDs successfully restored
RESULT - Bd channedl (DCH 202 26) SUCCESSFULLY MOVED FROM
XSG 300 to XSG 303
Done.
>
```

Note: This example of a MAP display shows an example of output where there are active calls on the Bd channel.

If the move is	Do
successful	Step 13
unsuccessful	Step 9

8 Move the Bd channel to a different XSG or XLIU by typing

`>MOVE <ch_type> <type_#> <chan_#> [TO <t _type> <dest>]`

where

ch_type
is either DCH or ISG

type_#
is the numeric identifier for the channel type

chan_#
is the DCH/ISG number

t_type
is either XSG or XLIU

Moving a Bd channel to a different XSG/XLIU (end)

dest
is the numeric identifier for the XSG or XLIU

Example input

>MOVE DCH 51 30 TO XSG 334

Example of a MAP display:

```
>MOVE DCH 51 30 TO SXG 334 FORCE

Request Queues at position 2

Processing Started on Request 2.

INFO - All LTIDs successfully removed

INFO - New SPECCONN entry has been added

INFO - All LTIDs successfully restored

RESULT - Bd channel (DCH 51 30) SUCCESSFULLY MOVE FROM XSG
303 to XSG 334

Done.
```

> ***Note:*** This example of a MAP display shows an example of output where there are active calls on the Bd channel.

If the move is	Do
successful	Step 13
unsuccessful	Step 9

9 Take note of the error message. Refer to chapter 3, "Packet Resource Reassignment tool" on page -1 for an explanation of the message.

10 Go to Step 13.

11 Try the command later when there is less competition for system resources.

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

13 You have completed this procedure.

Displaying available XSGs

Application

Use this procedure to display the status and availability of all XSGs for automatic resource assignment (ARA).

Interval

Perform this procedure whenever you need to assess available resources for ARA.

Common procedures

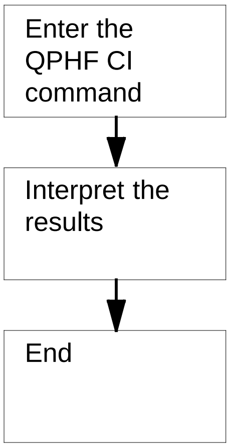
None.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Displaying available XSGs (continued)

Summary of Displaying XSG status and availability



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Displaying available XSGs (end)

Displaying XSG status and availability

At the MAP

1 Return to the CI level.

2 Enter the QPHF ARA command by typing

>QPHF ARA

Example of a MAP display:

```
CI:
>qphf ara
XSG AVAILABILITY FOR USE BY AUTO RESOURCE ASSIGNMENT
-----------------------------------------------------

-------------------------------------------------------
-------
|XSG | ARA AVAILABLE |   XSG   | FREE CHNLS || XSG USABLE
| XSG  ||
| #  |               |  STATE  |  AVAILABLE ||   BY ARA
| RANK ||
|----|-------------|---------|------------||------------
|----||
 | 310|     Y      |  SysB |     Y     ||    N     |   -  ||
 | 311|     Y      |  SysB |     Y     ||    N     |   -  ||
 | 312|     Y      |  InSv |     N     ||    N     |   -  ||
 | 313|     Y      |  ISTb |     Y     ||    Y     |   6  ||
 | 314|     N      |  ISTb |     Y     ||    Y     |   -  ||
 | 315|     N      |  InSv |     Y     ||    Y     |   -  ||
 | 316|     Y      |  InSv |     Y     ||    Y     |   2  ||
 | 319|     Y      |  ISTb |     Y     ||    Y     |   7  ||
 | 320|     Y      |  InSv |     Y     ||    Y     |   1  ||
 | 321|     Y      |  InSv |     Y     ||    Y     |   5  ||
 | 322|     Y      |  InSv |     Y     ||    Y     |   4  ||
 | 323|     Y      |  ISTb |     Y     ||    Y     |   3  ||
 | 324|     Y      |  ManB |     Y     ||    N     |   -  ||
 | 325|     Y      |  Offl |     Y     ||    N     |   -  ||

-------------------------------------------------------
-------
```

3 You have completed this procedure.

Displaying XSG status and availability

Application

Use this procedure to display the status and operating characteristics of a specific XSG for automatic resource assignment (ARA).

Interval

Perform this procedure whenever you need to assess available resources for ARA.

Common procedures

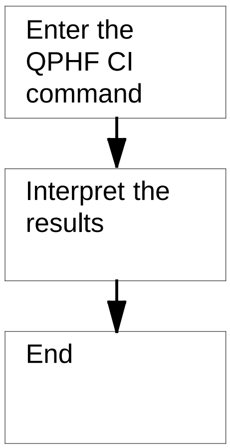
None.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the specific steps to perform this procedure.

Displaying XSG status and availability (continued)

Summary of Displaying XSG status and availability



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Displaying XSG status and availability (end)

Displaying XSG status and availability

At the MAP

1 Return to the CI level.

2 Enter the QPHF XSG command by typing

>QPHF XSG <xsg_no>

where

xsg_no
is the numeric identifier for the XSG

Example input

>QPHF XSG 301

Example of a MAP display:

```
CI:
>qphf xsg 300
                    XSG INFORMATION
                    ---------------

   XSG EXT INDEX: 300     CURRENT NUMBER OF LINKS: 15
   XLIU INDEX: 300        MAXIMUM NUMBER OF CHANNELS: 12
   XSG 300 IS AVAILABLE FOR USE BY AUTO RESOURCE
ASSIGNMENT

 MAPPING
 -------
 CHANNEL:  1  X.25 PB
 CHANNEL:  2  X.25 PB
 CHANNEL:  3  X.25 PB
 CHANNEL:  4  X.25 PB
 CHANNEL:  5  X.25 PB
 CHANNEL:  6  X.25 Bd
 CHANNEL:  7  X.25 PB
 CHANNEL:  8  X.25 PB
 CHANNEL:  9  X.25 PB
 CHANNEL: 10  X.25 PB
 CHANNEL:  11   X.25 PB
```

3 You have completed this procedure.

4 Logs

This chapter contains a table that describes the logs associated with Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI), and a second table that lists the high-priority logs and the actions to be taken.

Log reports

Log reports are messages generated by the DMS-100 switch when a significant event has occurred, such as the line group controller (LGC) changes 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 specific 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 control the routing and generation of output reports temporarily.

For specific information on LOGUTIL commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

ISDN BRI logs

Table 4-1 lists all the logs associated with ISDN BRI and includes a description of each log.

Table 4-1 Summary of ISDN BRI related logs (Sheet 1 of 9)

Log	Description
Audit logs	
AUD559	Generated during a call dump if the routing characteristic extension block is present. The message includes the call identification number, the extension block pointer, the RCNAME numeric value, and the pretranslator name.

Table 4-1 Summary of ISDN BRI related logs (Sheet 2 of 9)

Log	Description
AUDT680	Generated to report mismatches for directory numbers (DN) on National ISDN 2 (NI-2) sets between the notification busy counter (NBC) stored internally in the computing module (CM) and the actual number of calls alerting on the set on a call type basis.
Automatic Message Accounting logs	
AMA118	Periodically reports the status of all office automatic message accounting (AMA) options in table AMAOPTS, including whether ISDN circuit-mode AMA billing is active or inactive.
Distributed Data Manager logs	
DDM100	The Distributed Data Manager (DDM) successfully transferred data to a peripheral module (PM).
DDM101	DDM failed to transfer data to a PM.
DDM103	DDM successfully transferred a data table to a PM.
DDM104	DDM failed to transfer data to a PM or a PM lost data synchronization.
DDM105	DDM successfully transferred data to a PM and the PM has maintained data synchronization.
DDM106	An audit of DDM data failed and the faulty table has been identified.
DDM107	An attempt to retrieve OM data failed and the faulty table has been identified.
ISDN logs	
ISDN100	The D-channel handler (DCH) or enhanced D-channel handler (EDCH) channel associated with an ISDN line could not be put into traffic level because a terminal was unavailable for message traffic. The terminal did not respond to a terminal endpoint identifier (TEI) check or audit.
ISDN101	The DCH or EDCH channel associated with an ISDN line could not be put into traffic level because the loop was unavailable for message traffic.
ISDN102	The DCH or EDCH detected duplicate TEIs on the same ISDN line and removed the TEI from service.
ISDN103	A manual action changed the state of a D-channel used for D-channel packet service.
ISDN104	The Bd channel used for D-channel packet service lost synchronization and was removed from service.

Table 4-1 Summary of ISDN BRI related logs (Sheet 3 of 9)

Log	Description
ISDN105	Layer 1 of a D-channel failed. The loop changed to the manual busy (ManB) state and the fail flag, i, was set.
ISDN106	Layer 1 of a D-channel, or layer 2 associated with the LLM, failed. The line state changed to D-channel maintenance busy (DMB) and the fail flag, I, was set.
ISDN107	The system failed to restore a TEI.
ISDN108	The system restored a TEI.
ISDN109	The system restored a failed D-channel to service. The line state changed from DMB to idle (IDL), and the fail flag, I, was cleared.
ISDN115	An attempted dynamic TEI assignment exceeded the maximum allowable number of links for a specific set of TEI values. The switch performed a TEI audit.
ISDN116	This report is generated when the DCH or EDCH detects that the TEI that responded is unassigned.
ISDN120	This report is generated when a Routine Test, for example a periodic TEI audit, fails.
ISDN121	This log is generated when a terminal initiates an identity verify message with a terminal TEI of 127.
ISDN122	This report is generated when a terminal sends an unexpected frame to the switching system for the current LAPD state.
ISDN200	Up to ten faulty ISDN lines for each log were identified with peg counts and percentages of frames received in error and retransmitted.
ISDN201	The overall switch percentage of frames received in error and retransmitted, the number of line equipment numbers (LEN) on the switch reporting these types of errors, and the number of LENs experiencing high protocol abnormality rates.
ISDN202	The layer 2 protocol abnormality registers for a posted LEN were reset.
ISDN203	Identifies up to ten LENs for each log with a layer 2 high protocol abnormality rate, service disruption, or packet abnormality, and lists the abnormality count or the number of minutes of service disruption for each LEN.
ISDN204	Identifies up to ten LENs for each log with a layer 3 high abnormality rate or packet abnormality. This report generates when a layer 2/3 audit completes.
ISDN205	This report generates if the layer 2 transmission performance exceeds the value set for office parameter LAYER2_PEGS_THRESHOLD_LEVEL. This report generates once every 24 h when a layer 2/3 audit completes.

Table 4-1 Summary of ISDN BRI related logs (Sheet 4 of 9)

Log	Description
ISDN300	Provides the following information statements: Current LTMAP entry has been removed (PKT XX). New SPECCONN entry has been added. Previous LTMAP entry has been restored. (PKT XX) LTID (PKT XX) successfully moved from XSG XXX to XSG XXX.
ISDN301	This report generates when the extended peripheral module user part (XPM UP) detects a layer 3 protocol abnormality. Technical Requirement 821 (TR821) describes layer 3 protocol abnormalities. X.25 Protocol Systems (XPS) in the X.25 link interface unit (XLIU) generate this log report. This log report is for voice services and packet data. For voice services the log report includes the peripheral module identifier (PMID), LEN, terminal endpoint identifier (TEI), primary directory number (PDN), abnormality type, and abnormality cause. For packet data the log report includes the LEN, abnormality type, and abnormality cause.
ISDN303	This log report generates when layer 3 packet abnormality counters exceed their capacities. XPSs generate this log for the XLIU. The XPSs also port the information for this log to the CM for generation of its log report. The CM log report is identical to the XLIU log. This log report includes the type of counter capacity, the abnormality type, and the counter capacity in hexadecimal numbers.
ISDN304	This report generates when a layer 2 abnormality specified in TR821 is detected by the DCH or the EDCH. The report includes the abnormality type and cause.
ISDN305	This report generates when an ISDN line exceeds the service disruption threshold. This threshold is defined in table OFCVAR by office parameter LAYER2_SERVICE_DSRPT_THLD.
ISDN306	This log report generates when layer 2 packet abnormality counters exceed their capacities. XPSs generate this log for the XLIU. The XPSs also port the information for this log to the CM. The CM log is identical to the XLIU log. The log report includes the type of counter capacity, the abnormality type, and the counter capacity in hexadecimal numbers.
ISDN307	This log report generates when the HDLC frame processor (HFP) of the DMS packet handler finds a layer 2 packet abnormality. XPSs in the XLIU detect packet abnormalities and generate this log. XPSs also port the log information to the CM for generation of its log report. This log report includes the LEN and the type of packet abnormality. The CM log report ISDN307 also includes the channel type on which the layer 2 packet abnormality occurred.
ISDN308	This report generates if the count of layer 2 service disruptions exceeds the value set for office parameter LAYER2_SERVICE_DSRPT_THLD. This report generates once every 24 h when a layer 2/3 audit completes.

Table 4-1 Summary of ISDN BRI related logs (Sheet 5 of 9)

Log	Description
ISDN309	This report generates if the layer 3 service disruptions exceeds the value set for office parameter LAYER3_PACKET_SVC_THLD. This report generates once every 24 h when a layer 2/3 audit completes.
ISDN311	This report generates when an ISDN line exceeds the layer 3 service disruption threshold for circuit-switched services. Office parameter L3_SVC_DSRPT_THLD in table ISDNVAR defines the threshold value. The XPM detects ISDN layer 3 signaling conditions that cause D-channel service disruption on a BRI. The XPM sends a record of the service disruption to the CM, which increments the layer 3 service disruption counter.
ISDN312	This report generates when the ISDN line count for layer 3 service disruptions for circuit-switched abnormalities reaches the counter capacity. XPMs detect the D-channel abnormalities and send these abnormalities to the CM, which maintains the counter. This log report lists the affected PMID, LEN, and counter capacity.
ISDN313	This report generates when the ISDN subsystem finds a layer 3 packet protocol abnormality on a packet link. Technical Requirement 821 (TR821) describes the layer 3 protocol abnormality. XPSs in the XLIU detect packet abnormalities and generate log report ISDN301. The XPSs also port this log information to the CM for generation as log report ISDN313. This report lists the LEN, the channel type, the type of abnormality, and information about the cause of the abnormality.
Line logs	
LINE100	An ISDN loop passed the line diagnostics initiated by the ICMO queue, the shower queue, or the DIAG command.
LINE101	An ISDN loop failed the line diagnostics initiated by the ICMO queue, the shower queue, or by the DIAG command.
LINE107	The system requested a line insulation test. This test provides the ac and dc offset voltage for the tested line equipment.
LINE110	A foreign potential test detected foreign electromagnetic force on the line.
LINE118	The system failed to make the metallic connection between the line card and the test equipment using a metallic test access (MTA).
LINE131	For the 2B1Q line card and mp-eoc line units: This log is generated when a performance threshold for an individual multipoint embedded operations channel (mp-eoc) line unit is exceeded.

Table 4-1 Summary of ISDN BRI related logs (Sheet 6 of 9)

Log	Description
	For the S/T-line card: The frame error rate (FER) or percentage error seconds (PES) was degraded or unacceptable, and was reported as part of loop performance monitoring. At the MAP terminal, in both cases, a flag, P, was set against the loop. The flag is cleared by a diagnostic. **Note:** The MAP command QLAYER at the LTPISDN level of the MAP can be used to query the ES and SES counters to obtain their exact values.
LINE145	
	The signal at layer 1 of the 2B1Q U-loop was lost or recovered. Loss of signal can be caused by • loss of U-loop synchronization • loss of signal with "dying gasp • loss of signal with no "dying gasp • loss of synchronization word (LOSW) When mp-eoc line units are used, this log indicates where the signal loss occurred. This log can also indicate an mp-eoc line unit internal failure (node failure).
LINE146	T synchronization was lost or recovered.
LINE147	Maintenance initiated by the customer changed the NT1 test mode at the customer's NT1.
LINE148	Layer 1 basic line monitoring (BLM) parameters were refreshed. The layer 1 BLM audit detected a mismatch between the BLM data stored on the 2B1Q line card and the data stored in the DMS-core for the loop. The audit refreshed the BLM parameters and generated this log. This log also reports PM mode conditions on 2B1Q loops equipped with mp-eoc line units.
LINE149	The LCME audits detected a difference between the stored mp-eoc configuration and the actual configuration.
LINE 204	A problem has been detected during call processing.
LINE205	The system detected incoming message overflow on an ISDN line, and an ICMO report is generated.
Network logs	

Table 4-1 Summary of ISDN BRI related logs (Sheet 7 of 9)

Log	Description
NET102	
	Generated when • integrity is not found on a network channel • integrity is lost on a network channel • integrity is lost due to an overflow of parity errors on a network channel The NET102 log is also used when ISDN special connections, using table SPECCONN, are made through the network. Logs PM231, PM232, PM233, and PM234 are generated by the SPECCONN audit and SPECCONN daily audit when the special connection changes status. Changes to or from the status NO_INTEG are excluded. Log PM236 is generated when integrity is found, or not found, on a network channel.
Peripheral module logs	
PM100	A PM failed a diagnostic (DIAG) test.
PM101	A PM failed a checksum test (CHKSUM-TST).
PM102	A PM changed state to system busy (SysB) because of a system request.
PM103	A PM changed from manual busy (ManB) to offline (OffL), or a PM was added to its inventory table while OffL and unequipped (Uneq).
PM104	A PM changed state from OffL to unequipped (Uneq), or a tuple is deleted from the LTCINV inventory table.
PM105	A PM changed to ManB.
PM106	A PM was returned to service (RTS).
PM107	
	A PM changed to C-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 SysB.
PM113	Message congestion occurred in a peripheral processor.
PM114	A PM 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 a PM.

Table 4-1 Summary of ISDN BRI related logs (Sheet 8 of 9)

Log	Description
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 PM is affected. PM115 does not contain this field.
PM128	A PM changed to in-service trouble (ISTb).
PM179	A hardware condition affected the normal operation of the DMS-100 switch or its PMs. This log supplies information for the PM hardware exception report.
PM180	A PM 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	A PM exception occurred as a result of diagnostics.
PM182	A PM P-side link changed to ManB.
PM183	A PM P-side link changed to SysB.
PM184	A PM P-side link was returned to service.
PM187	A PM carrier changed to SysB.
PM188	A PM carrier was returned to service or was protection-switched.
PM190	The DCH or EDCH changed to SysB. The system detected a DCH or EDCH card fault.
PM191	The DCH or EDCH changed to ManB.
PM192	The C-side node (LGC/LTC) of the DCH or EDCH was removed from service.
PM193	The DCH or EDCH changed to OffL. The DCH or EDCH card was datafilled but was not recognized by the switch.
PM194	The DCH or EDCH changed from in-service (InSv) to ISTb. Service was not affected, but a fault was detected.
PM195	The DCH or EDCH changed to InSv.
PM196	The DCH or EDCH was removed from the customer data table (DCHINV).
PM198	The system detected a DCH or EDCH fault, which did not affect service.
PM199	Provides DCH or EDCH diagnostic results.
PM200	Provides DCH load information.

Table 4-1 Summary of ISDN BRI related logs (Sheet 9 of 9)

Log	Description
PM231	A PM failed to acknowledge an audit request from SPECCONN to add or delete a channel connection.
PM232	A PM acknowledged an audit request from SPECCONN to add or delete a channel connection.
PM233	A PM repeatedlyfailed to acknowledge an audit request from SPECCONN to add or delete a channel connection.
PM234	A PM detected a problem with the PM channel connection data in SPECCONN.
PM235	A DCH or EDCH takeover occurred. The source and destination DCHs or EDCHs and the ISDN service group (ISG) were identified, and the failure reason is given, if applicable.
PM236	Integrity was found or not found on a network channel.
PM270	The system detected DCH or EDCH congestion or overload.
PM600	A PM failed a routine exercise (REx) test.
TRK101	The percentage of busy trunks in a trunk group has reached or exceeded the threshold value for a minor alarm in table CLLIMTCE.
TRK102	The percentage of busy trunks in a trunk group has reached or exceeded the threshold value for a major alarm in table CLLIMTCE.
TRK103	The percentage of busy trunks in a trunk group has reached or exceeded the threshold value for a critical alarm in table CLLIMTCE.
TRK104	The percentage of busy trunks in a trunk group has dropped below the threshold value for a minor, major, or critical alarm in table CLLIMTCE.

Priority logs

ISDN BRI priority logs are 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. 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 4-2 lists the service-affecting logs for ISDN BRI. The table includes the alarm class, if applicable, and the action to be taken for each log.

Table 4-2 ISDN BRI service-affecting logs

Log	Alarm class	Action
ISDN100	no alarm	Determine the reason for the unavailability of the terminal.
ISDN101	no alarm	Determine the reason for the unavailability of the loop.
ISDN102	no alarm	Verify the information datafilled for the terminals. Disconnect both terminals with duplicated TEIs from the ISDN line. Restore the TEI to service using the TEI RESTORE command.
ISDN104	no alarm	Use the CONT command at the ISG level of the MAP to isolate the problem on the loop.
ISDN106	no alarm	Perform BERT testing on the ISDN line to isolate the fault.
LINE101	minor	Perform the appropriate lines alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
LINE145	no alarm	Use the DIAG command from the LTP level of the MAP display to determine the reason for loss of sync at layer 1.
LINE146	no alarm	Use the DIAG command from the LTP level of the MAP display to determine the reason for loss of sync at layer 1.
PM102	critical	Clear the alarm by performing the LGCI 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 network alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
TRK103	critical	Perform the appropriate trunk alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.

Table 4-3 lists the potential service-affecting logs for ISDN BRI. The table includes the alarm class, if applicable, and the action to be taken for each log.

Table 4-3 ISDN BRI potential service-affecting logs (Sheet 1 of 2)

Log	Alarm class	Action
NET102	no alarm	Collect and compare subsequent integrity messages to determine the cause of the integrity mismatches. Use the NETINTEG level of the MAP display.
PM100	no alarm	Repeat the diagnostic 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.
PM101	no alarm	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 LGCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
PM109	minor	If this log appears fewer than three times over a period of 2 min, do not take any action. If this log appears for more than 2 min, clear the alarm by performing the LGCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
PM115	no alarm	If this log appears with log PM108, clear the alarm by performing the LGCI 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 LGCI 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 fewer 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 LGCI 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*.

Table 4-3 ISDN BRI potential service-affecting logs (Sheet 2 of 2)

Log	Alarm class	Action
PM179	no alarm	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.
PM180	minor	If the character string indicates a hardware problem, perform diagnostic maintenance on the suspect equipment. Clear the alarm by performing the LGCI or LTCI alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
PM183	minor	Perform testing and diagnostics for P-side link.
PM187	no alarm	Perform testing and diagnostics for the carrier.
PM190	major	Perform the DCH alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
PM194	major	Perform the DCH alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.
PM234	no alarm	Check and verify the status of endpoints.
PM235	major	Perform the DCH 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*.
TRK103	minor	Perform the appropriate trunk alarm clearing procedure in *Alarm and Performance Monitoring Procedures*.

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

Table 4-4 ISDN BRI provisioning and engineering information logs

Log	Alarm class	Action
PM113	no alarm	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*.
PM270	no alarm	If the DCH or EDCH congestion persists, contact the group responsible for ISDN engineering and provisioning so that ISDN services can be redistributed to improve DCH or EDCH load balance.

5 Operational measurements

Operational measurements (OM) are a useful surveillance tool for Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI). Use OM information for real-time maintenance activities, long-term maintenance analysis, and administration.

ISDN BRI OM groups

Table 5-1 lists and describes the OM groups used for ISDN BRI maintenance and administration. For detailed explanations of OM registers, refer to the *Operational Measurements Reference Manual*. For detailed information about how to activate OMs, refer to the *Basic Administration Procedures*, 297-1001-300. For a detailed list of OMs recommended for thresholding, along with their associated alarm levels and scan times, refer to the *Maintenance and Operational Manual*.

Table 5-1 Summary of ISDN BRI OM groups (Sheet 1 of 2)

Group	Description
AUTSPID	Measures usage data associated with the Automated Service Profile Identifier (SPID) feature for each extended peripheral module (XPM) on North American BRI functional sets (BRIFS) only.
DS1CARR	Provides information about maintenance thresholds and out-of-service thresholds for digital trunks on peripheral modules (PM), and also provides usage registers for the DS-1.
ISDNBACT	Monitors usage for B-channels in circuit mode for the office. Usage is based on bearer service.
ISDNBLCD	Monitors traffic handling on B-channels for each line concentrating device (LCD).
ISGBD	Monitors traffic handling on Bd channels.
ISGBRA	Monitors traffic on D-channels.
ISGCPU	Measures the CPU occupancy of an ISDN service group (ISG).
ISGOVLD	Measures the degree of overload of an ISG.

Table 5-1 Summary of ISDN BRI OM groups (Sheet 2 of 2)

Group	Description
LINAC	Monitors the grade of service for line access.
LMD	Provides traffic information for the LCME.
NCMCPUST	Provides a measure of the amount of network interface unit (NIU) CPU time used by the DMS packet handler XPM link interface unit (XLIU) and other nodes.
OFZ	Summarizes the composition of an office's incoming traffic, routing, and outgoing traffic, including DMS packet handler traffic.
PM	Counts errors, faults, and maintenance state transitions for DMS-100 PMs that have node numbers.
PMOVLD	Counts originations and terminations denied by an PM to reduce the processing load of an overloaded PM.
RND	Provides Redirecting Number and Reason Delivery traffic measurements for the switch. These measurements include deliveries of one or two redirecting numbers or non-delivery events.
TRK	Provides traffic analysis for each trunk group. This group is useful when DMS packet handler trunks have unique CLLIs.
TROUBLEQ	Provides information on the operation of trouble queues.
XPMLINK	Provides link blockage and usage measurements on each of the XPMs.

Priority OM registers

Table 5-2 lists the priority OM groups, OM registers, and their associated logs.

Table 5-2 Priority OM registers (Sheet 1 of 3)

Group	Register	Associated logs	Description
AUTSPID	ATSPDREQ	none	Counts the number of valid automated SPID requests received for each XPM, if the office parameter AUTOSPID in table ISDNVAR is ON and it receives a valid request.
	SUCCREQS	none	Counts the number of automated SPID requests that are successfully processed and a SPID sent to the requesting LTID.
	SPDUNVL	none	Counts the number of automated SPID request failures because a SPID was not available on the interface.

Table 5-2 Priority OM registers (Sheet 2 of 3)

Group	Register	Associated logs	Description
	NO_TSP	none	Counts the number of automated SPID request failures because a terminal service profile (TSP), or LTID, was not provisioned on the interface.
	UNSPDREQ	none	Tracks AUTOSPID requests that are not necessary. When a request for an AUTOSPID has already processed successfully, subsequent requests are tagged as UNSPDREQ.
DS1CARR	DS1BER	PM110	Counts messages received from a PM that indicate the bit error rate exceeds the maintenance or out-of-service (OOS) threshold.
	DS1BPV	PM110	Counts messages received from a PM that indicate the bipolar violations exceed the maintenance or OOS threshold.
	DS1LOF	PM110	Counts frame loss occurrence on the incoming side of an associated digital carrier.
	DS1SLP	PM112	Counts occurrences of frame slip on an associated digital carrier because of overrun or underrun events on the incoming bit stream.
	DS1ES	none	Counts the DS-1 errored seconds (ES) that occur during an XPM audit.
	DS1SES	none	Counts the DS-1 severely errored seconds (SES) that occur during an XPM audit.
ISGBD	DBDTXDSC	PM270	Counts the number of frames destined for the packet handler that are discarded by a DCH or EDCH because of hardware problems.
	DBDRXDSC	PM270	Counts the number of frames received from the packet handler and discarded by the DCH or EDCH because of an invalid logical terminal identifier (LTID), a message that cannot be decoded, a flow control problem, an abort, or a hardware error.
ISGBRA	DBRLKRED	PM190 PM194 PM198 PM270	Counts the number of links reset by a DCH or EDCH.
	DBRLKREP	PM270	Scored each time the far-end device performs a link reset.

Table 5-2 Priority OM registers (Sheet 3 of 3)

Group	Register	Associated logs	Description
	DBRRXDSC	PM190 PM194 PM198 PM270	Counts the number of frames discarded by the DCH or EDCH because of flow control problems, unregistered terminal endpoint identifiers, messages that cannot be decoded, partially received messages, sequencing errors, or an unknown service access point identifier (SAPI).
	DBRTXDSC	PM190 PM194 PM198 PM270	Scored each time a frame destined for packet handler is discarded by the DCH or EDCH because of a hardware problem.
ISGOVLD	CONGENTR	PM270	Counts the number of times that an ISG enters a congested state.
	CONGEXIT	PM270	Counts the number of times that an ISG leaves a congested state.
	OVLDENTR	PM270	Counts the number of times an ISG enters an overloaded state.
	OVLDEXIT	PM270	Counts the number of times an ISG leaves an overloaded state.
	OV16 DSC	PM270	Counts the number of SAPI 16 frames that are discarded due to overload controls.
PMOVLD	PORGDENY	PM106 PM128	Counts line originations that are denied by an in-service PM because of an overload condition.
	PTRMDENY	PM106 PM128	Counts terminations denied by an in-service PM because of an overload condition.
TROUBLEQ	TRBQATT	LINE 100 LINE101 LINE 204 LINE 205	Counts the number of times the system tried to place a line on the trouble queue.
	TRBQOCC	LINE 100 LINE 205	Records the number of lines in a trouble queue every 100 s.
	TRBQOVFL	LINE 204 LINE 205	Counts the number of times the system failed while trying to place a line on a queue that was full.

Associated OMs

Table 5-3 lists and describes associated OM groups not directly used for ISDN BRI maintenance and administration, but used for business and feature studies.

Table 5-3 Associated OM groups

Group	Description
BCAPCG	*Bearer capability per customer group* Collects OMs on bearer capability for each customer group.
BCAPOF	*Bearer capability per office*Collects OMs on bearer capability for each office.
CALLFWD	*Call forwarding feature group* Provides information about incoming calls that are redirected using call forwarding features.
CALLWAIT	*Call waiting feature group* Provides information on the use of Call Waiting.
CPICG	*Call progress indication customer group* Counts calls that are entirely within the ISDN and calls for which only one party is within the ISDN.
CPICKUP	*Call pickup group* Provides information on incoming calls to another station in a predefined call pickup group.
EXT	*Extension block*Monitors the use of extension blocks, that is, additional memory allocated by the switch to process call data.
IBNGRP	*IBN customer group* Provides information about the use of integrated business network (IBN) call processing by a customer group.
MWTCAR	*Message waiting and call request group* Provides information on feature use, traffic measurements, and failures that occur because of insufficient software and hardware resources for message waiting features.
OHQCBQCG	*Off-hook queuing and call-back queuing group* Provides information about the Off-hook Queuing and Call-back Queuing features.
PRKOM	*Call park group* Provides information on feature usage, traffic measurement, and failures that occur because of insufficient software and hardware resources for Call Park features.
RTLTSUM	*Real-time tool line and trunk call attempts summary* Counts real-time origination and termination attempts for each line and trunk type.
SPEEDCAL	*Speed calling group*Provides information on the activity of the speed calling long list and speed calling short list services.
TRMTFR2	*Feature-related treatment extension*Counts calls that the system routes to treatment. The treatment must be a normal progression of a call. Register TFRACRJ, which counts the number of rejected calls that the system routes to anonymous caller rejection (ACRJ) treatment, is pegged for BRI lines.

Performance factors and system faults related to OMs

Table 5-4 lists ISDN BRI performance factors and system faults and their associated OM groups, registers, and logs.

Table 5-4 Performance factors and system faults related to OMs (Sheet 1 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
Bd channel traffic, DCH or EDCH failures	ISGBD	DBDCRC, DBDRXDSC, DBDRXPH, DBDTXDSC, DBDTXPH	For DBDCRC, none For DBDRXDSC: • PM270 • ISDN103 • ISDN104 For DBDRXPH, none For DBDTXDSC: • PM270 • ISDN103 • ISDN104 For DBDTXPH, none
D-channel traffic, DCH or EDCH failures	ISGBRA	DBRCRC, DBRLKRED, DBRLKREP, DBRREJRX, DBRREJTX, DBRRNRD, DBRRNRP, DBRRXDSC, DBRS16RX, DBRS16TX, DBRSARX, DBRSATX, DBRS0RX, DBRS0TX, DBRTXDSC	For DBRCRC, none For DBRLKRED: • PM190 • PM194 • PM198 • PM270 For DBRLKREP, PM270 For DBRREJRX, none For DBRREJTX, none For DBRRNRD, none For DBRRNRP, none

Table 5-4 Performance factors and system faults related to OMs (Sheet 2 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
D-channel traffic, DCH or EDCH failures (cont)	ISGBRA	DBRCRC, DBRLKRED, DBRLKREP, DBRREJRX, DBRREJTX, DBRRNRD, DBRRNRP, DBRRXDSC, DBRS16RX, DBRS16TX, DBRSARX, DBRSATX, DBRS0RX, DBRS0TX, DBRTXDSC	For DBRRXDSC: • PM190 • PM194 • PM198 • PM270 For DBRS16RX, none For DBRS16TX, none For DBRSARX, none For DBRSATX, none For DBRS0RX, none For DBRS0TX, none For DBRTXDSC: • PM190 • PM194 • PM198 • PM270
DCH or EDCH overload	ISGOVLD	CONGENTR, CONGEXIT, CONGTIME, OVLDENTR, OVLDEXIT, OVLDTIME, OV16DSC, OV16DSC2	For all associated OM registers, log PM270
DCH or EDCH processor occupancy	ISGCPU	DCPU10, DCPU20, DCPU30, DCPU40, DCPU50, DCPU60, DCPU70, DCPU80, DCPU90, DCPU100, DCPUTOT, DCPURTR	For all associated OM registers, none

Table 5-4 Performance factors and system faults related to OMs (Sheet 3 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
DS-1 link availability, DS-1 link failures	DS1CARR	DS1AIS, DS1BER, DS1BPV, DS1CBU, DS1ECF, DS1ES, DS1LCGA, DS1LOF, DS1MBU, DS1PBU, DS1RCGA, DS1SBU, DS1SES, DS1SLP, DS1UAS	For DS1AIS, none For DS1BER, log PM110 For DS1BPV, log PM110 For DS1CBU, log PM107 For DS1ECF, none For DS1ES, none For DS1LCGA: • PM109 • TRK109
DS-1 link availability, DS-1 link failures (cont)	DS1CARR	DS1AIS, DS1BER, DS1BPV, DS1CBU, DS1ECF, DS1ES, DS1LCGA, DS1LOF, DS1MBU, DS1PBU, DS1RCGA, DS1SBU, DS1SES, DS1SLP, DS1UAS	For DS1LOF, log PM110 For DS1MBU: • PM105 • PM111 For DS1PBU, log PM182 For DS1RCGA, log PM183 For DS1SBU: • PM109 • TRK109 For DS1SES: • PM109 • PM111 For DS1SLP, none For DS1UAS, PM112
DS30 and DS30A link availability, LGC traffic	XPMLNK	CSLAA, CSLBLK, CSLCBU, CSLMU, PSLAA, PSLBLK, PSLCBU, PSLMU	For all associated OM registers, none

Table 5-4 Performance factors and system faults related to OMs (Sheet 4 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LCME real time, LCME traffic, LGC traffic	LMD	LMTRU, MADNTATT, NORIGATT, NTERMATT, ORIGABN, ORIGBLK, ORIGFAIL, PERCLFL, REVERT, STKCOINS, TERMBLK	For LMTRU, none For MADNTATT, none For NORIGATT, none For NTERMATT, none For ORIGABN, log LINE106 For ORIGBLK, log LINE108 For ORIGFAIL: • NET130 • LINE104 • LINE105 • LINE106 For PERCLFL: • LINE108 • LINE109 For REVERT: • LINE138 For STKCOINS, LINE107
LCME real time, LCME traffic, LGC traffic (cont)	LMD	LMTRU, MADNTATT, NORIGATT, NTERMATT, ORIGABN, ORIGBLK, ORIGFAIL, PERCLFL, REVERT, STKCOINS, TERMBLK	For TERMBLK: • LINE113 • LINE138 • LINE112 • NET130
LGC overload	PMOVLD	PORGDENY, PTRMDENY	For PORGDENY and PTRMDENY, PM106 and PM128
Line traffic	LINAC	LINABAN, LINCAT, LINCATF, LINTDEL	For all associated OM registers, none

Table 5-4 Performance factors and system faults related to OMs (Sheet 5 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LGC overload, LCME overload, line card failures, module faults	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMCCTDG: • LINE101 • LINE131 For PMCCTFL, log LINE101 For PMCCTOP, none For PMERR: • NET102 • PM101 • PM108 • PM113 • PM115 • PM116 • PM117 • PM118 • PM119 • PM122 • PM124 • PM125 • PM126 • PM128

Table 5-4 Performance factors and system faults related to OMs (Sheet 6 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LGC overload, LCME overload, line card failures, module faults (cont)	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMFLT: • PM180 • PM181 • PM190 • PM194 • PM270 For PMINTEG: • PM100 • PM101 • PM102 • PM114 • PM117 For PMMBP: • PM180 • PM181 For PMMBTCO, log PM185 For PMMCXFR: • NET102 • PM101 • PM108

Table 5-4 Performance factors and system faults related to OMs (Sheet 7 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LGC overload, LCME overload, line card failures, module faults (cont)	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMMMBU: • PM113 • PM118 • PM119 • PM122
LGC overload, LCME overload, line card failures, module faults (cont)	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMMSBU: • PM124 • PM180 • PM181 • PM185 For PMMWXFR: • PM182 • PM191 For PMPSERR, none For PMPSFLT: • PM128 • PM179 For PMRGERR: • PM180 • PM181 For PMRGFLT: • PM105 • PM128

Table 5-4 Performance factors and system faults related to OMs (Sheet 8 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LGC overload, LCME overload, line card failures, module faults (cont)	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMSBP: • PM170 • PM182 • PM191 For PMSBTCO: • PM102 • PM128 For PMSCXFR: • PM170 • PM183 • PM190 • PM192 • PM102 • PM128 • PM183 • PM110 • PM181 • PM109 • PM161 • PM162 • PM163 • PM107 • PM179 • PM180

Table 5-4 Performance factors and system faults related to OMs (Sheet 9 of 9)

Performance factor or system fault	Associated OM group	Associated OM registers	Associated logs
LGC overload, LCME overload, line card failures, module faults (cont)	PM	PMCCTDG, PMCCTFL, PMCCTOP, PMERR, PMFLT, PMINTEG, PMMBP, PMMBTCO, PMMCXFR, PMMMBU, PMMSBU, PMMWXFR, PMPSERR, PMPSFLT, PMRGERR, PMRGFLT, PMSBP, PMSBTCO, PMSCXFR, PMSWXFR, PMUMBU, PMUSBU	For PMSWXFR: • PM128 • PM179 • PM180 • PM181
			For PMUMBU: • PM105 • PM128 • PM182 • PM191 For PMUSBU: • PM102 • PM128 • PM152 • PM183 • PM190 • PM192

6 User interface

This chapter describes the user interface associated with integrated services digital network (ISDN) basic rate interface (BRI), including information about

- the MAP level hierarchy
- menu MAP commands
- unlisted MAP commands
- query commands
- line status indicators
- channel status indicators
- link status indicators
- trunk status indicators
- peripheral module (PM) status indicators

> ***Note:*** The user interface can vary in appearance. Some MAP levels and commands are available only when specific hardware or software is provisioned.

MAP level hierarchy

Figure 6-1, "MAP level hierarchy" on page 6-2 and Figure 6-2, "MAP level hierarchy (continuation)" on page 6-2 illustrate the MAP level hierarchy for ISDN BRI maintenance.

Figure 6-1 MAP level hierarchy

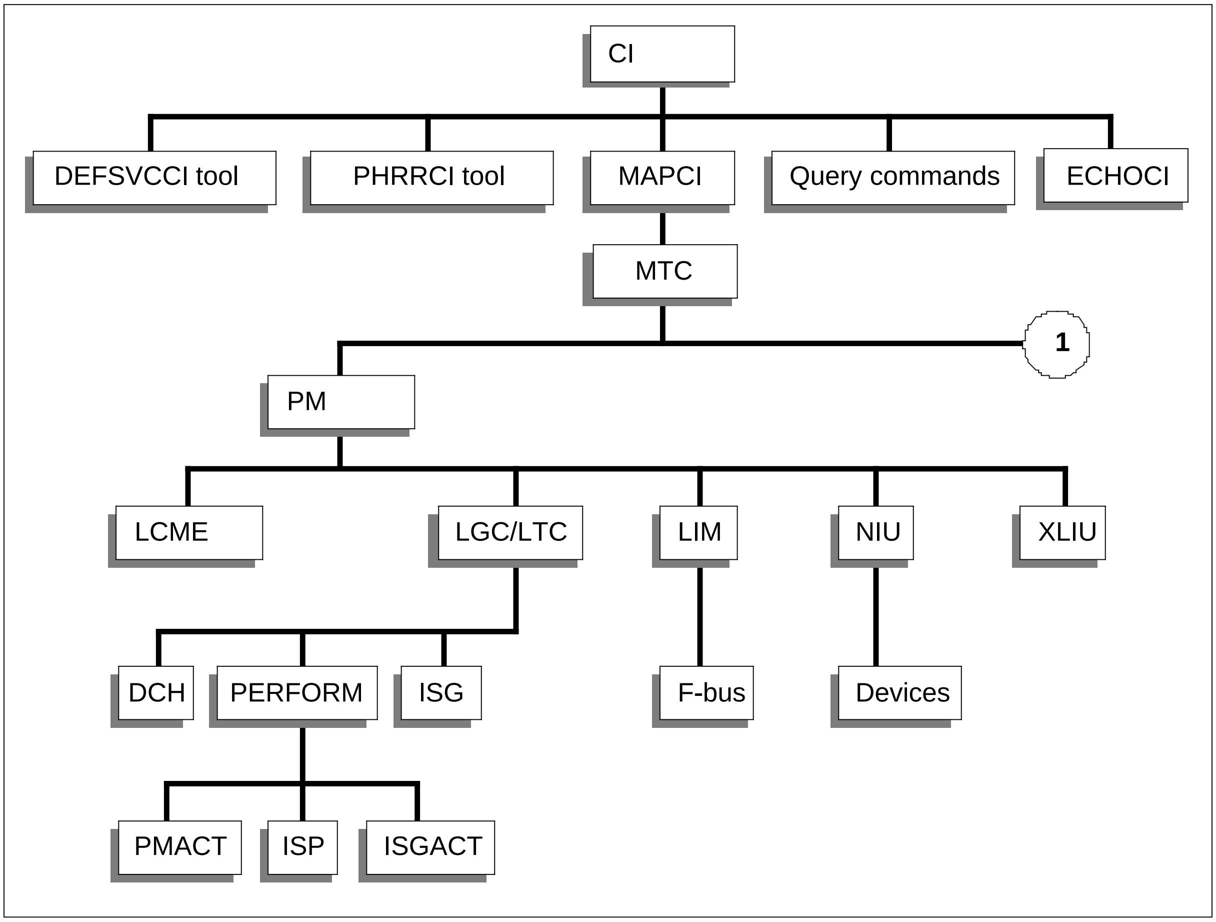
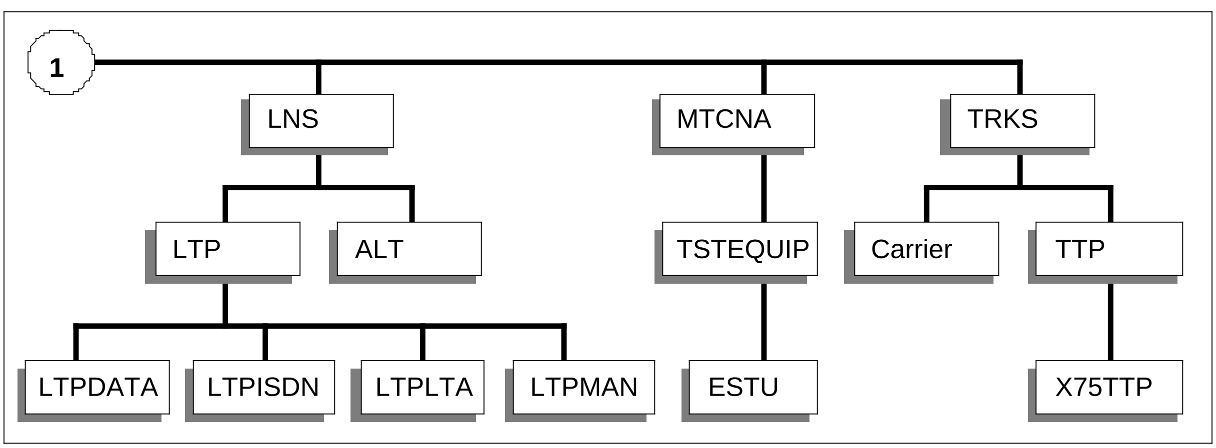


Figure 6-2 MAP level hierarchy (continuation)



Commands

This section lists and describes ISDN BRI menu MAP commands, unlisted MAP commands, and query commands.

Menu MAP commands

Table 6-1 lists all the ISDN BRI menu MAP commands.

Table 6-1 Menu MAP commands (Sheet 1 of 7)

Command	Level	Description
ALMSTAT	LTP	Displays the status of LNS alarms and changes alarm thresholds.
ALTINFO	ALT	Displays information about the ALT scheduled data.
BCHCON	LTPISDN	Performs a B-channel continuity test from an XLIU XSG channel through the NET, NIU, LTC, and LCME to the T interface of the NT1 at the customer premises.
BERT	LTPDATA	Performs a bit error rate tests on a line to either the L, LU, T, or CPE loopback points. The L, LU, and T loopback points are set at the switch using the LOOPBK command at the LTPDATA level of the MAP terminal. The CPE loopback is set at the CPE end; the M5209 and the M5317 ISDN sets both have this capability.
BSY	Most levels	Busies the posted lines, trunks, carriers, links, PM units, or PM. The BUSY command does not busy lines or trunks with PVCs; use the FRLS command.
CAP	LTPLTA	Performs capacitance measurements without disconnecting the NT1 from the line at the U-interface.
CKT	TTP	Connects two X.75 trunk circuits.
CKTINFO	TTP, X75TTP	Provides X.75 trunk and associated PM state information.
CKTLOC	LTP, TTP, X75TTP	Locates and identifies the line or trunk circuit card.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 2 of 7)

Command	Level	Description
CKTTST	ALT	Sends test messages to the line card or to the terminal. These messages are looped back to the LCME.
CONNECT	LTPDATA	Connects DTA test equipment to the BRI loop or B-channel in the control position.
CONT	ISG	Runs an internal or external continuity test on the posted ISG channel.
DELAYS	PERFORM	Accesses the DELAYS level and displays information on call processing delays.
DCHCON	LTPISDN	Performs a D-channel continuity test on the ISDN loop.
DIAG	ALT, LTP	Performs an extended diagnostic on a posted line in the control position. ***Note:*** At the LTP level, the NOWAIT option with the DIAG command allows diagnostics to run in a background process. The NOWAIT option is for BX26AA and BX27AA line cards only.
DISP	PM	Displays a list of lines, trunks, carriers, or PMs in a specified state, or a summary of diagnostic failures.
EQUIP	LTPDATA	Reserves, queries, and releases DTA monitor equipment for testing ISDN lines.
HOLD	Most LNS and TRKS levels	Moves the line or trunk in the control position to a spare hold position, and the next line or trunk in the posted set, if any, to the control position.
ISGACT	PERFORM	Accesses the ISGACT level and displays the number and type of SAPI frames transmitted and received successfully by the DCH or EDCH, and the total number of SAPI frame errors transmitted and received by the DCH or EDCH.
LCO	LTP	Operates or releases the line card cutoff relay of the line in the control position.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 3 of 7)

Command	Level	Description
LISTSET	All PM levels	Lists the set of posted PMs.
LNTST	LTPLTA	Connects the line test access (LTA) to a line card and performs resistance, capacitance, ac voltage tests, and dc voltage tests on the ISDN line.
LOADPM	Most PM levels	Loads the software into the PM.
LOADTE	ESTU	Downloads a software file to the ESTU, or to one of the units: EMM or ITM.
LOOPBK	ISG, LTPDATA, X75TTP	Sets, queries, or releases a loopback point.
LTA	LTPLTA	Sets the test configuration to IN, OUT, or BRIDGED (for 2B1Q) and releases the LTA from the line card.
LTLOOPBK	LTPISDN	Sets up a loopback point in the DCH or EDCH for the given logical terminal identifier (LTID) for continuity testing from the DPN.
NEXT	Most LNS, PM, and TRKS levels	Moves the next line, trunk, or PM in the posted set into the control position or the next line, trunk, or PM into the control position.
OFFL	Most PM levels	Offlines the line, trunk, channel, or PM.
PFQUERY	PERFORM	Displays up to five PMs currently undergoing the performance process.
POST	All	Posts one or more lines, the LEN of a specified LTID, trunks, carriers, channels, PM units, PMs, echo station directory numbers at line test position in the control position for maintenance.
POSTISG	ISGACT	Posts an ISG channel.
POSTISP	ISP	Posts an ISP channel.
PMACT	PERFORM	Accesses the PMACT level and displays PM performance monitoring data.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 4 of 7)

Command	Level	Description
QLAYER	LTPISDN	Queries layers 1, 2, 3 performance information and protocol abnormality (PA) data for the posted ISDN line. Information display on layer 3 includes service disruption count for circuit services. While in the segmented PM mode, QLAYER can be used to collect the following: • block errors • PM mode • alert status (ON or OFF) • near end (NE) and far end (FE), errored seconds (ES) and severely errored seconds (SES) previous hour and day registers • threshold condition registers • previous four hours of NE and FE ES While in the PATH PM mode, QLAYER can be used to collect the following: • block errors • PM mode • NE and FE, current ES and SES registers • NE and FE ES and SES previous hour and day registers • previous four hours of NE and FE ES
QLOOP	LTPISDN	Displays all the LTIDs, Rapid Messaging states, directory numbers (DN), and TEIs associated with an ISDN loop.
QUERYCH	ISG	Displays all the channels and the associated Bd channel information for the posted ISG.
QUERYISG	ISGACT	Displays all the ISGs under the posted PM.
QUERYPM	Most PM levels	Displays information about the posted line PM.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 5 of 7)

Command	Level	Description
RES	LTPLTA	Performs resistance measurements on a subscriber loop.
REX	Most PM levels	Performs a routine exercise (REx) test on a PM unit or PM.
RLAYER	LTPISDN	
		Resets and displays layers 1, 2, 3 performance information and protocol abnormality (PA) data for the posted ISDN line. Information display on layer 3 includes service disruption count for circuit services. The user can do the following: • query and reset the current registers for all line units on an mp-eoc line • query and reset current registers and history registers for all line units on an mp-eoc line • correct PM mode mismatches between the line units and the mode stored on the computing module (CM) The user hsa The user has the ability to reset the following: • alert, ES, SES, block errors (BE), and PM thresholds • threshold condition, history, and PM mode registers on sub-tending line units
RLS	TTP	Releases a posted line or trunk.
RTS	Most LNS, PM, and TRKS levels	Returns to service a posted line, LTIDs for each LEN, trunk, carrier, PM unit, or PM.
SEIZE	TTP	Seizes lines or trunks for maintenance.
STATUS	PM	Shows the PM status.
STOP	ISGACT, ISP, PMACT	Stops the process begun by the STRT command.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 6 of 7)

Command	Level	Description
STOPLOG	ISGACT, ISP, PMACT	Stops the process begun by the STRTLOG command.
STRT	ISGACT, ISP, PMACT	Starts the timer and the performance testing process.
STRTLOG	ISGACT, ISP, PMACT	Starts generating the PM logs for the performance testing process.
SUSTATE	LTPDATA, LTPISDN	Displays the status of the ISDN line card, NT1, or TEI.
SWACT	Most PM levels	Switches active and inactive units in the posted PM.
SWRG	LCME	Switches activity between the ringing generators.
SWTCH	DCH	Moves the services from one DCH or EDCH to a spare DCH or EDCH.
TEI	LTPISDN	Checks the status of the terminal equipment identifiers (TEI).
TEST	Most LNS, PM, and TRKS levels	Performs a layer 1 test on the 2B1Q loop based on the specified options (see table 6-2).
TEST X75E	TTP, X75TTP	Performs an external continuity test over an X.75 trunk to a loopback point set on an XLIU at the far end office.
TEST X75I	TTP, X75TTP	Performs an internal continuity test from an XLIU to a loopback point set on a trunk PM.
TONGEN	LTPMAN	Generates a metallic tone for the posted loop
TRNSL	Most PM levels	Displays the C-side or P-side speech or link information.
TST	Most levels	Tests the posted line, trunk, carrier, channel, link, card, PM unit, or PM and enables or disables the REX test.

Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE.

Note 2: The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.

Table 6-1 Menu MAP commands (Sheet 7 of 7)

Command	Level	Description
TSTSGNL	LTPISDN	Operates the test tone in the S/T line card.
VAC	LTPLTA	Performs ac voltage measurements without disconnecting the NT1 from the line at the U-interface.
VDC	LTPLTA	Performs dc voltage measurements without disconnecting the NT1 from the line at the U-interface.
Note 1: The following commands are not available for generic services framework (GSF) call processing: LTLOOPBK, QLOOP, and TEI. The following commands have limited functionality for GSF call processing: QLAYER, RLAYER, and SUSTATE. ***Note 2:*** The following commands are not available for a VLCM line: TERMCHK, SUSTATE, BCHCON, LTLOOPBK, DCHCON, TEST, TSTSGNL, TEI, GLOOP, QLAYER, and RLAYER.		

Unlisted MAP commands

Table 6-2 lists all the ISDN BRI unlisted MAP commands.

Table 6-2 Unlisted MAP commands (Sheet 1 of 2)

Command	Level	Description
ALM	LTPISDN	Verifies that the DMS-100 switch can detect and report loss of signal without an NT1 "dying gasp.
BERTIME	LTPDATA	Schedules and audits BERT routines. Can be used to preset the length of time the IBERT is run.
COLDST	LTPISDN	Establishes U-synchronization when the 2B1Q line card and NT1 are initially connected.
DCSIG	LTPISDN	Detects the presence of the NT1 by means of its dc signature.
DET	LTPISDN	Performs the basic line monitoring (BLM) detection test of block errors (BE), errored seconds (ES), and severely errored seconds (SES) counters on the 2B1Q loop.
FRLS	LTP LTPISDN	Forces a line or trunk to release. Busies line or trunks with permanent virtual circuits (PVC).
Note: The QPHINFO command is not available for generic services framework (GSF) call processing.		

Table 6-2 Unlisted MAP commands (Sheet 2 of 2)

Command	Level	Description
ILOSS	LTPISDN	Performs an insertion loss measurement test that detects the presence of load coils on the loop and verifies if the amount of loss on the loop is acceptable.
IMP	LTPISDN	Performs impulse noise measurements on the 2B1Q loop.
L1BLMALM	LTPISDN	Sets or queries the automatic alarm reporting capability of the specified integrated services digital network (ISDN) loop. This command is only valid for ISDN lines. L1BLMALM can inhibit logs related to layer 1 alarms such as loss of T-SYNC or loss of signal. It reads and writes to table LNTHRSH. L1BLMALM can set and query the mp-eoc unit alarm control parameter MPLUFAIL. The MPLUFAIL parameter can be used to inhibit the mp-eoc line unit nodal failure alarm reports. The mp-eoc line unit logs (Line Unit Loss of Sync Word, Line Unit Node Failure, and Line Unit Layer 1 PM Threshold Exceeded) can be inhibited.
L1THRSH	LTPISDN	Sets or queries the layer 1 performance threshold values for the 2B1Q loop.
L2LOGCTL	LTPISDN	Sets status or queries definition or status of the layer 2 log control entities for posted ISDN line. Sets override (OVR) state for log generaton. Turns on or off a single log or all log reports for an individual line.
L3LOGCTL	LTPISDN	Controls layer 3 abnormality logs that are generated or inhibited. Allows control of logs by ISDN line. Sets override (OVR) state for log generation. Turns on or off a single log or all log reports for an individual line.
NSE	LTPISDN	Performs the wideband noise measurement test.
QPHINFO	LTPISDN	Displays the terminating DNs for all DMS PH X.25 calls on the posted DN.
SCUR	LTPISDN	Performs the sealing current test on the 2B1Q loop.
SPARING	DCH	Enables or disables DCH or EDCH sparing.
THR	LTPISDN	Confirms the thresholds set for ES and SES.

Note: The QPHINFO command is not available for generic services framework (GSF) call processing.

Query commands

Table 6-3 lists the query commands used for ISDN BRI maintenance. Query commands can be used from the CI level and any level of the MAP terminal.

Table 6-3 Query commands (Sheet 1 of 3)

Command	Level	Description
QBB	All	Displays B-channel X.25 service group (XSG), circuit, channel, and LEN information.
QCOUNTS	All	Displays and resets the link-level protocol, packet-level protocol, and protocol abnormality counts for a particular X.25 LTID or X.75 interface.
QDCH	All	Displays D-channel handler ISG, Bd-channel, channel, and endpoint information.
QDN	All	Displays information about DNs on an LTID. This command displays the existence of one or more LTIDs, with different call types, options, and information about each LTID associated with a shared DN.
QDNSU	All	Displays a summary or a detailed listing of all DNs that are not assigned in software.
QDNWRK	All	Displays a summary or a detailed listing of all DNs assigned in software. For shared DNs, this command displays the existence of one or more LTIDs, with different call types, options, and information about each LTID.
QGRP	All	Displays call appearance and member information for a CACH DN, LTID, or LEN.
QHA	All	Displays a summary or a detailed listing of all hardware assigned in software.
QHASU	All	Displays a summary or a detailed listing of all hardware assigned and software unassigned LENs.
QHU	All	Displays a summary or a detailed listing of hardware unassigned LENs.
Note: The following commands are not available for GSF call processing: QDN, QDNSU, QDNWRK, QIT, QLOOP, and QLT, QDCH, and QLEN will display inaccurate information for GSF call processing.		

Table 6-3 Query commands (Sheet 2 of 3)

Command	Level	Description
QIT	All	Displays the service information associated with an ISDN terminal, including the DS-1 connection to the packet handler for a special connection. For a logical terminal with a shared DN, the call type displays for each shared DN. Keys without a shared DN are blank under the CALLTYPE heading.
QLEN	All	Obtains all relevant information about a logical terminal associated with the LEN specified when the QLEN command is used.
QLENWK	All	Displays a summary or a detailed listing of all hardware assigned and software assigned LENs.
QLOAD	All	Displays a summary of LEN assignments based on line class code.
QLOOP	All	Displays LTID, Rapid Messaging, DN, and TEI information.
QLT	All	Displays a listing of information about a logical terminal. For logical terminals with shared DNs, the call type displays for each DN. Keys without a shared DN are blank under the CALLTYPE heading. Information on the X.25/X.75 service group (XSG) is displayed if the logical terminal is an echo station mapped to a XSG.
QMADN	All	Displays information about the multiple appearance directory number (MADN) group and each member assigned to the group for a specified DN. A MADN CACH DN can be associated with 1-16 call appearances and each call appearance can be associated with 1-32 members. A MADN CACH display includes the call appearance number, call appearance reservation (CARES) type, and call arrangement type of CACH.
QPHF	All	Displays DMS packet handler configuration information related to directory number, logical terminal identifier and X.25/X.75 service group.
QPHF ARA	All	Displays the status of all XSGs on the switch, including ARA available setting, XSG state, free channels available, ARA usability, and XSG rank.

Note: The following commands are not available for GSF call processing: QDN, QDNSU, QDNWRK, QIT, QLOOP, and QLT, QDCH, and QLEN will display inaccurate information for GSF call processing.

Table 6-3 Query commands (Sheet 3 of 3)

Command	Level	Description
QPHF AUTO_XSG	All	Displays all the XSGs on the switch and their maintenance, resource availability, and ARA availability status.
QPHF XSG	All	Displays the status of a specific XSG on the switch.
QSCONN	All	Displays information about the SPECCONN endpoints, connection type, status, P-side ports and channels, and C-side ports and channels.
QX75	All	Displays DMS packet handler X.75 trunk XSG, endpoint, carrier, common language location identifier (CLLI), and member information.
Note: The following commands are not available for GSF call processing: QDN, QDNSU, QDNWRK, QIT, QLOOP, and QLT, QDCH, and QLEN will display inaccurate information for GSF call processing.		

PHRRCI commands

Table 6-4 lists the PHRRCI tool commands used for routine maintenance of ISDN BRI. PHRRCI commands are used from the CI level.

Table 6-4 PHRRCI commands

Command	Level	Description
PHRRCI	CI	Opens the PHRRCI directory.
MOVE	PHRRCI	The primary command that allows the operating company personnel to perform resource moves.
QUIT	PHRRCI	Exits the PHRRCI directory and returns the operating company personnel to the CI level.
HELP	PHRRCI	Provides online help for the PHRRCI MOVE command.

For more information on the PHRRCI tools and its commands, see the chapter titled "Packet Resource Reassignment Tool."

DEFSVCCI commands

Table 6-5 lists the DEFSVCCI tool commands used for provisioning Default Service on a BRI interface. DEFSVCCI commands are used from the CI level.

Table 6-5 DEFSVCCI commands

Command	Level	Description
DEFSVCCI	CI	Opens the DEFSVCCI directory.
SETUP	DEFSVCCI	Provisions all the necessary data in table LNINV on each ISDN interface that supports Default Service. ***Note:*** The operating company must use this command before provisioning the Default Service DN in table DNROUTE.
REMOVE	DEFSVCCI	Removes all provisioning established by the SETUP command. ***Note:*** Before using this command, the operating company must remove the Default Service DN from table DNROUTE.
QUIT	DEFSVCCI	Exits the DEFSVCCI directory and returns to the previous level.
HELP	DEFSVCCI	Provides online help for the DEFSVCCI commands.

ECHCOCI commands

Table 6-6 lists the ECHOCI tool commands that can be used to:

- add an echo station directory number or logical terminal identifier to be provisioned on a X.25/X.75 service group or X.25/X.75 link interface unit.
- modify the parameter of an echo station.
- de-provision an echo station directory number.
- exit from the ECHOCI level.

Table 6-6 ECHCOCI commands (Sheet 1 of 2)

Command	Level	Description
ECHOCI	CI	Accesses the ECHOCI level.
ADD	ECHOCI	Adds an echo station directory number or logical terminal identifier to be provisioned on a X.25/X.75 service group or X.25/X.75 link interface unit.
MOD	ECHOCI	Modifies the parameter of an echo station.

Table 6-6 ECHCOCI commands (Sheet 2 of 2)

Command	Level	Description
REM	ECHOCI	De-provision an echo station directory number.
HELP ECHOCI	CI	Provides on-line help for all commands at the ECHOCI level.
QUIT	ECHOCI	Exits from the ECHOCI level.

Status indicators

This section describes ISDN BRI line, channel, link, trunk, and PM status indicators.

Line state indicators

The following information is displayed for lines:

- The LEN identifies the ISDN line but not its constituent channels.
- LEN states NEQ, INB, LMB, CUT, DMB, LO, IDL, MB, CPB, CPD, DEL, and SB apply to ISDN lines.
- LEN state PLO does not apply to ISDN lines.

  Note: An off-hook (permanent signal) condition on an ISDN line results in the line being routed to treatment. Treatment is removed after a time-out period of 1 to 3 min. The line then returns to the idle state.

- The primary DN or the logical terminal with the lowest TEI and its state is displayed when an ISDN LEN is posted.

  Note: Not applicable for GSF call processing.

- Any other activator with a state of CPB, CPD, or DEL on the ISDN line is displayed in reverse video.

Limitations

DNs are not supported and do not display for GSF call processing. TEIs are not fully supported for GSF call processing.

ISDN line fail flags

Table 6-7 lists and describes the ISDN line fail flags.

Run a diagnostic on the ISDN line with fail flags except for the following:

- the Q flag, which indicates that the line is in the ICMO queue or the shower queue
- the O flag
- the o flag

The flag is cleared if the condition causing the diagnostic is cleared.

Table 6-7 ISDN line fail flags (Sheet 1 of 2)

Flag	Meaning	Action
D	Indicates that the line failed extended or fast diagnostics.	Use the DIAG command to run diagnostics on the line to determine the probable cause.
F	Indicates a failed extended diagnostic because of a facility fault.	Use the LNTST command to verify the loop parameters.
I	Indicates either a DCH babbler or a line card babbler. At least one diagnostic has already been run on the line.	Check the terminal equipment and run line diagnostics to ensure that there are no line card or loop problems.
i	Indicates either a DCH babbler or a line card babbler. Indicates that a line has to be placed on a queue.	Check the terminal equipment to ensure that there are no line card or loop problems. Diagnostics will be run automatically once the line card is placed on the queue.
L	Indicates that the automatic line test (ALT) detected a line card fault.	Use the DIAG command with the LC parameter to diagnose the line card fault.
m	Indicates a missing NT1.	A metallic measurement performed by the diagnostic produces this flag.
M	Indicates a missing ISDN line card.	Check that the card is in the slot and is properly seated. Replace the card if it is defective.
N	Indicates a passed LC diagnostic after a previous diagnostic failure.	Perform an extended diagnostic.
O	Indicates that two or more LTIDs for each LEN are out-of-service due to Rapid Messaging.	Use the RTS LT ALL command to recover all LTIDs.

Table 6-7 ISDN line fail flags (Sheet 2 of 2)

Flag	Meaning	Action
o	Indicates that one LTID for each LEN is out-of-service due to Rapid Messaging.	Use the RTS LT command to recover the LTID.
P	Indicates that the performance of the ISDN line is degraded.	For both the U-ISLC and S/T-ISLC, set a single B-channel loopback at the NT1 and perform a BERT.
Q	Indicates that the system detected a fault and scheduled diagnostics.	If the in-service diagnostic fails due to a service-affecting fault, a full diagnostic is scheduled and a log report is output.
S	Indicates a failed diagnostic. The system generates a log when the failure occurs.	Perform a full diagnostic using the DIAG command to determine the cause.
U	Indicates that a utility card failed. This applies to the 2B1Q line card in the LCME.	Check the point-of-use power supply (PUPS) in the line drawer. Run a diagnostic on the drawer.

Posting ISDN lines

The following options for the POST command are available for posting ISDN lines:

- When the ALL option is used and the ISDN option is specified, only ISDN lines are included in the posted set. Using the ALL option without the ISDN option results in all the lines in the office being posted.
- When the parameter CARD is used, ISDN lines can be selected by card code.
- When the line set INSVDGQ is used, the first 32 lines awaiting in-service diagnostics are posted. The in-service queue can contain up to 128 lines. If there are more than 32 lines in the queue, a message indicating the total number of lines in the queue is displayed.
- When the parameter DF is used with the POST command, ISDN lines can be posted by the fail flag type.

Limitations Not all options are available with the POST command for posting GSF lines.

ISDN line states

Table 6-8 lists and describes the ISDN line and channel states.

Table 6-8 ISDN line states (Sheet 1 of 3)

State	Description
***	*Invalid state* The correct type and the connection status in table SPECCONN do not correspond.
CMB	*Connection PM busy* The SPECCONN channel is not in an available state because one of the PMs involved in the connection is busy (BSY).
CMT	*Connection in maintenance* The SPECCONN channel is undergoing maintenance and is not available.
CNA	*Connection not available* The SPECCONN channel is datafilled, but the request to the peripheral to establish the connection is not successful.
CON	*Connection connected* The SPECCONN channel is connected and ready to handle traffic.
CPB	*Call processing busy* Processing circuit-switched calls or DMS packet handler (PH) packet-switched calls.
CPD	*Call processing deload* Processing circuit-switched calls or DMS PH packet-switched calls, pending manual maintenance.
CUT	*Cutoff* The cutoff relay is operated, which cuts off the ISDN line card from the subscriber.
DEL	*Deloaded* A transitional state between CPB and MB, which results from a request to manually busy the line.

Table 6-8 ISDN line states (Sheet 2 of 3)

State	Description
DMB	*D-channel maintenance busy* The path between the DCH or EDCH card, the ISG, V5.1, or ILD and the ISDN line is not working for one of the following reasons: • The DCH or EDCH is out of service. • The LCME is faulty. • The DCH or EDCH and the line card are not connected. • The DMB lines, which are also babbling and registered as incoming message overload (ICMO), have the I fail flag set.
DMB (inverse video)	*D-channel maintenance busy* The path between the DCH or EDCH card and the ISDN line is not working for one of the following reasons: • The ISDN line is busy due to a DCH babbler and cannot be used for call processing. • The ISDN line may or may not have been reported as an ICMO line. The I fail flag in this case is used for either the DCH and ICMO conditions or the DCH condition.
IDL	*Idle* Customers have access to circuit-switched and packet-switched data services.
INB	*Installation busy* The ISDN line is out of service for one of the following reasons: • line data has not been assigned in the tables • the line was set to INB by the BSY INB command
LMB	*Line module busy* The LCME or the LGC is out of service.
LO	*Lock out* There is a loss of sync between the ISDN line card and the NT1. This state does not apply to the S/T-line card.
MB	*Manual busy* Maintenance activity is in progress, for example, an operator could be performing tests on the line at a line test position (LTP), or an incoming message overflow fault was detected and the i-flag was set.

Table 6-8 ISDN line states (Sheet 3 of 3)

State	Description
NEQ	*Not equipped* The line is not datafilled in table LNINV.
PSU	*Packet service unavailable* The Bd channel is connected (CON), but packet service is unavailable on that channel for some reason other than connection PM busy (CMB), connection not available (CNA), or connection in maintenance (CMT). Layer 1, layer 2, or layer 3 could be down between the terminal and the XLIU.
SB	*System busy* The system has removed an ISDN line from service and the line cannot be used for call processing. Lines in the SB state can be put in the MB state using the FRLS or BSY command.

Table 6-9 lists and describes the effects of ISDN line states on service and equipment.

Table 6-9 Effects of ISDN line states on service and equipment (Sheet 1 of 2)

State of ISDN line	Equipment affected	Service access	Description
CPB	none	yes	A call is in progress.
CPD	ISDN line card	denied	A line is waiting for maintenance.
DMB	DCH link	denied	The path between the DCH or EDCH card and the ISDN line is faulty.
IDL	none	yes	All equipment is in service.
INB	ISDN line card	denied	Installation is not complete.
LMB	LGC, link or LCME	denied	Controlling equipment is out of service.
LO	NT1	denied	Synchronization is lost.

Table 6-9 Effects of ISDN line states on service and equipment (Sheet 2 of 2)

State of ISDN line	Equipment affected	Service access	Description
MB	ISDN line card	denied	System or manual maintenance is in progress or there is an incoming message overflow flag.
NEQ	ISDN line card	denied	The ISDN line is not datafilled.

PM, DCH/EDCH, and ISG status indicators

Table 6-10 lists and describes the PM, DCH/EDCH, and ISG states. When the PM, DCH or EDCH, or ISG becomes faulty, its state changes to CBsy, ISTb, or SysB. A PM is an LCME, LGC, or LTC.

Table 6-10 PM, DCH/EDCH, and ISG states (Sheet 1 of 2)

State	Description
CBsy	*Control side busy* LCME: Both message links from the LGC are out of service. LGC:There is no access to the LGC from the network. One or more links from the network to the LGC are out of service. DCH/EDCH or ISG: The LGC to which the DCH or EDCH card is connected is out of service.
InSv	*In service* The PM is in service.
ISTb	*In service trouble* LCME: A fault exists. Service is not affected. LGC: A fault exists on one or both units. The LGC is overloaded. Either C-side or P-side links are out of service. DCH/EDCH: Service is not affected, but a fault has been detected. The DCH or EDCH is overloaded and SAPI 16 service is disrupted. When the DCH or EDCH is severely overloaded, incoming SAPI 16 traffic is blocked. ISG:The ISG channel is operating, but there could be a logical loopback on the channel. (Service is not affected but a fault has been detected.) The DCH or EDCH is overloaded and SAPI 16 service is disrupted or temporarily shut down.

Table 6-10 PM, DCH/EDCH, and ISG states (Sheet 2 of 2)

State	Description
ManB	*Manual busy* Manual maintenance is in progress.
OffL	*Offline* The PM is offline. DCH/EDCH: The DCH or EDCH card was datafilled, but is not recognized by the DMS-100 switch. A DCH or EDCH card is usually placed in this condition by manual action during office data modification. ISG: Table SPECCONN is not datafilled with ISG connection information. Bd channels, LENS, or BRI channels were not assigned. A channel is usually placed in this condition before it is datafilled, or by manual action during office data modifications.
SysB	*System busy* The system detected a PM fault and removed the PM from service.

LCME maintenance states

LCME maintenance states are listed in Table 6-11. The status display shows the PM state of the LCME as a whole (LCME node), and the states of the individual two units.

Table 6-11 LCME maintenance states (Sheet 1 of 2)

LCME node state	Unit state	Mate unit state	Description
CBsy	ManB CBsy	CBsy ManB, CBsy	For a PM node to be C-side busy (CBsy), one or both units must be C-side busy.
InSv	InSv	InSv	For a PM node to be in service (InSv), both units must be in service. The node or unit can process calls while it is in service, including when one unit is in the takeover mode. Only in-service tests are done by the system.

Table 6-11 LCME maintenance states (Sheet 2 of 2)

LCME node state	Unit state	Mate unit state	Description
ISTb	CBsy, ManB, SysB InSv	InSv, ISTb CBsy, ISTb, ManB, SysB	When a unit is in the in-service trouble (ISTb) state and its mate is busied by the system (SysB), the unit attempts to take over its mate.
ManB	ManB	ManB	For a PM node to be manually busy (ManB), both units must be manually busied. Tests can be performed.
OffL	OffL	OffL	For a PM node to be offlined (OffL), both units must first be manually busied and then taken offline. No tests can be performed on an OffL PM.
SysB	SysB	SysB, ManB, or CBsy	For a node to be system busy (SysB), one or both units must be system busy. Out-of-service tests are done.

LCME drawer states

At the LCME level of the MAP, the drawers are numbered from 0 to 15, and are arranged in groups of two. The drawers in each group share the same BIC card, and the single scan chip on it, and therefore, the same state. The status of the drawers of a posted LCME is displayed as

```
                             11  11  11
Drwr:01  23  45  67  89  01  23  45
      ••  ss  ••  ••  ••  ••  ••  ••
```

The status codes are listed in Table 6-12.

When the state of a drawer changes, the status display is updated. The change of state can be caused by system or by manual intervention.

Table 6-12 LCME line drawer states

Code	Description
•	*Inservice* The drawer is in service, with no faults.
-	*Unequipped* The drawer is unequipped and cannot be made offline unless table LNINV is datafilled with line data.
I	*Inservice trouble* The drawer has in-service trouble because the BIC looparound test has failed. For the LCME, this state also results from failure of the scan chip hardware access test, of the PUPS diagnostic, or of the ring generator fault among others.
S	*System busy* The drawer is busied by the system because the BIC to DCC looparound test has failed. It is also busied if the TCON status check or the S14 BIC scan test fails. Since a BIC in the LCME is capable of serving two equipped drawers, both drawers are busied when the BIC to DCC test fails. In this case, the status display for the drawer pair is *ss.*
M	*Manual busy* The drawer is manual busy.
O	*Offline* Line data is assigned to the drawer, but the drawer is offline. The drawer cannot be used until it is made busy and returned to service.

Channel status indicators

This section describes ISDN channel status indicators.

When a loop is posted, the following information is displayed for channels:

- When a B-channel in the CPB state is posted, the DNs of both the calling party and the called party are displayed.
- The state of the loop reflects the state of one channel; therefore, if loop state is LMB, CUT, INB, DMB, or LO, the channel state is the same as the loop state.

- Only nailed-up channels can be CON or RES. RES indicates that a nailed-up channel has been taken down for maintenance.
- If the loop is MB or IDL, a channel can be MB if single-channel maintenance is in progress (for example, BERT test on a single B-channel).
- RES or CON is displayed in the field state when B-channels are nailed-up in the LGC equipped for ISDN. The special connections are datafilled in table SPECCONN for nailed-up ISDN line-to-ISDN line connections, and for ISDN line-to-packet network connections.

Table 6-13 lists all the SPECCONN states.

Table 6-13 SPECCONN states

Code	Description
PMBUSY	*Peripheral module busy* One of the nodes in the SPECCONN connection is busy. The connection is automatically be returned to service as soon as the node is returned to service.
MAINTENANCE	*Maintenance* The node is performing a maintenance action. Once the maintenance action is finished, the SPECCONN connection is automatically be returned to its previous state.
NOINTEG	*No integrity* Thereis no integrity on the SPECCONN connection; integrity either was lost or did not exist. The PM, however, is in service.
ACTIVE	*Active* The SPECCONN connection is established and there is integrity.
INACTIVE	*Inactive* A peripheral has not established the looped connection between the two endpoints for one of the following reasons: • call processing is using one of the PM's channels • the connection type is RES • the connection type is PEND • the PM is not able to make the connection

Link status indicators

This section describes the ISDN link status indicators.

DS30A link states

Table 6-14 lists the DS30A link capabilities and the associated changes of state during maintenance.

Table 6-14 DS30A link state changes

Link	State	Channel	Maintenance action
Message/ speech	ManB SysB	D or B	The LCME node state changes to CBsy. All LENs on the LCME become LMB.
	OK	D or B	The LCME node state changes from CBsy. All LENs on the LCME are removed from LMB.
Speech	ManB SysB	D	The LCME node state does not change. All LENs change to the DMB state.
		B	The LCME node state does not change. The LEN state does not change.
	OK	D	The LCME node state does not change. LENs are removed from the DMB state.
		B	The LCME node state does not change. The LEN state does not change.

Trunk status indicators

This section describes ISDN trunk status indicators.

DS-1, X.75, and X.75' trunk states

Table 6-15 lists and describes DS-1, X.75, and X.75' trunk states.

Table 6-15 DS-1, X.75, and X.75' trunk states (Sheet 1 of 3)

State	Description
CBSY	*C-side busy* The carrier is not available for service because the associated C-side node is busy.
CPB	*Call processing busy* The circuit is carrying traffic.
CPD	*Call processing deload* The circuit is carrying traffic but will be available for maintenance once call processing is completed.

Table 6-15 DS-1, X.75, and X.75' trunk states (Sheet 2 of 3)

State	Description
CFL	*Carrier failure* The carrier has failed and the trunk has been removed from service.
DEL	*Deload* The circuit that was previously CPD is now available for maintenance.
IDL	*Idle* The circuit is available for service.
INB	*Installation busy* The 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	*Inservice trouble* The trunk is in service but faults have been detected on the circuit.
LO	*Lock out* Either the trunk has been locked out by the far or near end office or in the case of X.75 trunks, the NIU or XLIU is out of service.
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.

Table 6-15 DS-1, X.75, and X.75' trunk states (Sheet 3 of 3)

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	*P-side module busy* The carrier is not available for service because the associated P-side node is busy.
PMB	*Peripheral module busy* The circuit is not available for service because the associated PM 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 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.

7 Cards

This chapter describes and illustrates the integrated services digital network (ISDN) basic rate interface (BRI) frame and shelf layouts, and also describes the ISDN BRI-related cards.

Shelf layouts

This section describes and illustrates ISDN BRI shelf layouts.

Line concentrating array

Each enhanced line concentrating module (LCME) consists of two line concentrating arrays (LCAI). Each LCAI occupies a separate shelf and consists of the following components:

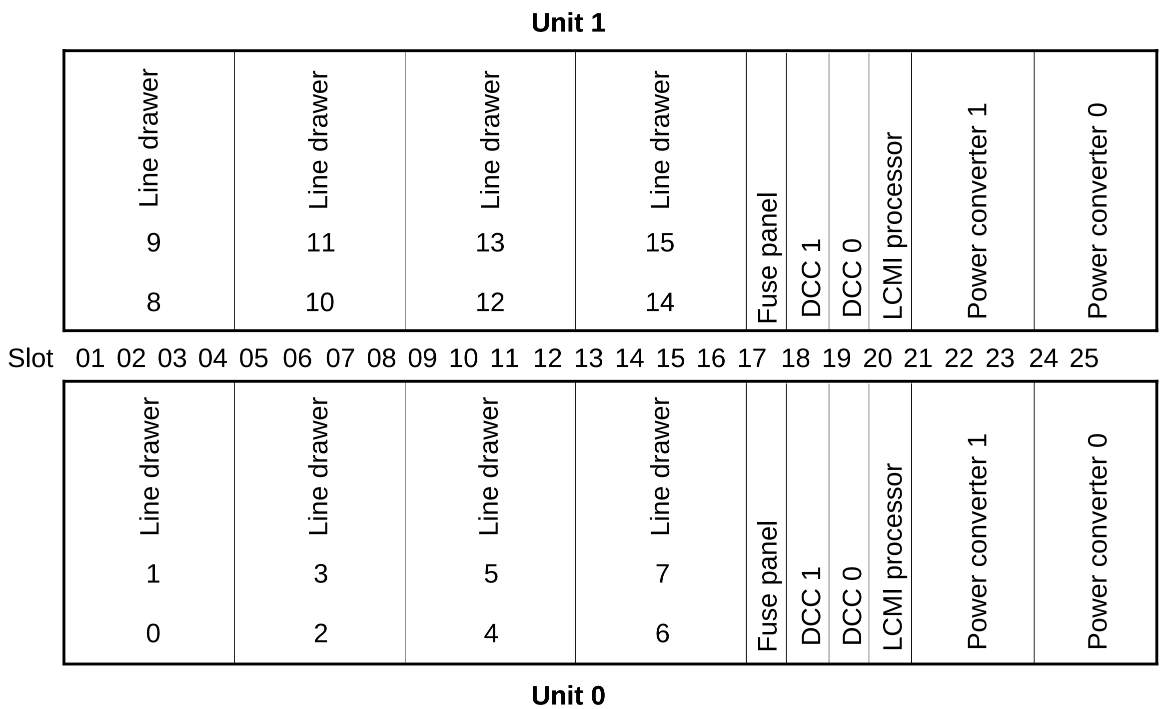
- four physical line drawers, each providing space for up to 60 line cards (equipped depending on the line types installed)
- four ISDN bus interface cards (BIC), one in each line drawer
- four point-of-use power supply (PUPS) cards, one in each line drawer
- two ISDN digroup controller cards (DCC)
- one LCME processor card
- two power converters
- 1 to 18 DS30A links for connection to the line group controller (LGC) or line trunk controller (LTC)

Figure 7-1 illustrates the arrangement of the cards in the LCME shelves.

The LCME has eight physical line card drawers (four for each LCAI). Each physical line drawer is divided into two logical line drawers. Each even-numbered logical line drawer has 32 single line card slots, and each odd-numbered logical line drawer has 28 single line card slots. The PUPS card occupies the space of four single line card slots in the odd-numbered logical line drawers. ISDN and non-ISDN cards can be mixed in the same logical drawer.

In each logical line drawer, ISDN S/T-line cards, data line cards, and Datapath line cards occupy two single-slot positions (for example, slots 0 and 1 or slots 4 and 5), as shown in figure Physical and logical layout of the LCME line drawer.

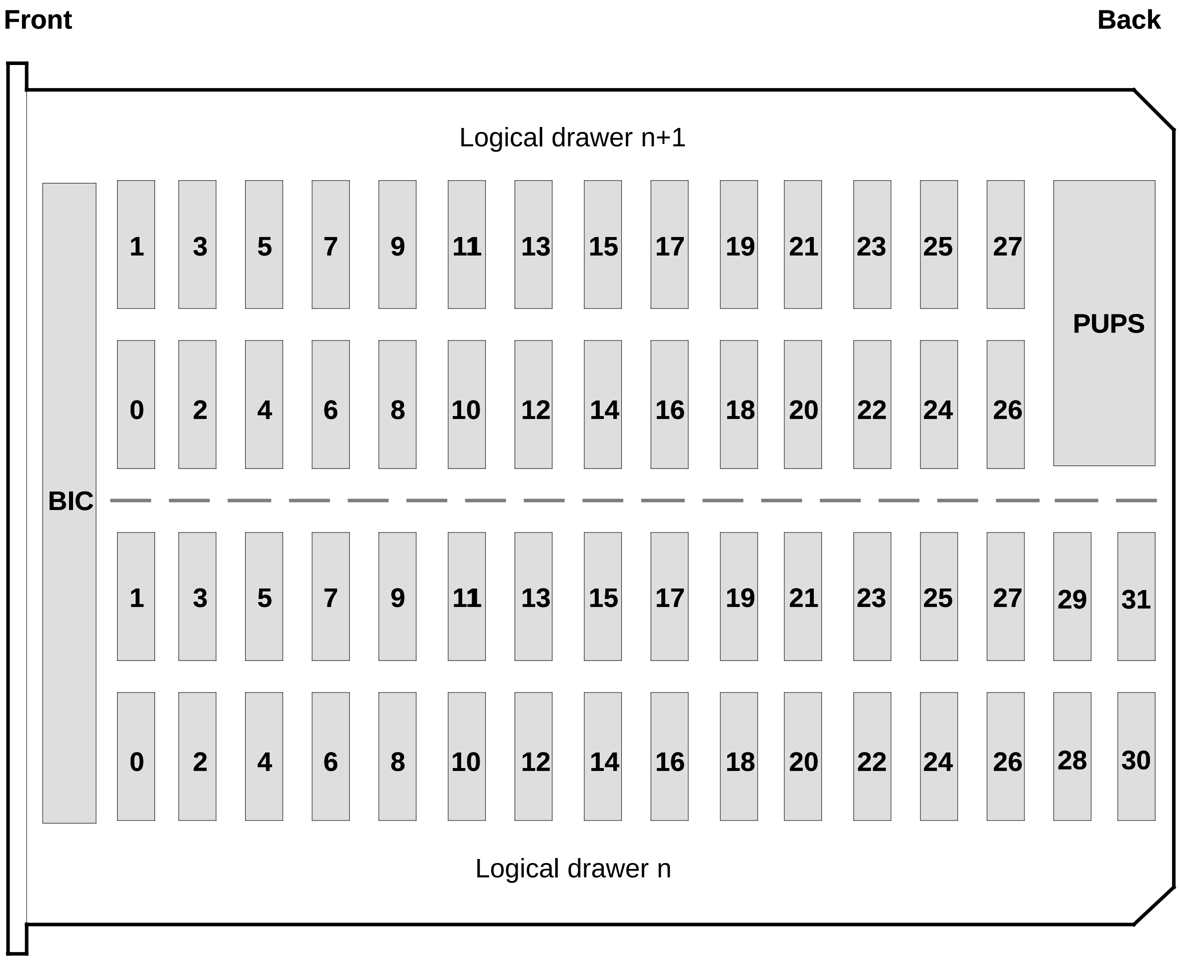
Figure 7-1 LCME shelf



Legend:
DCC Digroup controller card
LCMI ISDN line concentrating module

Note: Slot positions 01--17 are approximate in the figure. Line drawers do not necessarily occupy four slots**.**

Figure 7-2 Physical and logical layout of the LCME line drawer



Legend:
BIC Bus interface card
PUPS Point-of-use power supply

Line group array

An LGC consists of two shelves called line group arrays (LGA). Each LGA contains a set of cards forming the control complex and a set of interface cards. The types of cards allocated in the LGA depend upon the hardware options selected for the LGC as shown in Figure 7-3, "ISDN LGA shelf with the EISP and the UP card" on page 7-5 and Figure 7-4, "ISDN LGA shelf with the ISP, MP, and SP cards" on page 7-5.

The LGC supports one of the following card combinations as the control complex in each LGA:

- the enhanced ISDN signaling preprocessor (EISP) card with the unified processor (UP) card
- the ISDN signaling preprocessor (ISP) card with the master processor (MP) and signaling processor (SP) cards

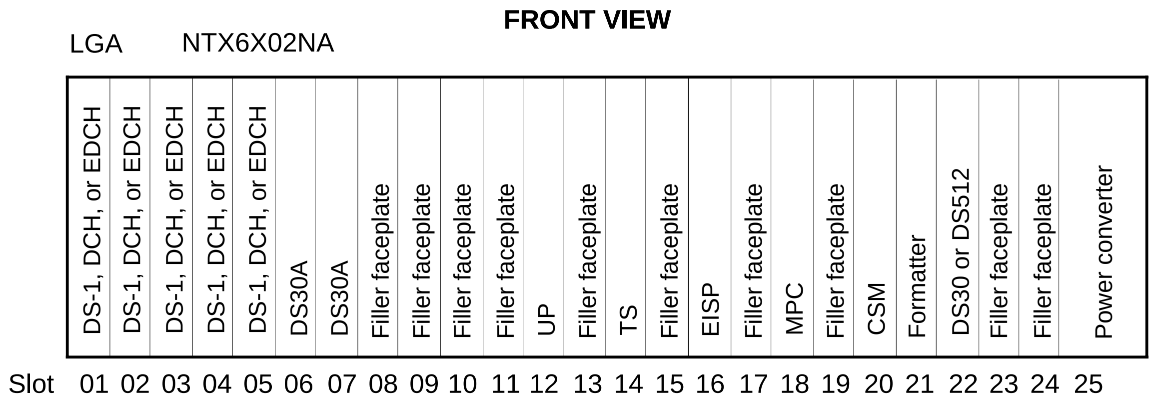
The following set of cards provides the P-side, C-side, and internal interfaces for each LGA and is the same regardless of the hardware options selected:

- one or two DS30A interface cards
- one DS30 interface card or DS512 card
- a combination of up to five DS-1 and D-channel handler (DCH) or enhanced D-channel handler (EDCH) cards

One of the following sets of cards provides the LGC control complex. The set used depends on the hardware options selected. The two options available are

- EISP with UP(see figure ISDN LGA shelf with the EISP and UP cards)
  - — EISP card
  - — timeswitch card
  - — UP card
  - — message protocol (MPC) card
  - — formatter card
  - — channel supervision message (CSM) card
- ISP with MP and SP (see figure ISDN LGA shelf with the ISP and SP cards)
  - — ISP card
  - — timeswitch card
  - — MP card and two MP memory cards
  - — SP card and SP memory card
  - — message protocol (MPC) card
  - — formatter card
  - — channel supervision message (CSM) card

Figure 7-3 ISDN LGA shelf with the EISP and the UP card

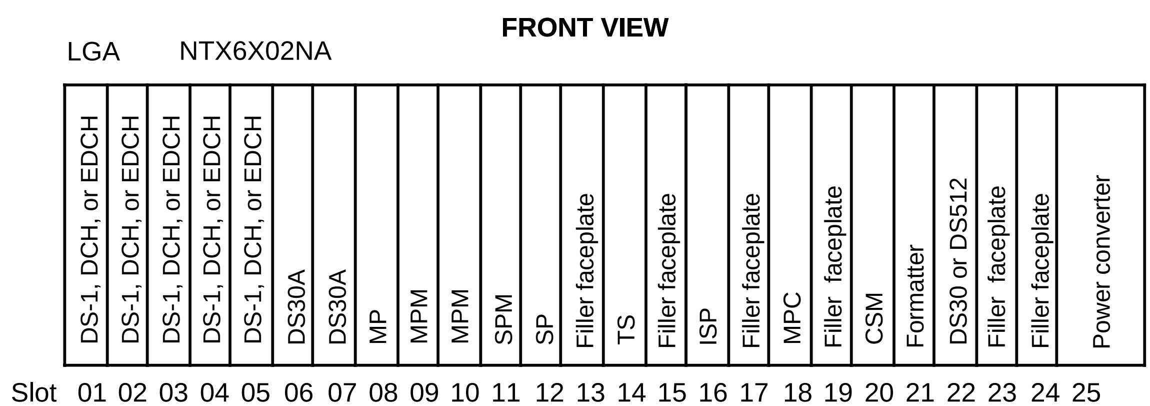


Legend:

CSM	Channel supervision message card
DCH	D-channel handler
EDCH	Enhanced D-channel handler
EISP	Enhanced ISDN signaling preprocessor
LGA	Line group array
MPC	Message protocol and tone generator
TS	Time switch
UP	Unified processor

Note: Each LGC is provisioned with a minimum of two DCH or EDCH cards, one in each LGA.

Figure 7-4 ISDN LGA shelf with the ISP, MP, and SP cards



Legend:

CSM	Channel supervision message card
DCH	D-channel handler
EDCH	Enhanced D-channel handler
ISP	ISDN signaling preprocessor
LGA	Line group array
MP	Master processor
MPC	Message protocol and tone generator
MPM	Master processor memory
SP	Signaling processor
SPM	Signaling processor memory
TS	Timeswitch

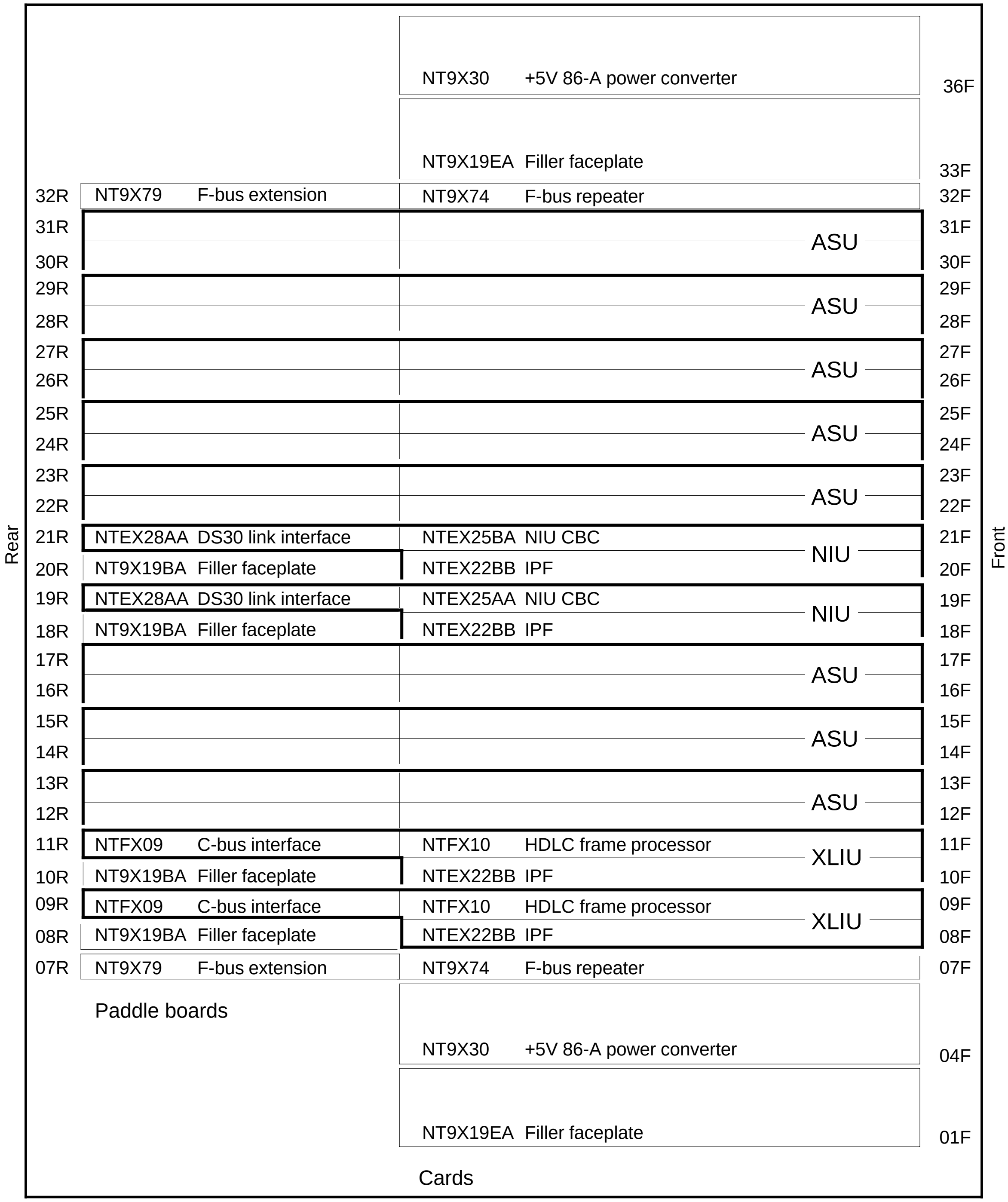
Note: Each LGC is provisioned with at least two DCH or EDCH cards, one in each LGA.

Link interface shelf

The link interface shelf (LIS) can be configured with DMS packet handler X.25/X.75/X.75' link interface units (XLIU) that provide the DMS SuperNode and DMS SuperNode SE switches with integrated X.25, X.75, and X.75' data packet switching capabilities.

Figure 7-5 illustrates DMS packet handler XLIUs configured in a LIS shelf.

Figure 7-5 XLIUs in a LIS shelf



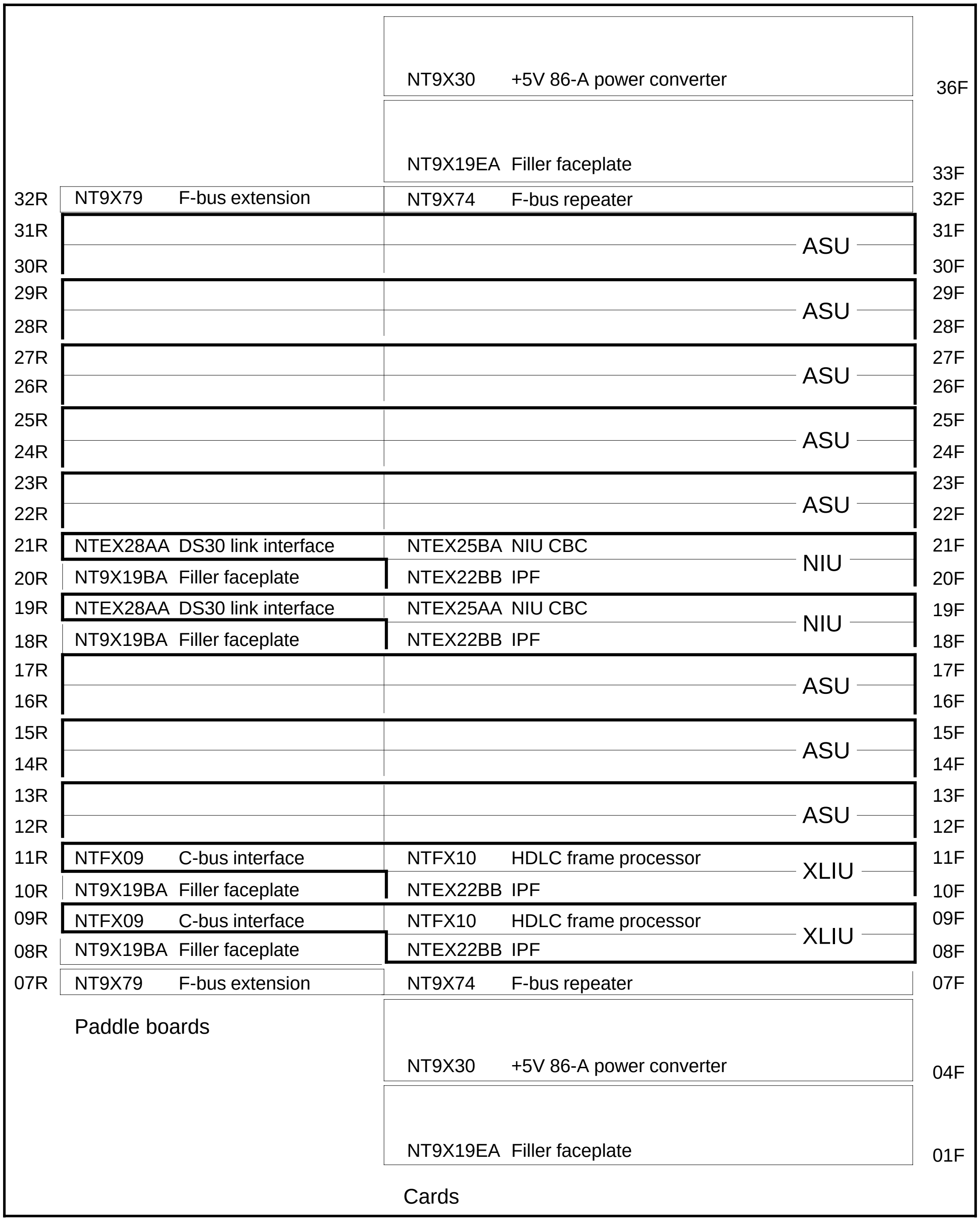
Note: The XLIU can function with other ASUs on the same LIS.

Single-shelf link peripheral processor

The single-shelf link peripheral processor (SSLPP) can be configured with DMS packet handler X.25/X.75/X.75' link interface units (XLIU) that provide the DMS SuperNode and DMS SuperNode SE switches with integrated X.25, X.75, and X.75' data packet switching capabilities.

Figure 7-6 illustrates DMS packet handler XLIUs configured in an SSLPP shelf.

Figure 7-6 XLIUs in an SSLPP shelf



Note: The XLIU can function with other ASUs on the same LIS.

Cards

Table 7-1 lists the following information for each ISDN BRI-related card:

- PEC code
- PEC suffix
- card name
- slot number
- comments and functions

Table 7-1 ISDN BRI cards (Sheet 1 of 12)

PEC	PEC suffix	Card name	Slot number	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.
NT6X17	AC	Type-A line card	single-slot position in LCME drawer	*Comments* • When POTS lines are provisioned in an LCME, the ring generator card must also be provisioned. *Functions* • Provides the voice and signaling interface between the two-wire analog subscriber line and the four-wire 32-channel, 2.56-Mbit digital data stream of the DMS-100 switch.

Table 7-1 ISDN BRI cards (Sheet 2 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NT6X18	AA AB	Type-B line card (non-coin ANI)	single-slot position in LCME drawer	*Comments:* • NT6X18AB is line card type B with +48V. • The type B line card interacts with subscriber lines, coin private automatic branch exchange (PABX), and coded ringing circuits. *Functions* • Provides the voice and signaling interface between the two-wire analog subscriber line and the four-wire 32-channel, 2.56-Mbit digital data stream of the DMS-100 switch..
NT6X19	AB	Message waiting line card	single-slot position in LCME drawer	*Comments* • The NT6X20 card is required when the NT6X19 card is provisioned. *Functions* • Contains the circuitry to flash the lamp in a message waiting telephone set.
NT6X20	AA	Message waiting power converter card	single-slot position in LCME drawer	*Functions* • Provides power for the message waiting lamp circuit.
NT6X21	AA AC	EBS (P-phone) line card	single-slot position in LCME drawer	*Comments:* • NT6X21AC is referred to as P-phone line card 15 kft. *Functions:* • Provides voice and signaling interfaces between the two-wire analog subscriber lines using business sets and the four-wire 32-channel, 2.56-Mbit digital data stream of the DMS-100 switch.

Table 7-1 ISDN BRI cards (Sheet 3 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NT6X30	AA CA	Ringing generator card	single-slot position in LCME drawer	*Comments:* • The NT6X30AA contains two cards: the NT6X38 ringing control and the NT6X37 ringing amplifier. Ringing signals originate in the NT6X38 and are amplified by NT6X37. *Functions:* • Generates ringing signals and dc voltages for ANI and coin functions.
NT6X40	AC	DS30 C-side interface card	22 and 23	*Functions:* • Carries B- and D-channels between the LGC and the network.
NT6X40	FA GA	DS512 C-side interface card	22 and 23	*Comments:* • NT6X40GA is the DS512 C-side interface paddle board. *Functions* • Converts the internal LGC or LTC 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 LGC or LTC and the network.
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 LGC and other peripheral modules. • Reports error conditions to the SP or the UP card.

Table 7-1 ISDN BRI cards (Sheet 4 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NT6X44	AA AB CA EA	Time switch card	14	*Comments* • The NT6X44AA is functionally equivalent to the NT6X44AB and NT6X44AC versions, but is application-specific. *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.
NT6X45	AB AC BA	LTC/DTC/LGC processor CP card	08 or 12	*Comments* • 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.

Table 7-1 ISDN BRI cards (Sheet 5 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NT6X48	AA	DS30A peripheral interface card	06 to 07	*Functions* • Carries B- and D-channels between the LCME and the LGC. • Converts between the signal type used for internal LGC communication and the bipolar encoded signal used on a DS30 link.
NT6X50	AB	DS-1 interface card	01 to 05	*Functions* • Carries B- and D-channel packet data between the LGC or LTC and the DPN packet handler. • Converts between the unipolar signal type used for internal LGC communication and the bipolar encoded signal used on a DS-1 link.
NT6X53	BA	Power converter +5V/+15V card	22 to 27	*Functions* • Converts a nominal -48V input to a +5V and a +15V output.
NT6X69	AB AC	Message protocol and tone generator card	18	*Comments:* • NT6X69AC is compatible with fibre-optics applications. *Functions:* • Supervises the receipt of all incoming control messages and the transmission of all outgoing messages between the LGC and the LCME, and between the LGC and the DMS-core.
NT6X71	AA AC	Data line card	double slot position in LCME drawer	*Comments:* • NT6X71AC is CSA/UL-compliant. *Functions:* • Provides an interface between the two-wire loop from a data unit and one channel of the four-wire 32-channel, 2.56-Mbit digital data stream of the DMS-100 switch.

Table 7-1 ISDN BRI cards (Sheet 6 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NT6X76	AA AC	Asynchronous interface line card	double slot position in LCME drawer	*Comments* • When the NT6X76AA card is used, provisioning is limited to 26 per drawer, and to a total of 208 in an LCME. *Functions* • Provides an interface between a four-wire RS-422 line and one channel of the four-wire 32-channel, 2.56-Mbit digital data stream of the DMS-100 switch.
NT6X92	AA BB	Universal tone receiver (UTR) card	17	*Comments* • The firmware in NT6X92BB is not backward compatible with NT6X92AA. *Functions* • Identifies and processes various tones, for example, MF and DTMF.
NT6X99	AA	Datapath bit error tester (2-slot)	double slot position in LCME	*Functions* • Allows bit error rate tests to be generated and applied to a Datapath data transmission link.

Table 7-1 ISDN BRI cards (Sheet 7 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NTAX78	AB	Enhanced time switch (ETS) card	14	*Comments:* • The NTAX78AB card is functionally equivalent to the NT6X44CA transmitter card. The ETS card is for C-side to C-side connections or required to perform ISDN DTA functions on an ESMU, SMA, DTCI, or any subtending RCU ISDN lines. The ETS card is required to double the number of P-side ports and to make P-side to P-side hairpin connections. • The NTAX78BA card is functionally equivalent to the NT6X44AA card, but the number of P-side ports is double that of the NT6X44AA (40 instead of 20). Also, you can make direct P-side to P-side (hair-pin) connections without the use of a C-side channel. Direct P-side to P-side connections are made for ISDN TDM connections, DTA connections, and table SPECCONN connections Use this card only in a line group controller ISDN (LGCI) or a line trunk controller ISDN (LTCI). The NTAX78BA card is not a replacement (spare) for the NT6X44AA. You can upgrade an LGCI or LTCI for use of the NTAX78BA card through an in-service or out-of-service upgrade procedure. This procedure is initiated at the MAP (maintenance and administration position) with the UPGRADE command. For new installations, NTAX78BA can be datafilled in field OPTCARD in table LTCINV.

Table 7-1 ISDN BRI cards (Sheet 8 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
				Functions: • Inverts A/B signaling bits in either direction on a per-channel basis. • Provides P-side to P-side and C-side to C-side looparounds for ISDN diagnostics. ***Note:*** C-side to C-side connection functionality is not used by any applications at this time. • Reads incoming A/B bits on the P-side of the timeswitch.
NTBX01	AA, AB	ISDN signaling preprocessor card	16	*Comments* • NTBX01AB is the enhanced ISP (EISP) card. • The EISP card has the following enhancements over the ISP card: — 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 DCH or EDCH maintenance functions. • Provides an interface between the DCH or EDCH cards and the other processors in the LGC (MP, SP, and UP). • Receives Q.931 messages from the DCH or EDCH and recodes them into a format suitable for the switching network. • Sends the recoded messages to the MP or the UP, which are sent to the switching network through the DS30 card.

Table 7-1 ISDN BRI cards (Sheet 9 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NTBX02	AA, BA	ISDN D-channel handler card	01 to 05	*Comments* • NTBX02BA is the enhanced D-channel handler (EDCH) card. • The EDCH has the following enhancements: — Motorola 68020 processor running at 20 MHz (16MHz for DCH) — 4 Mbytes dynamic RAM (one Mbyte for DCH) — 32-bit data bus — Before the DCH or EDCH card is busied, switch the ISG to a spare DCH or EDCH. *Functions* • Sets up communication with an ISDN terminal (or packet handler) on request from the terminal (or packet handler). • Maintains a logical link with any ISDN terminal that is sending or receiving data. • Maintains a connection with the packet handler as long as data flows over that channel. • Verifies and routes D-channel frames according to their type (D-call control or D-packet).
NTBX26	AA	ISDN S/T line card	double- slot position in LCME	*Functions* • Terminates and exchanges data between the L-bus that connects the line card to the BIC and the S/T-bus. • Provides registers, looparound points, and metallic test access points for maintenance activities.

Table 7-1 ISDN BRI cards (Sheet 10 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NTBX27	AA	2B1Q U-interface ISDN line card	single-slot position in LCME	*Functions* • Terminates and exchanges data between the L-bus that connects the line card to the BIC, and the U-loop that connects the line card and the NT1. • Provides registers, looparound points, and metallic test access points for maintenance activities. • The 2B1Q line card has a maintenance processor that provides the following maintenance and control functions: — message transaction processing — serial control port interface control — U-subsystem maintenance — line card self-diagnostics
NTBX34	BA	ISDN enhanced LCME processor card	21	*Functions* • Carries out all processing performed by the LCME. • Generates and responds to control messages sent to and from the DMS-core. • Supervises the transfer of messages between the LGC or LTC and the LCME. • Exchanges line card, M-channel control, maintenance, and test messages with the bus interface card (BIC).
NTBX35	AA	ISDN LCM digroup control card	19 and 20 (one slot per card)	*Functions* • Provides the connection between the LCME line drawer and the DS30A links. • Separates B- and D-channel data, and performs the timeswitching functions among up to 18 DS30A ports (to the LGC or LTC) and 12 P-side digroups. • Inserts PCM codes into the PCM stream.

Table 7-1 ISDN BRI cards (Sheet 11 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NTBX36	BA	ISDN LCM enhanced line drawer BIC	single-slot position in LCME drawer	*Functions* • Provides the connection between the line card and the digroup controller card (DCC). • Receives control messages from the DCCs and passes them on to the line cards. • Relays messages between the LCME processor and the line card. • Scans the line cards to detect changes in supervision bits and reports the changes. • Timeswitches the two B-channels and D-channel between the DCCs and the line card. • Depending on direction of data flow, either multiplexes or demultiplexes the 16-kbit/s D-channel. • Splits the M-channel off each ISDN line and terminates it. • Monitors the status of the point-of-use power supply (PUPS) and reports changes to the LCME.
NTBX71	AA	ISDN enhanced line drawer PUPS card	single-slot position in LCME	*Comments* • The PUPs is not duplicated. All ISDN line cards in the drawer go out of service if the PUPs card fails. *Functions* • Converts -48V input to +5V output for the line card.
NTBX72	AA	ISDN LCME battery and ringing router card	18	*Functions* • Monitors the level of ring current from ANI/COIN circuits. • Turns on an LED failure indicator and sends an alarm signal to the frame supervisory panel when the +5V or the -48V power supply fails.

Table 7-1 ISDN BRI cards (Sheet 12 of 12)

PEC	PEC suffix	Card name	Slot number	Comments and functions
NTEX22	BB , CA	Integrated processor and F-bus interface card	8F, 10F, 12F, 14F, 16F, 18F, 20F, 22F, 24F, 26F, 28F, 30F	*Functions* • Processes messages for the XLIU. • Provides the F-bus interface for the XLIU. • Handles layer 3 protocol for the XLIU.
NTFX09	AA	C-bus interface paddle board	9R, 11R, 13R, 15R, 17R, 19R, 21R, 23R, 25R, 27R, 29R, 31R	*Functions* • Terminates 31 HDLC channels.
NTFX10	AA	HDLC frame processor	9F, 11F, 13F, 15F, 17F, 19F, 21F, 23F, 25F, 27F, 29F, 31F	*Functions* • Provides the C-bus interface for the XLIU.
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.

Card replacement procedures

Card replacement procedures for the cards described in this chapter are documented in *Card Replacement Procedures*.

Additional card information

For detailed card descriptions of the cards described in this chapter, refer to the *Hardware Description Manual Reference Manual*.

8 Protocols

This chapter describes integrated services digital network (ISDN) basic rate interface (BRI) D-channel and B-channel protocols and the CCITT X.75 protocol analysis for voice and data. The protocols and protocol layers described in this chapter are based on CCITT, Bellcore, ANSI, and ISO standards.

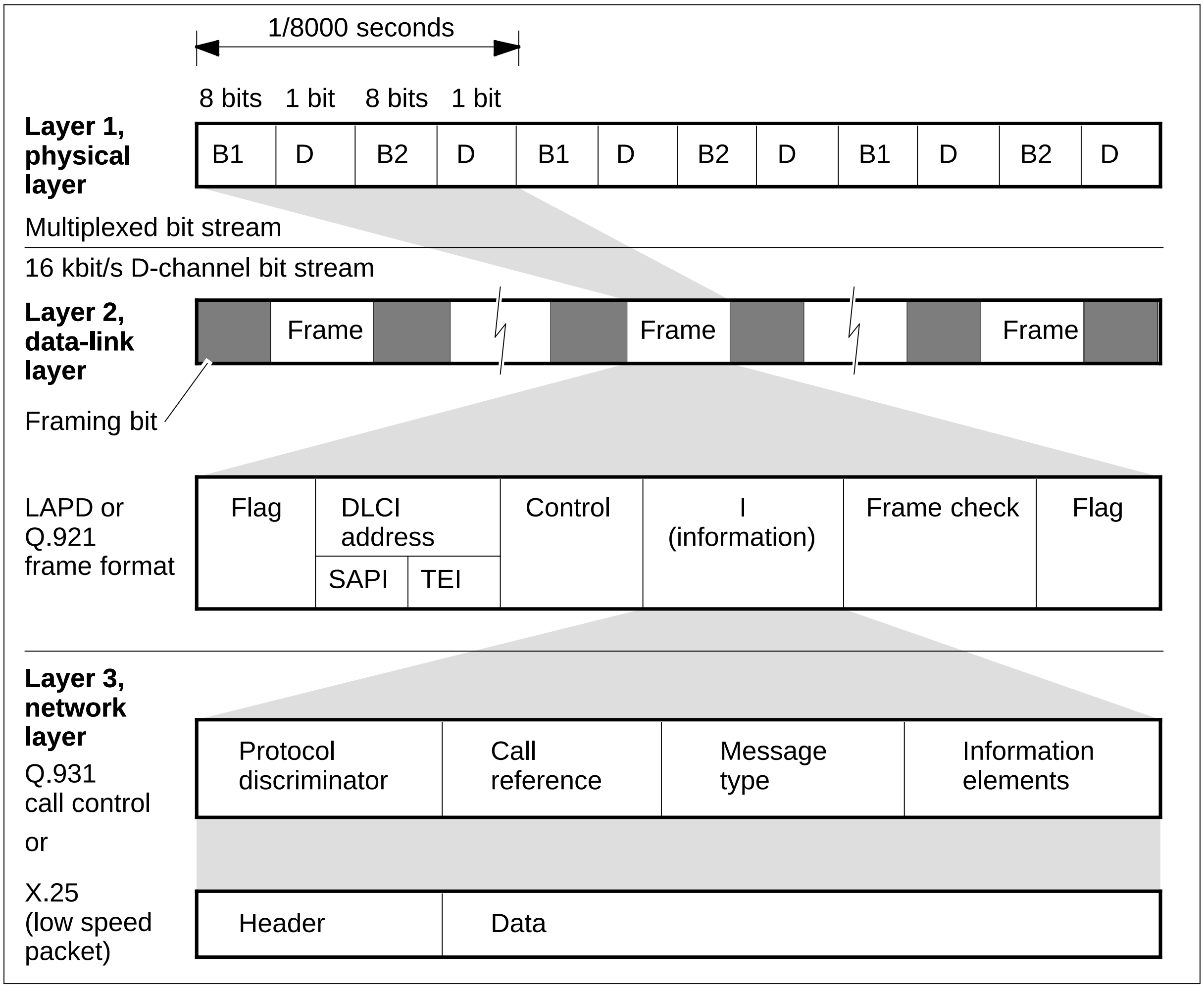
D-channel voice and data protocols

This section describes the D-channel voice and data protocols: link access procedure D-channel (LAPD) or Q.921, Q.931, and X.25. The D-channel protocols are used for the following:

- call control for B-channel circuit-switched voice
- call control for B-channel circuit-switched data
- transmission of low speed D-channel packet-switched data

Figure 8-1 illustrates the relationship between these protocols.

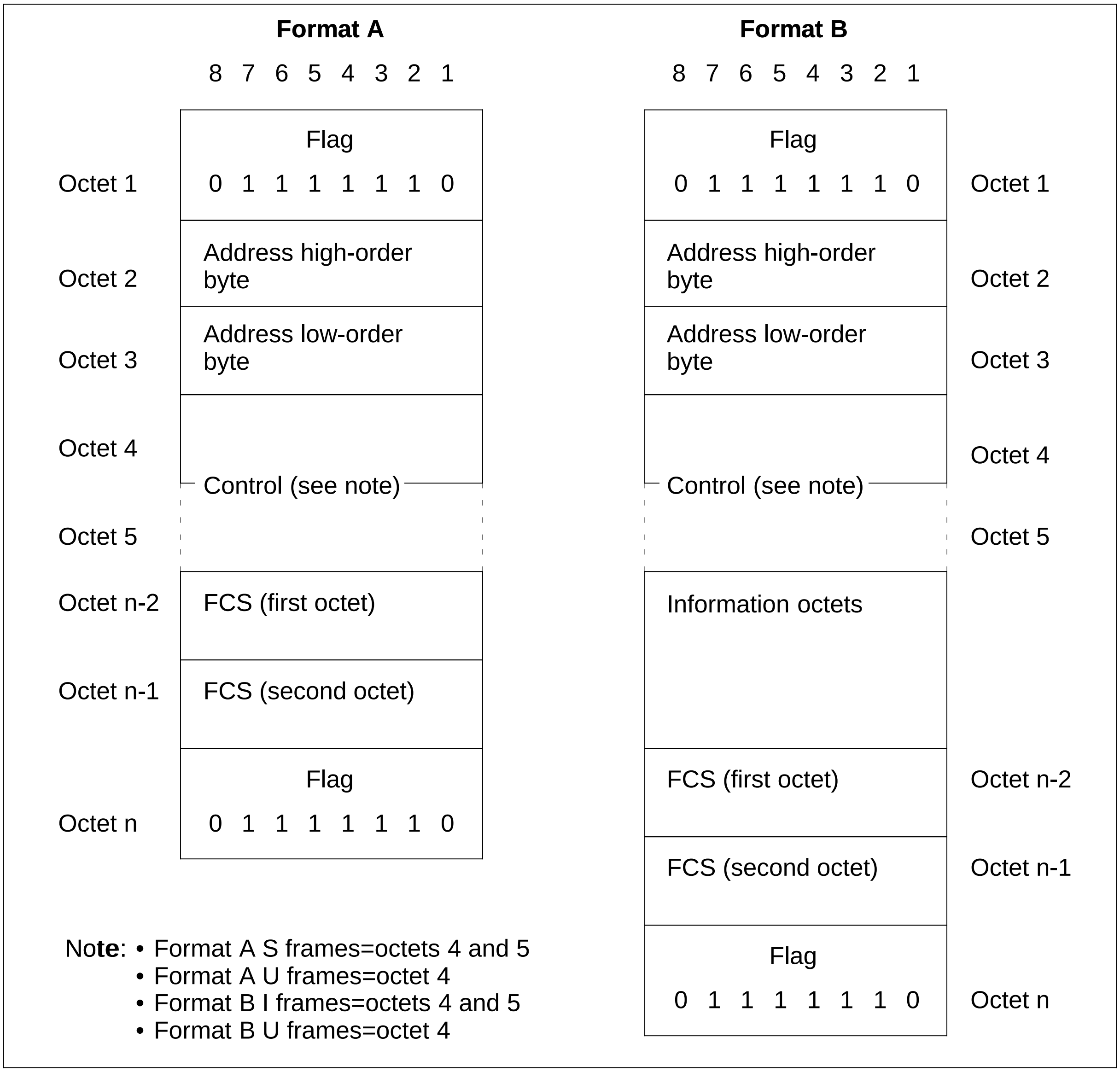
Figure 8-1 D-channel protocols



LAPD or Q.921 frame formats

There are two types of LAPD or Q.921 frame formats, format A and format B. Frame format A is used for frames that do not contain information octets, and frame format B is used for frames that do contain information octets. Both frame formats are illustrated in Figure 8-2.

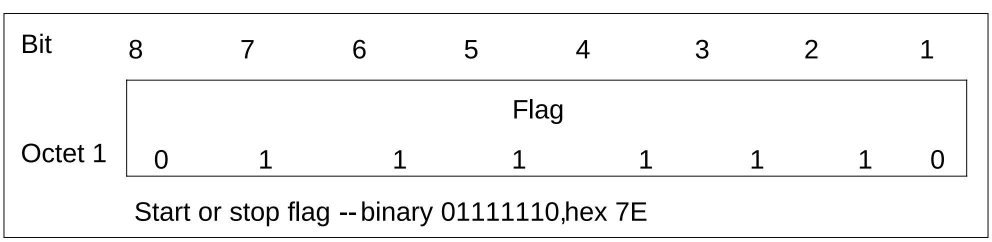
Figure 8-2 LAPD or Q.921 frame formats



Start flag

All frames start and stop with the flag sequence illustrated in Figure 8-3.

Figure 8-3 Start and stop flag



Address octets

The address octets, illustrated in Figure 8-4, contain a service access point identifier (SAPI), a command or response (C/R) field bit, address field extension (EA) bits, and a terminal endpoint identifier (TEI).

Figure 8-4 Address octets

Bit	8	7	6	5	4	3	2	1
Octet 2	SAPI						C/R	EA 0
Octet 3	TEI							EA 1

Legend:
C/R Command or response field bit
EA Address field extension bit
SAPI Service access point identifier
TEI Terminal endpoint identifier

The SAPI identifies the type of message that is being sent. The C/R bit identifies the frame as either a command or a response. The TEI identifies the logical ISDN terminal. Table 8-1, 8-2, and 8-3 list the possible values for each of these items.

Table 8-1 SAPI values

SAPI value (binary)	Octet value (hex)	Description
0	00	Circuit-switched call control message
16	40	LAPD X.25 message
17	44	Terminal loopback SAPI message (i.e. loopback on the same line)
63	FC	Layer 2 management procedure message

Table 8-2 C/R values (Sheet 1 of 2)

Command or response	Bit value (binary)	Description
Command	0	User to network
Command	1	Network to user

Table 8-2 C/R values (Sheet 2 of 2)

Command or response	Bit value (binary)	Description
Response	0	Network to user
Response	1	User to network

Table 8-3 TEI values

Dynamic or static	Range (decimal)	User type
Dynamic user assigned	0 to 63	Manual TEI assignment
	127	Broadcast TEI
Dynamic network assigned	64 to 126	Automatic TEI assignment
Static	0 to 63	Manual TEI assignment

Control octets

There are three Q.921 control octet types illustrated in Figure 8-5:

- information transfer (I)
- supervisory (S)
- unnumbered (U)

I octets transfer layer 3 messages, S octets are used for link supervision, and U octets provide additional data link control functions and unnumbered information transfers.

Figure 8-5 Control octets

	Control field bits	8	7	6	5	4	3	2	1
Octet 4	I format	N(S)							0
Octet 5		N(R)							P
Octet 4	S format	0	0	0	0	S	S	0	1
Octet 5		N(R)							P/F
Octet 4	U format	M	M	M	P/F	M	M	1	1

Legend:

M Modifier function bit
N(R) Transmitter receive sequence number
N(S) Transmitter send sequence number
P Poll bit
P/F Poll bit or final bit
S Supervisory function bit

I octets

I octets, illustrated in Figure 8-6, contain a transmitter send sequence number [N(S)], a transmitter receive number [N(R)], and a poll (P) bit. When used in a command, the poll bit is set to 1, indicating that a response to the command is expected by the far-end office.

Figure 8-6 I octets

Bit	8	7	6	5	4	3	2	1
Octet 4	N(S)							0
Octet 5	N(R)							P

Legend:

N(R) Transmitter receive sequence number
N(S) Transmitter send sequence number
P Poll bit

S octets

S octets, illustrated in Figure 8-7, contain supervisory function (S) bits, a transmitter receive sequence number [N(R)], and a poll or final (P/F) bit. Table 8-4 lists the possible values for each of these items.

Figure 8-7 S octets

Bit	8	7	6	5	4	3	2	1
Octet 4	0	0	0	0	S	S	0	1
Octet 5	N(R)							P/F

Legend:
N(R) Transmitter receive sequence number
P/F Poll bit or final bit
S Supervisory function bit

Table 8-4 S octet values

Octet	Bits	Value (binary)	Explanation
4	8 to 5	0 0	Reserved for future use
4	4 and 3	0 1	Receive not ready (RNR)
4	4 and 3	1 0	Reject (REJ)
4	4 and 3	0 0	Receive ready (RR)
4	2 and 1	0 1	Identifies the control octet as an S type format
5	8 to 2		Identifies the transmitter receive sequence number [N(R)]
5	1	1 or 0	A poll bit when issued as a command, a final bit when issued as a response

U octets

U octets, illustrated in Figure 8-8, contains modifier function (M) bits and a poll or final (P/F) bit. Table 8-5 lists the possible values for each of these items.

Figure 8-8 U octets

Bit	8	7	6	5	4	3	2	1
Octet 4	M	M	M	P/F	M	M	1	1

Legend:
M Modifier function bit
P/FPoll bit or final bit

Table 8-5 U octet values

Octet	Bits	Value (binary)	Octet value (hex)	Explanation
4	8 to 1	0 1 1 P 1 1 1 1	6F or 7F	Set asynchronous balance mode extended (SABME)
4	8 to 1	0 0 0 P 0 0 1 1	03 or 13	Unnumbered information (UI)
4	8 to 1	0 0 0 P 1 1 1 1	0F or 1 F	Disconnect mode (DM)
4	8 to 1	0 1 0 F 0 0 1 1	43 or 53	Disconnect (DISC)
4	8 to 1	0 1 1 F 0 0 1 1	63 or 73	Unnumbered acknowledgment (UA)
4	8 to 1	1 0 0 F 0 1 1 1	87 or 97	Frame reject (FRMR)
4	5	1 or 0		A poll bit when issued as a command, a final bit when issued as a response
4	2 and 1	1 1		Identifies the control octet as a U-type format

Information octets

The Q.931 information octets are

- a protocol discriminator octet
- call reference octets
- a message type octet
- information elements

Figure 8-9 illustrates format of an information octets.

Figure 8-9 Information octets

Bit	8	7	6	5	4	3	2	1
	Protocol discriminator							
	0	0	0	0	1	0	0	0
	0	0	0	0	Length of call reference value			
	Call reference value							
	Call reference value							
	0	Message type						
	Other information elements as required							

Protocol discriminator octet

The protocol discriminator octet, illustrated in figure Information octets, is always hex 08, indicating that the message is Q.931 call control.

Call reference octet

The call reference octets, illustrated in figure Information octets, identify the call, the facility registration, or the facility cancellation in progress. The call reference value is assigned at the start of the call and lasts for the duration of the call. The reference flag is set to 0 to indicate the originating side and to 1 to indicate the destination side.

Message type octet

The message type octet, illustrated in figure Information octets, identifies the function of the message being sent. Table 8-6 lists the possible message type values.

Table 8-6 Message type octet values (Sheet 1 of 3)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	Escape to network specific message types
0 0 0 n n n n n		**Call establishment messages**
0 0 0 0 0 0 0 1	01	Alerting
0 0 0 0 0 0 1 0	02	Calling proceeding
0 0 0 0 0 0 1 1	03	Progress
0 0 0 0 0 1 0 1	05	Setup

Table 8-6 Message type octet values (Sheet 2 of 3)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 1 1 1	07	Connect
0 0 0 0 1 1 0 1	0D	Setup acknowledge
0 0 0 0 1 1 1 1	0F	Connect acknowledge
0 0 1 n n n n n		**Call information phase messages**
0 0 1 0 0 1 0 0	24	Hold
0 0 1 0 1 0 0 0	28	Hold acknowledge
0 0 1 1 0 0 0 0	30	Hold reject
0 0 1 1 0 0 0 1	31	Retrieve
0 0 1 1 0 0 1 1	33	Retrieve acknowledge
0 0 1 1 0 1 1 1	37	Retrieve reject
0 1 0 n n n n n		**Call clearing messages**
0 1 0 0 0 1 0 1	45	Disconnect
0 1 0 0 1 1 0 1	4D	Release
0 1 0 1 1 0 1 0	5A	Release complete
0 1 1 n n n n n		**Miscellaneous messages**
0 1 1 0 0 0 1 0	62	Facility
0 1 1 0 0 1 0 0	64	Register
0 1 1 0 1 1 1 0	6E	Notify
0 1 1 1 0 1 0 1	75	Status enquiry
0 1 1 1 1 0 1 1	7B	Information
0 1 1 1 1 1 0 1	7D	Status
1 n n n n n n n		**Network specific messages**
1 1 1 1 1 0 1 1	FB	Key hold
1 1 1 1 1 1 0 0	FC	Key release

Table 8-6 Message type octet values (Sheet 3 of 3)

Octet value (binary)	Octet value (hex)	Message
1 1 1 1 1 1 0 1	FD	Key setup
1 1 1 1 1 1 1 0	FE	Key setup acknowledge

Information elements

Information elements provide data on the specific users and calls. There are two types of information elements: single-length information elements and variable-length information elements.

Single-length information elements Setting bit 8 to 1 identifies the element as a single-length information element. The octet can be an identifier or an indication of a new Q.931, local, or national network information element. Figure 8-10 illustrates a single length information element and Table 8-7 lists the possible single-length information element octet values.

Figure 8-10 Single-length information element octet xxx

Bit	8	7	6	5	4	3	2	1
	1	Information element identifier			Contents of information element			

Table 8-7 Single-length information element octet values

Octet value (binary)	Octet value (hex)	Message
1 0 0 1 0 n n n		Single-length information element shift
1 0 0 1 0 0 0 0	90	Locking shift to codeset 0 (Q.931 information elements)
1 0 0 1 0 1 0 1	95	Locking shift to codeset 5 (national network)
1 0 0 1 0 1 1 0	96	Locking shift to codeset 6 (local network)

Variable-length information elements Setting bit 8 to 0 identifies the element as a variable-length information element. Figure 8-11 illustrates a variable-length information element and Table 8-8 lists the possible variable-length information element identifier values.

Figure 8-11 Variable-length information element octet

Bit	8	7	6	5	4	3	2	1
	0	Information element identifier						
	Length of information element (octets)							
	Contents of information elements							

Table 8-8 Variable-length information element identifier values (Sheet 1 of 2)

Octet value (binary)	Octet value (hex)	Message
0 n n n n n n n		**Variable information element shift**
0 0 0 0 0 1 0 0	04	Bearer capability
0 0 0 0 1 0 0 0	08	Cause
0 1 0 0 1 1 0 0	4C	Connected number
0 0 0 1 0 1 0 0	14	Call state
0 0 0 1 1 0 0 0	18	Channel identification
0 0 0 1 1 1 0 0	1C	Facility
0 0 0 1 1 1 1 0	1 E	Progress indicator
0 0 1 0 0 1 1 1	27	Notification indicator
0 0 1 0 1 1 0 0	2C	Keypad
0 0 1 1 0 0 1 0	32	Information request
0 0 1 1 0 1 0 0	34	Signal
0 0 1 1 1 0 0 0	38	Feature activation
0 0 1 1 1 0 0 1	39	Feature indication
0 0 1 1 1 0 1 0	3A	Service profile identification
0 0 1 1 1 0 1 1	3B	Endpoint identifier
0 1 1 0 1 1 0 0	6C	Calling party number
0 1 1 0 1 1 0 1	6D	Calling party subaddress

Table 8-8 Variable-length information element identifier values (Sheet 2 of 2)

Octet value (binary)	Octet value (hex)	Message
0 1 1 1 0 0 0 0	70	Called party number
0 1 1 1 0 0 0 10	71	Called party sudaddress
0 1 1 1 0 1 0 0	74	Redirecting number
0 1 1 1 1 0 0 0	78	Transit network selection
0 1 1 1 1 1 0 0	7C	Low -layer compatibility
0 1 1 1 1 1 0 1	7D	High-layer compatibility

X.25 packet octets

X.25 packet octets replace Q.931 information octets in low speed packet-switched data signaling. The X.25 packets consist of header and user data octets.

Header octets

The X.25 header octets contain:

- a general format indicator (GFI)
- logical channel number (LCN) information
- packet type information

Figure 8-12 illustrates X.25 header octets and Table 8-9 lists the possible X.25 header octets values.

Figure 8-12 X.25 header octets

Bit	8	7	6	5	4	3	2	1
	Q	D	Modulo		LCN high order nibble			
	0	0	0	1	1	0	0	0
	LCN low order octet							
	0	0	0	0	0	0	0	1
	Packet type							
	0	0	0	0	1	0	1	1

Table 8-9 X.25 header octets values (Sheet 1 of 2)

Octet	Bits	Bit or octet value (binary)	Octet value (hex)	Explanation
1	8	0 or 1		0 indicates user data and 1 indicates control data
1	7	0 or 1		Set to 1 if end-to-end confirmation is required
1	6 and 5	0 1		Modulo 8
1	6 and 5	1 0		Modulo 128
1 and 2	4 to 1 and 8 to 1		000 to FFF	Logical channel number
3	8 to 1	n n n n n n n 0	n 0	Data
3	8 to 1	0 0 0 0 1 0 1 1	0B	Call request/incoming call
3	8 to 1	0 0 0 0 1 1 1 1	0F	Call accept/call connect
3	8 to 1	0 0 0 1 0 0 1 1	13	Clear request/clear indication
3	8 to 1	0 0 0 1 0 1 1 1	17	Clear confirmation
3	8 to 1	0 0 1 0 0 0 1 1	23	Interrupt
3	8 to 1	0 0 1 0 0 1 1 1	27	Interrupt confirmation

Table 8-9 X.25 header octets values (Sheet 2 of 2)

Octet	Bits	Bit or octet value (binary)	Octet value (hex)	Explanation
3	8 to 1	0 0 0 1 1 0 1 1	1B	Reset request/reset indication
3	8 to 1	0 0 0 1 1 1 1 1	1F	Reset confirmation
3	8 to 1	1 1 1 1 0 0 0 1	F1	Diagnostic
3	8 to 1	1 1 1 1 1 0 1 1	FB	Restart request/restart indication
3	8 to 1	1 1 1 1 1 1 1 1	FF	Restart confirmation

Clear cause octet

A clear cause octet follows a clear request/clear indication or clear confirmation octet. Table 8-10 lists the clear cause values.

Table 8-10 Clear cause values (Sheet 1 of 2)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	DTE originated
1 n n n n n n n	80	DTE originated
0 0 0 0 0 0 0 1	01	Number busy
0 0 0 0 0 0 1 1	03	Invalid facilities request
0 0 0 0 0 1 0 1	05	Network congestion
0 0 0 0 1 0 0 1	09	Out of order
0 0 0 1 0 0 0 1	11	Remote procedure error
0 0 0 1 0 0 1 1	13	Local procedure error
0 0 0 1 0 1 0 1	15	RPOA out of order
0 0 0 1 1 0 0 1	19	Reverse charging acceptance not subscribed
0 0 1 0 0 0 0 1	21	Incompatible destination
0 0 1 0 1 0 0 1	29	Fast select acceptance not subscribed
0 0 1 1 1 0 0 1	39	Ship absent

Table 8-10 Clear cause values (Sheet 2 of 2)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 1 0 1 1	0B	Access barred
0 0 0 0 1 1 0 1	0D	Not obtainable

Reset cause octet

A reset cause octet follows a reset request/reset indication or reset confirmation octet. Table 8-11 lists the reset cause values.

Table 8-11 Reset cause values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	DTE originated
1 n n n n n n n	80	DTE originated
0 0 0 0 0 0 0 1	01	Out of order (PVC circuits only)
0 0 0 0 0 0 1 1	03	Remote procedure error
0 0 0 0 0 1 0 1	05	Local procedure error
0 0 0 0 0 1 1 1	07	Network congestion
0 0 0 0 1 0 0 1	09	Remote DTE operational
0 0 0 0 1 1 1 1	0F	Network operational
0 0 0 1 0 0 0 1	11	Incompatible destination
0 0 0 1 1 0 0 1	19	Network out of order

Restart cause octet

A restart cause octet follows a restart request/restart indication or restart confirmation octet. Table 8-12 lists the reset cause values.

Table 8-12 Restart cause values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 1	01	Local procedural error
0 0 0 0 0 0 1 1	03	Network congestion
0 0 0 0 0 1 1 1	07	Network operational
0 1 1 1 1 1 1 1	7F	Registration/cancellation confirmed

Diagnostic cause octet

A diagnostic cause octet follows a clear, reset, or restart octet. Table 8-13 lists the diagnostic cause values.

Table 8-13 Diagnostic cause values (Sheet 1 of 3)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	No additional information
0 0 0 0 0 0 01	01	Invalid P(S)
0 0 0 0 0 0 1 0	02	Invalid P(R)
0 0 1 0 0 0 0 0	20	**Packet not allowed**
0 0 1 0 0 0 0 1	21	Unidentifiable packet
0 0 1 0 0 0 1 0	22	Call on one way logical channel
0 0 1 0 0 0 1 1	23	Invalid packet type on a PVC
0 0 1 0 0 1 0 0	24	Packet on unassigned logical channel
0 0 1 0 0 1 0 1	25	Reject not subscribed to
0 0 1 0 0 1 1 0	26	Packet too short
0 0 1 0 0 1 1 1	27	Packet too long
0 0 1 0 1 0 0 0	28	Invalid GIF
0 0 1 0 1 0 0 1	29	Restart with non-zero bits 1 to 4, 9 to 16

Table 8-13 Diagnostic cause values (Sheet 2 of 3)

Octet value (binary)	Octet value (hex)	Message
0 0 1 0 1 0 1 0	2A	Packet type not compatible with facility/utility
0 0 1 0 1 0 1 1	2B	Unauthorized interrupt confirmation
0 0 1 0 1 1 0 0	2C	Unauthorized interrupt
0 0 1 0 1 1 0 1	2D	Unauthorized reject
0 0 1 1 0 0 0 0	30	**Time expired**
0 0 1 1 0 0 0 1	31	For incoming call/call request
0 0 1 1 0 0 1 0	32	For clear indication/request
0 0 1 1 0 0 1 1	33	For reset indication/request
0 0 1 1 0 1 0 0	34	For restart indication/request
0 1 0 0 0 0 0 0	40	**Call set-up or clearing problem**
0 1 0 0 0 0 0 1	41	Facility/utility code not allowed
0 1 0 0 0 0 1 0	42	Facility utility parameter not allowed
0 1 0 0 0 0 1 1	43	Invalid called address
0 1 0 0 0 1 0 0	44	Invalid calling address
0 1 0 0 0 1 0 1	45	Invalid facility length
0 1 0 0 0 1 1 0	46	Incoming call barred
0 1 0 0 0 1 1 1	47	No logical channel available
0 1 0 0 1 0 0 0	48	Call collision
0 1 0 0 1 0 0 1	49	Duplicate facility/utility requested
0 1 0 0 1 0 1 0	4A	Non-zero address length
0 1 0 0 1 0 1 1	4B	Non-zero facility length
0 1 0 0 1 1 0 0	4C	Facility/utility not provided when expected

Table 8-13 Diagnostic cause values (Sheet 3 of 3)

Octet value (binary)	Octet value (hex)	Message
0 1 0 0 1 1 0 1	4D	Invalid CCITT specified DTE facility
0 1 0 1 0 0 0 0 to 1 1 1 1 1 1 1 1	50 to FF	DPN codes

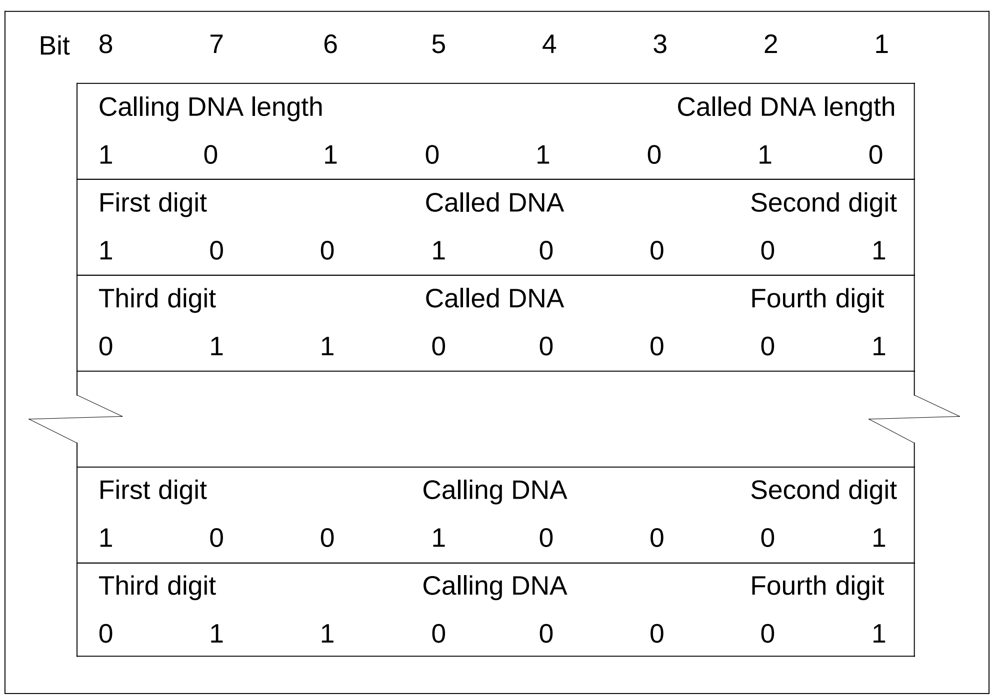
Data network address octets

Data network address octets (DNA) contain:

- a calling and called DTE's address length octet
- calling DTE's address fields
- called DTE's address fields

The calling and called DTE's address length fields are each four bits long. Bits 8, 7, 6, and 5 indicate the length of the calling DTE address; bits 4, 3, 2, and 1 indicate the length of the called DTE address. The called and calling DTE address fields contain the called and calling DTE's DNA in four bit blocks. Figure 8-13 illustrates the DNA octets' format.

Figure 8-13 DNA octets



Facility request octets

The facility request octets are present only after call request/incoming call packet types. The facility request octets contain the following octets and fields:

- facility field length octet
- facility class and code octet
- facility parameter octets
- additional facility code octet

Table 8-14 lists all the facility class and code octet values.

Table 8-14 Facility class and code octet values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 1	01	Call options
0 0 0 0 0 0 1 0	02	Throughput class
0 0 0 0 0 0 1 1	03	Closed user group
0 1 0 0 0 0 1 0	42	Maximum packet size
0 1 0 0 0 0 1 1	43	Local window size
0 1 0 0 0 1 0 0	44	RPOA
1 1 1 1 1 1 1 1	FF	Facility extension

Facility parameter octets

For facility parameter octets information, refer to the *CCITT Recommendation X.25*.

Additional facility code octets

For additional facility code octets information, refer to the *CCITT Recommendation X.25*.

User data octets

For user data octets information, refer to the *CCITT Recommendation X.25*.

Frame-checking sequence octets

The frame checking sequence octets are two octets that contain error-checking information.

Start and stop flag

All frames start and stop with the flag sequence illustrated in Figure 8-14.

Figure 8-14 Start and stop flag

Bit	8	7	6	5	4	3	2	1
	Flag							
Octet 1	0	1	1	1	1	1	1	0

Start or stop flag -- binary 01111110,hex 7E

B-channel data protocols

This section describes B-channel protocols that are used for packet-switched data: LAPB and X.25.

LAPB frame formats

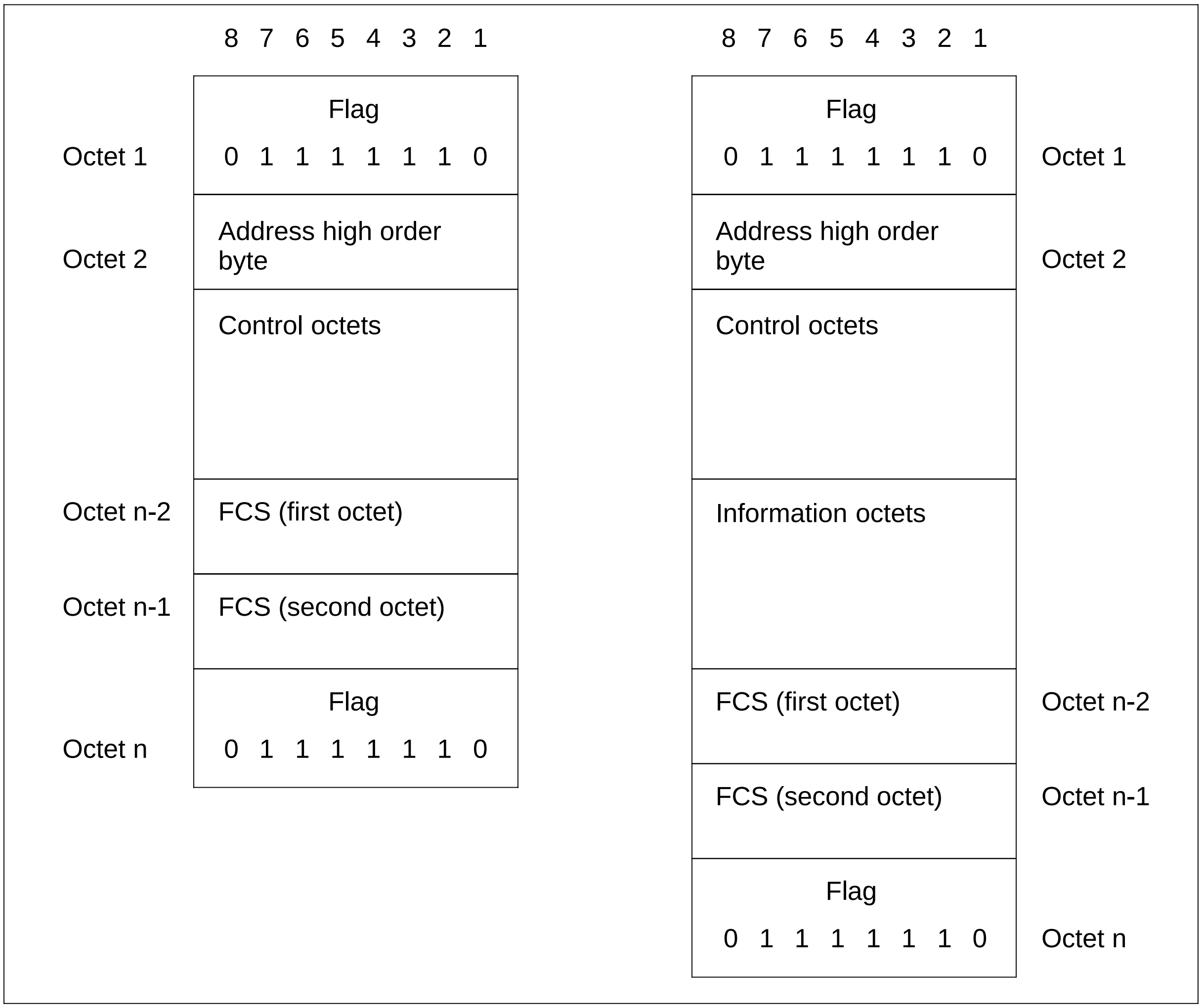
There are two link access procedure, balanced (LAPB) frame formats: modulo 8 and modulo 128. Modulo 8 is used for basic service. Modulo 128 is used for extended service. Figure 8-15 and 8-16 illustrate modulo 8 and modulo 128 frame formats respectively.

Figure 8-15 Modulo 8 frame formats

	8 7 6 5 4 3 2 1
Octet 1	Flag 0 1 1 1 1 1 1 0
Octet 2	Address
Octet 3	Control
Octet n-2	FCS (first octet)
Octet n-1	FCS (second octet)
Octet n	Flag 0 1 1 1 1 1 1 0

8 7 6 5 4 3 2 1	
Flag 0 1 1 1 1 1 1 0	Octet 1
Address	Octet 2
Control	Octet 3
Information octets	
FCS (first octet)	Octet n-2
FCS (second octet)	Octet n-1
Flag 0 1 1 1 1 1 1 0	Octet n

Figure 8-16 Modulo 128 frame formats



Start and stop flag

All frames start and stop with the flag sequence illustrated in Figure 8-17.

Figure 8-17 Start and stop flag

Bit	8	7	6	5	4	3	2	1
	Flag							
Octet 1	0	1	1	1	1	1	1	0

Start or stop flag -- binary 01111110,hex 7E

Address octets

The address octets identify the frame as either a command or a response. Table 8-15 lists the possible address octet values.

Table 8-15 Address octet values

Type	Command value (binary)	Command value (hex)	Response value (binary)	Response value (hex)
Single link node to host	0 0 0 0 0 0 1 1	03	0 0 0 0 0 0 0 1	01
Single link host to node	0 0 0 0 0 0 0 1	01	0 0 0 0 0 0 1 1	03
Multilink node to host	0 0 0 0 1 1 1 1	0F	0 0 0 0 0 1 1 1	07
Multilink host to node	0 0 0 0 0 1 1 1	07	0 0 0 0 1 1 1 1	0F

Control octets

There are five control octet types:

- Modulo 8 information transfer (I)
- Modulo 128 information transfer (I)
- Modulo 8 supervisory (S)
- Modulo 128 supervisory (S)
- Modulo 8 and 128 unnumbered (U)

I octets are used to transfer layer 3 messages. S octets are used for link supervision. U octets are used to provide additional data link control functions and unnumbered information transfers.

I octets

The modulo 8 and modulo 128 I octets, illustrated in figure 8-18 and figure 8-19, contains a transmitter send sequence number [N(S)], a transmitter receive number [N(R)], and a poll (P) bit. When used in a command, the poll bit is set to 1 indicating a response to the command is expected by the far end. Table 8-16 lists the possible values for each of these items.

Figure 8-18 Modulo 8 I octet

Bit	8	7	6	5	4	3	2	1
	Flag							
Octet 1	0	1	1	1	1	1	1	0

Start or stop flag -- binary 01111110,hex 7E

Figure 8-19 Modulo 128 I octets

Bit	8	7	6	5	4	3	2	1
	N(S)							0
	N(R)							P

Legend:
N(R) Transmitter receive sequence number
N(S) Transmitter send sequence number
P Poll bit

Table 8-16 I octet values

Type	Octet	Bit	Value (binary)	Explanation
Mod 8	1	8 to 6	n n n	Transmitter receive number N(R)
Mod 8	1	5	1 or 0	Poll bit
Mod 8	1	4 to 2	n n n	Transmitter send sequence number N(S)
Mod 8	1	1	0	Identifies the control octet as an I type format
Mod 128	1	8 to 2	n n n n n n n	Transmitter send sequence number N(S)
Mod 128	1	1	0	Identifies the control octet as an I type format
Mod 128	2	8 to 2	n n n n n n n	Transmitter receive number N(R)
Mod 128	2	1	1 or 0	Poll bit

S octets

The modulo 8 and modulo 128 S octet, illustrated in Figure 8-20 and Figure 8-21, contains supervisory function (S) bits, a transmitter receive sequence number [N(R)], and a poll/final (P/F) bit. Table 8-17 lists the possible values for each of these items.

Figure 8-20 Modulo 8 S octet

Bit 8	7	6	5	4	3	2	1
0	0	0	0	0	0	A/B	1
N(R)			P/F	S	S	0	1

Legend:
A/B Single link LAPB address type bit
N(R) Transmitter receive sequence number
P/F Poll bit or final bit
S Supervisory function bit

Figure 8-21 Modulo 128 S octets

Bit 8	7	6	5	4	3	2	1
0	0	0	0	S	S	0	1
N(R)							P/F

Legend:
N(R) Transmitter receive sequence number
P/F Poll bit or final bit
S Supervisory function bit

Table 8-17 S octet values (Sheet 1 of 2)

Type	Octet	Bit	Value (binary)	Explanation
Mod 8	1	2 and 1	0 1	Identifies the control octet as an S type format
Mod 8	1	8 and 6	n n n	Transmitter receive number N(R)
Mod 8	1	5	1 or 0	Poll bit when issued as a command. Final bit when issued as a response.
Mod 8	1	4 and 3	0 0	Receive ready (RR)
Mod 8	1	4 and 3	0 1	Receive not ready (RNR)
Mod 8	1	4 and 3	1 0	Receive ready (REJ)
Mod 128	1	8 to 5	0 0 0 0	Not used
Mod 128	1	4 and 3	0 0	Receive ready (RR)
Mod 128	1	4 and 3	0 1	Receive not ready (RNR)
Mod 128	1	4 and 3	1 0	Receive ready (REJ)

Table 8-17 S octet values (Sheet 2 of 2)

Type	Octet	Bit	Value (binary)	Explanation
Mod 128	1	2 and 1	0 1	Identifies the control octet as an S type format
Mod 128	1	8 to 2	n n n n n n n	Transmitter receive number N(R)
Mod 128	2	1	1 or 0	Poll bit when issued as a command. Final bit when issued as a response.

U octet

The modulo 8 and 128 U octet, illustrated in Figure 8-22 and 128 U octet, contains modifier (M) bits and a poll or final (P/F) bit. Table 8-18 lists the possible values for each of these items.

Figure 8-22 Modulo 8 and 128 U octet

Bit	8	7	6	5	4	3	2	1
	M	M	M	P/F	M	M	1	1

Legend:
M Modifier function bit
P/F Poll bit or final bit

Table 8-18 U octet values (Sheet 1 of 2)

Type	Bit	Bit or octet value (binary)	Octet value (hex)	Explanation
Mod 8	8 to 1	0 0 1 P 1 1 1 1	2F or 3F	Set asynchronous balanced mode (SABM)
Mod 8 and 128	8 to 1	0 1 0 P 0 0 1 1	43 or 53	Disconnect (DISC)
Mod 8 and 128	8 to 1	0 0 0 F 1 1 1 1	0F or 1F	Disconnect mode (DM)
Mod 8 and 128	8 to 1	0 1 1 F 0 0 1 1	63 or 73	Unnumbered Acknowledgement (UA)
Mod 8 and 128	8 to 1	1 0 0 F 0 1 1 1	87 or 97	Frame reject (FRMR)
Note: P=pollbit, F=finalbit				

Table 8-18 U octet values (Sheet 2 of 2)

Type	Bit	Bit or octet value (binary)	Octet value (hex)	Explanation
Mod 128	8 to 1	0 1 1 P 1 1 1 1	6F or 7F	Set asynchronous balanced mode extended (SABME)
Mod 8 and 128	2 and 1	1 1		Identifies the control octet as a U type format
Note: P=pollbit, F=finalbit				

Information octets

Information octets are present only after frame reject (FRMR) messages. The information octets consist of

- a rejected frame control octet
- a send state variable [V(S)] or receive state variable [V(R)]
- a command or response (C/R) bit
- W, X, Y, and Z bits

The V(S) indicates the current send state variable at the DCE or DTE reporting the rejected frame. The V(R) indicates the current receive state variable at the DCE or DTE reporting the rejected frame. The C/R bit is set to 1 if the rejected frame was a response. The C/R bit is set to 0 if the rejected frame was a command. The W bit is set to 1 if the control octet is invalid. The X bit is set to 1 if the information octet was invalid. The Y bit is set to 1 if the information octet was too large. The Z bit set to 1 if the control octet contained an invalid N(R). Figure 8-23 and 8-24 illustrate modulo 8 and modulo 128 information octets respectively.

Figure 8-23 Modulo 8 information octets

Bit	8	7	6	5	4	3	2	1
	Control							
	V(R)			C/R	V(S)			0
	0	0	0	0	Z	Y	X	W

Legend:

C/R Command or response bit
V(R) Receive state variable
V(S) Send state variable

W W bit
X X bit
Y Y bit
Z Z bit

Figure 8-24 Modulo 128 information octets

Bit	8	7	6	5	4	3	2	1
	Q	D	Modulo		LCN high order nibble			
	0	0	0	1	1	0	0	0
	LCN low order octet							
	0	0	0	0	0	0	0	1
	Packet type							
	0	0	0	0	1	0	1	1

Header octets

The X.25 header octets contain:

- a general format indicator (GFI)
- logical channel number (LCN) information
- packet type information

Figure 8-25 and Table 8-19 lists the possible X.25 header octets values.

Figure 8-25 X.25 header octets

Bit	8	7	6	5	4	3	2	1
	Q	D	Modulo		LCN high order nibble			
	0	0	0	1	1	0	0	0
	LCN low order octet							
	0	0	0	0	0	0	0	1
	Packet type							
	0	0	0	0	1	0	1	1

Table 8-19 X.25 header octets values (Sheet 1 of 2)

Type	Bit	Bit or octet value (binary)	Octet value (hex)	Explanation
1	8	0 or 1		0 indicates user data and 1 indicates control data
1	7	0 or 1		Set to 1 if end-to-end confirmation is required
1	6 and 5	0 1		Modulo 8
1	6 and 5	1 0		Modulo 128
1 and 2	4 to 1 and 8 to 1		000 to FFF	Logical channel number
3	8 to 1	n n n n n n n 0	n0	Data
3	8 to 1	0 0 0 0 1 0 1 1	0B	Call request/incoming call
3	8 to 1	0 0 0 0 1 1 1 1	0F	Call accept/call connect
3	8 to 1	0 0 0 1 0 0 1 1	13	Clear request/clear indication
3	8 to 1	0 0 0 1 0 1 1 1	17	Clear confirmation
3	8 to 1	0 0 1 0 0 0 1 1	23	Interrupt
3	8 to 1	0 0 1 0 0 1 1 1	27	Interrupt confirmation
3	8 to 1	0 0 0 1 1 0 1 1	1B	Reset request/reset indication
3	8 to 1	0 0 0 1 1 1 1 1	1F	Reset confirmation

Table 8-19 X.25 header octets values (Sheet 2 of 2)

Type	Bit	Bit or octet value (binary)	Octet value (hex)	Explanation
3	8 to 1	1 1 1 1 0 0 0 1	F1	Diagnostic
3	8 to 1	1 1 1 1 1 0 1 1	FB	Restart request/ restart indication
3	8 to 1	1 1 1 1 1 1 1 1	FF	Restart confirmation

Clear cause octet

A clear cause octet follows a clear request/clear indication or clear confirmation octet. Table 8-20 list the clear cause values.

Table 8-20 Clear cause values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	DTE originated
1 n n n n n n n	80	DTE originated
0 0 0 0 0 0 0 1	01	Number busy
0 0 0 0 0 0 1 1	03	Invalid facilities request
0 0 0 0 0 1 0 1	05	Network congestion
0 0 0 0 1 0 0 1	09	Out of order
0 0 0 1 0 0 0 1	11	Remote procedure error
0 0 0 1 0 0 1 1	13	Local procedure error
0 0 0 1 0 1 0 1	15	RPOA out of order
0 0 0 1 1 0 0 1	19	Reverse charging acceptance not subscribed
0 0 1 0 0 0 0 1	21	Incompatible destination
0 0 1 0 1 0 0 1	29	Fast select acceptance no subscribed
0 0 1 1 1 0 0 1	39	Ship absent
0 0 0 0 1 0 1 1	0B	Access barred
0 0 0 0 1 1 0 1	0D	Not obtainable

Reset cause octet

A reset cause octet follows a reset request/reset indication or reset confirmation octet. Table 8-21 list the reset cause values.

Table 8-21 Reset cause values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	00	DTE originated
1 n n n n n n n	80	DTE originated
0 0 0 0 0 0 0 1	01	Out of order (PVC circuits only)
0 0 0 0 0 0 1 1	03	Remote procedure error
0 0 0 0 0 1 0 1	05	Local procedure error
0 0 0 0 0 1 1 1	07	Network congestion
0 0 0 0 1 0 0 1	09	Remote DTE operational
0 0 0 0 1 1 1 1	0F	Network operational
0 0 0 1 0 0 0 1	11	Incompatible destination
0 0 0 1 1 0 0 1	19	Network out of order

Restart cause octet

A restart cause octet follows a restart request/restart indication or restart confirmation octet. Table 8-22 lists the restart cause values.

Table 8-22 Restart cause values

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 1	01	Local procedural error
0 0 0 0 0 0 1 1	03	Network congestion
0 0 0 0 0 1 1 1	07	Network operational
0 1 1 1 1 1 1 1	7F	Registration/cancellation confirmed

Diagnostic cause octet

A diagnostic cause octet follows a clear, reset, or restart octet. Table 8-23 lists the diagnostic cause values.

Table 8-23 Diagnostic cause values (Sheet 1 of 2)

Octet value (binary)	Octet value (hex)	Message
0 0 0 0 0 0 0 0	0 0	No additional information
0 0 0 0 0 0 01	01	Invalid P(S)
0 0 0 0 0 0 1 0	02	Invalid P(R)
0 0 0 1 0 0 0 0	20	**Packet not allowed**
0 0 1 0 0 0 0 1	21	Unidentifiable packet
0 0 1 0 0 0 1 0	22	Call on one way logical channel
0 0 1 0 0 0 1 1	23	Invalid packet type on a PVC
0 0 1 0 0 1 0 0	24	Packet on unassigned logical channel
0 0 1 0 0 1 0 1	25	Reject not subscribed to
0 0 1 0 0 1 1 0	26	Packet too short
0 0 1 0 0 1 1 1	27	Packet too long
0 0 1 0 1 0 0 0	28	Invalid GIF
0 0 1 0 1 0 0 1	29	Restart with non-zero bits 1 to 4, 9 to 16
0 0 1 0 1 0 1 0	2A	Packet type not compatible with facility/utility
0 0 1 0 1 0 1 1	2B	Unauthorized interrupt confirmation
0 0 1 0 1 1 0 0	2C	Unauthorized interrupt
0 0 1 0 1 1 0 1	2D	Unauthorized reject
0 0 1 1 0 0 0 0	30	**Time expired**
0 0 1 1 0 0 0 1	31	For incoming call/call request
0 0 1 1 0 0 1 0	32	For clear indication/request
0 0 1 1 0 0 1 1	33	For reset indication/request
0 0 1 1 0 1 0 0	34	For restart indication/request

Table 8-23 Diagnostic cause values (Sheet 2 of 2)

Octet value (binary)	Octet value (hex)	Message
0 1 0 0 0 0 0 0	40	**Call set-up or clearing problem**
0 1 0 0 0 0 0 1	41	Facility/utility code not allowed
0 1 0 0 0 0 1 0	42	Facility utility parameter not allowed
0 1 0 0 0 0 1 1	43	Invalid called address
0 1 0 0 0 1 0 0	44	Invalid calling address
0 1 0 0 0 1 0 1	45	Invalid facility length
0 1 0 0 0 1 1 0	46	Incoming call barred
0 1 0 0 0 1 1 1	47	No logical channel available
0 1 0 0 1 0 0 0	48	Call collision
0 1 0 0 1 0 0 1	49	Duplicate facility/utility requested
0 1 0 0 1 0 1 0	4A	Non-zero address length
0 1 0 0 1 0 1 1	4B	Non-zero facility length
0 1 0 0 1 1 0 0	4C	Facility/utility not provided when expected
0 1 0 0 1 1 0 1	4D	Invalid CCITT-specified DTE facility
1 0 0 1 0 0 0 0 to 1 1 1 1 1 1 1 1	50 to FF	DPN codes

Data network address octets

Data network address octets (DNA) contain:

- a calling and called DTE's address length octet
- calling DTE's address fields
- called DTE's address fields

The calling and called DTE's address length fields are each four bits long. Bits 8, 7, 6, and 5 indicate the length of the calling DTE address; bits 4, 3, 2, and 1 indicate the length of the called DTE address. The called and calling DTE address fields contain the called and calling DTE's DNA in four bit blocks. Figure 8-26 illustrates the DNA octet's format.

Figure 8-26 DNA octets

Bit 8	7	6	5	4	3	2	1
Calling DNA length							Called DNA length
1	0	1	0	1	0	1	0
First digit			Called DNA				Second digit
1	0	0	1	0	0	0	1
Third digit			Called DNA				Fourth digit
0	1	1	0	0	0	0	1
First digit			Calling DNA				Second digit
1	0	0	1	0	0	0	1
Third digit			Calling DNA				Fourth digit
0	1	1	0	0	0	0	1

Facility request octets

The facility request octets are present only after call request/incoming call packet types. The facility request octets contain the following octets and fields:

- facility field length octet
- facility class and code octet
- facility parameter octets
- additional facility codes octet

Table 8-24 lists all the facility class and code octet values

Table 8-24 Facility class and code octet values (Sheet 1 of 2)

Octet value (Binary)	Octet value (Hex)	Message
0 0 0 0 0 0 0 1	0 1	Call options
0 0 0 0 0 0 1 0	0 2	Throughput class
0 0 0 0 0 0 1 1	0 3	Closed user group
0 0 0 0 0 0 0 0	42	Maximum packet size
0 1 0 0 0 0 1 1	43	Local window size

Table 8-24 Facility class and code octet values (Sheet 2 of 2)

Octet value (Binary)	Octet value (Hex)	Message
0 1 0 0 0 1 0 0	44	RPOA
1 1 1 1 1 1 1 1	FF	Facility extension

User data octets

For user data octets information, refer to the *CCITT Recommendation X.25*.

Frame checking sequence octets

The frame checking sequence octets consist of two octets that contain error-checking information.

Start and stop flag

All frames start and stop with the flag sequence illustrated in Figure 8-27.

Figure 8-27 Start and stop flag

Bit	8	7	6	5	4	3	2	1
	Flag							
Octet 1	0	1	1	1	1	1	1	0

Start or stop flag -- binary 01111110,hex 7E

X.75 protocol

The CCITT X.75/X.75' protocol uses the same frame format as X.25 except that a utilities octet is added to the frame. The ability of the XLIU to be used as an X.75/X.75' transit network is supported within the utilities octet by recording the DNICs of the networks used in the data transfer.

Protocol analysis

There are two types of DMS ISDN BRI protocol analysis: real-time protocol analysis and protocol abnormality count measurement.

Real-time protocol analysis is performed using a protocol analyzer or the PMDEBUG utility. A protocol analyzer can be connected to a line card to analyze B-channel or D-channel protocol but doing this removes the corresponding line from service. The combination of a protocol analyzer and the digital test access (DTA) feature, however, provides the ability to analyze protocol without removing a line from service. A detailed description of DTA is provided in the Troubleshooting chapter of this document. Figure 8-28 illustrates how a protocol analyzer and DTA can be used to monitor a circuit-switched voice call. PMDEBUG can also be used for Q.931 protocol analysis but it should only be used if you do not have access to a protocol analyzer: PMDEBUG can cause a loss of service. Figure 8-29 provides an example of how PMDEBUG can be used for protocol analysis.

Protocol abnormality counts can be measured using the QCOUNTS command.

Figure 8-28 Example of protocol analysis using DTA

>MAPCI;MTC;LNS;LTP;LEVEL LTPDATA

>EQUIP DTA LEN 4 0 1 12

Example of a MAP display:

```
DTA monitor equipment 1 reserved
```

>EQUIP DTA QUERY ALL

Example of a MAP display:

```
 MTR EQUIP        US  DS       CONNECT       CHNL STAT
-------------------------------------------------------
 1 HOST 04 0 01 12 B1  B2
```

>POST D 6320064

The DTA protocol analyzer is connected.

>CONNECT 1 D

Example of a MAP display:

```
ISDN LOOP   HOST 04 0 01 08     632 0056 IDL
DTA-CHNL       EQP STAT
 D TDM(1)       1   .
```

>EQUIP DTA QUERY ALL

Example of a MAP display:

```
 MTR EQUIP        US  DS       CONNECT       CHNL STAT
-------------------------------------------------------
 1 HOST 04 0 01 12 B1  B2   HOST 04 0 01 08   D(1)   .
```

The protocol is monitored.

Example of a protocol analyzer display:

```
Packet source: NT, length: 22 octets
First few octets: 08 01 01 05 04 03 80 90 a3 6c 0b 80 31 30 33 36
1 00001000  Protocol Discriminator Q.931 User-network Call Control Message
2 00000001  Call reference length=1
3 00000001  Call Reference Flag=0, Origination Side
            Call reference value=1
4 00000101  Message type: Call establishment: SETUP
5 00000100  Var-len Info Element, Type=0000100, Bearer Capability
6 00000011  Length=3
7 10000000  Extension bit=1, Last octet
            Coding standard=00, CCITT standardized coding
            Info transfer capability=00000, Speech
8 10010000  Extension bit=1, Last octet
            Info transfer mode=00, Circuit mode
            Info transfer rate=10000, 64 kbit/s
```

>CONNECT 1 RLS

```
DTA monitor 1 connection RELEASED.
```

>EQUIP DTA RESET 1

```
DTA monitor equipment 1 RESET.
```

WARNING
Use of PMDEBUG is restricted.
Only use the PMDEBUG utility if you do not have access to a protocol analyzer. Use of the PMDEBUG utility is restricted to

- signatories of the technical information agreement (TIA)
- experienced maintenance personnel. User errors in the PMDEBUG utility can result in a loss of service.
- periods of low traffic. PMDEBUG reduces the call processing speed of the switch.

Figure 8-29 Example of protocol analysis using PMDEBUG

>QLEN 67 1 09 12

MAP response:

```
LEN:      HOST  67 1 09 12
ISG: 203 DCH: 51 ISG BRA CHANNEL: 19
CARDCODE:  BX26AA    PADGRP: BRA
PM NODE NUMBER     :    129
PM TERMINAL NUMBER :    301

  TEI         LTID        CS    PS     BCH/ISG Bd
  ---     -------------   --    --     ----------
DYNAMIC   ISDN      751    Y     N      -
DYNAMIC   ISDN      752    Y     N      -
--------------------------------------------------------------------------
```

>PMDEBUG LTC 1

MAP response:

```
PMDEBUG MODE - CONNECTING TO PM
WARNING: You now have access to the PM monitor...proceed with caution
```

> CP

MAP response:

```
Dump,Unprot,Trmnl,Athb,Xdb,tVa,Chb,dsP,Fnb,Mod
Brk,Extint,Swct,Idlq,abtrK,Rmt,cLdb *
UP:CP>
```

The internal node and terminal number of the LEN is requested.

Figure 8-30 Example of protocol analysis using PMDEBUG

>EXTINT 129 301

MAP response:

```
INTERNAL NODE     NUMBER = 2
INTERNAL TERMINAL NUMBER = 943
Dump,Unprot,Trmnl,Athb,Xdb,tVa,Chb,dsP,Fnb,M
od
Brk,Extint,Swct,Idlq,abtrK,Rmt,cLdb *
UP:CP>
```

>LTCUP

The ISDNCP level is accessed.

>

MAP response:

```
Isprottbl,Lterm,Trmtype,Sidx,Ccbcs,ISLT_unpr
ot,ISCall_unpr,IS_c_te_unp,
IS_T_te_unp,IS_Loop_unp,DUmp_smb,HEX_smb,ISO
ptns,SSb,FSBMon,Hsg,Bradntbl,LLmsim,
ISLoop,FSB,Eventsim,CCSim,SCp_x_gen.
UP:ISdncp>
```

>ISLOOP

MAP response:

```
Loopinfo,Unprot.
```

The SIDX that is associated with the TID is requested.

>L 943

MAP response:

```
ISDN LOOP INFO.
===============
Int. Termno  = 943
Int. Nodeno  = 2
Assoc. Sidx  = 147
              Associated DCH = NIL
    No. of Logical Terminals = 2
No. of Dlcei links allocated = 2
        No. of circuit links = 2
        No. of  packet links = 0
Timer TI-T1 Info
================
Logical Link  Q931 Init Timer  Init Req Sent  First Service Received
------------  ---------------  -------------  ----------------------
     0             0                n                  n
     1             0                n                  n
Display log. terminal info ?  Yes / No.
```

> Y

MAP response:

```
Logical Terminal Info
=====================
Lidx  Termno  Priv  Sig  Clnk  Plnk  Phid  Ltid_b  Tei
----  ------  ----  ---  ----  ----  ----  ------  ---
 0      7001    B     F     0    --    --   112       64
 1      7000    B     F     1    --    --   113       65
```

Figure 8-31 Example of protocol analysis using PMDEBUG

The ISDNCP level is accessed.

>

>ISPROTTBL

Enter the SIDX.

>147

MAP response:

```
Searching the TERM_PROT_TBL...

  943    39
 7000    36
 7001    36

Done searching.

Continue Quit
A command is issued to continue the search.
```

>C

MAP response:

```
LOOP TID:                     2    943    255
DCH_STID:                   255    NO_LTERMS:                 2
NO_LLINKS:                  255    BCHGLARE:                  0
IFCLASS:                      0    CONFIG:                    0
BCHNEG:                       0    BCH_SEL_SEQ:               0
ECEQUIP:                      0    REMBSY:                    0
CRLENGTH:                     0    LOCATION:                  0
VERSION:                    255    NO_OF_BCHANNEL:           -1
VENDOR_TYPE                   0    PRODUCT_VERSION_NO:        0
   DATA_RATE                  0    POOL_IDX:                 62
   INV HDLC                   0
   L1 ABORT                   0
   ATP INDEX                  0

LTERMS INDEXES:    33     34
Continue Quit
```

Figure 8-32 Example of protocol analysis using PMDEBUG

A command is issued to continue search.

> C

MAP response:

```
DLCI_TABLE:
    64      0      0
    65      0      1
   255    255     15
   255    255     15
LTERM_RECORDS[0 ]:


LTERM_RECORDS[1 ]:

SET_INT_TERMNO:           7000
LTID_BYTE:                 113    TEI:                          65
REL_SEQ:                     0    OVERLAP:                       0
HOLDSUBSC:                   0    NOTIFY:                        0
CGNPRV:                      0    VOICE_CALL:                    1
CIR_DLCEI_LINK:              1    AUDTRMT:                       0
VBD_CALL:                    1    CMD_CALL:                      1
PMD_CALL:                    0    CGS_SUBSCRIBED:                0
CDS_SUBSCRIBED:              0    LLC_SUBSCRIBED:                0
HLC_SUBSCRIBED:              0    UUI_SUBSCRIBED:                0
ACC_PRIV:                    0    EKTS_SUBSCRIBED:               0
PROTOCOL VERSION:      [2] - Functional
PROTOCOL ISSUE:        2
SPID_SUFFIX:           ????????
   CACH_SUBSCRIBED:      0
DEFLTERM:            0    DNC_ALLOWED:         0
```

>LLMSIM

>OPTIONS

>SELECT 7001

>MON

MAP response:

```
Incoming monitor is now on.

OUT=Off; IN=Mon; Options=[verbose,stid,ltid,etid,ramfile,screen]

Outgoing monitor is now on.

OUT=Mon; IN=Mon; Options=[verbose,stid,ltid,etid,ramfile,screen]
```

Figure 8-33 Example of protocol analysis using PMDEBUG

Monitor the Q.931 protocol.

MAP response:

```
<== Q931: SETUP:     from S[7001] L[2,943,64] E[129,301,64]
  CR:  0,01
  BC:  speech
       64 kbit/s
       circuit mode
       mu-law speech
  CGN: e164
       national_number
       6137227051

==> Q931: SETUP ACK: to S[7001] L[2,943,64] E[129,301,64]
  CR:  1,01
  CID: B2
  PI:  public_network_serving_local_user
       in_band_info_or_pattern_now_avail
  SIG: dial_tone
```

>MOF

MAP response:

```
Incoming monitor is now off.

OUT=Mon; IN=Off; Options=[verbose,stid,ltid,etid,ramfile,screen]

Outgoing monitor is now off.

OUT=Off; IN=Off; Options=[verbose,stid,ltid,etid,ramfile,screen]

UP:LLmsim>
```

>QUIT

MAP response:

```
NOTE: PMDEBUG will terminate when last request is complete
PMDEBUG TERMINATES
```

9 Troubleshooting

This chapter describes the troubleshooting tools, typical test configurations, and diagnostics used to troubleshoot fault conditions on the integrated services digital network (ISDN) node.

Line troubleshooting

This section describes line troubleshooting.

Diagnostics

ISDN line diagnostics check the loop components to determine if a fault exists in

- the line card
- the NT1
- the loop
- the D-channel path

Line diagnostics can be run using the DIAG command from the LTP level of the MAP display. ISDN line diagnostics also can be run automatically on lines in the shower queue or the ICMO queue.

Shower queue

A line is put in the shower queue if a peripheral module (PM) reports trouble on the line or if there is a call on a line that cannot be terminated. A limited diagnostic is performed on each line in the shower queue, without removing the line from service. Packet and circuit-switched services to the subscriber are not interrupted during this in-service diagnostic.

Limitations The in-service diagnostic does not require an multiline test unit (MTU) or a trunk test unit (TTU). If the in-service diagnostic fails, an extended diagnostic can be performed.

ICMO queue

A line is put in the InComing Message Overloading (ICMO) queue if the ICMO audit process finds a system busy (SB) *i* minor ICMO line. An ICMO line reports excessive messages being sent between the line card and the enhanced line concentrating module (LCME). Each line in the ICMO queue is taken out of service, goes through line diagnostics, and then is returned to service when the fault has been cleared.

2B1Q and S/T line card diagnostics

The set of diagnostics applied depends on the type of line and type of line card. Table 9-1 and 9-2 show the range of tests for the 2B1Q U-type line card and the S/T-ISLC line card, respectively. Tests are controlled and limited by the following factors:

- use of the parameters FAST or LC
- use of the parameter FAST for S/T-ISLC
- use of the parameter INS for U-ISLC
- order by shower queue
- availability of an MTU
- accessibility of a D-channel handler (DCH) or enhanced D-channel handler (EDCH)
- accessibility of a NT1

As with other tests, the ISDN line diagnostic is limited. It checks the ISDN line card functions and its signaling to the NT1. The customer premises equipment (CPE) can be disconnected from the NT1 without affecting the ISDN line diagnostic. If the NT1 is disconnected, though, the diagnostic results indicate missing NT1 equipment.

Table 9-1 2B1Q line card diagnostic tests (Sheet 1 of 2)

Diagnostic tests	Shower queue	Fast	No DCH	No MTU	No NT1	Extended
line card occupancy test	Y	Y	Y	Y	Y	Y
PUPS power failure test	Y	Y	Y	Y	Y	Y
DR stuck test	Y	Y	Y	Y	Y	Y
line card restore test	Y	Y	Y	Y	Y	Y
Self test (LC)	N	N	Y	Y	Y	Y
BF stuck test	Y	Y	Y	Y	Y	Y
Relay test	N	N	Y	N	Y	Y
Sealing current test	N	N	Y	N	Y	Y
Continuity test (L)	N	Y	N	Y	Y	Y
Continuity test (LU)	N	Y	N	Y	Y	Y
DC signature test	N	N	Y	N	N	Y
NT1 restore test	Y	Y	Y	Y	N	Y
Status test (NT1)	Y	Y	Y	Y	N	Y
Continuity test (T)	N	Y	N	Y	N	Y

Note: The tests run from the shower queue can also be initiated manually by specifying the INS parameter with the DIAG command.

Legend

Y test is run

N test is not run

L L-interface

LC line card

LU LU-interface

NT1 network termination 1

T T-interface (S/T-bus side of NT1)

MTU multiline test unit

DCH D-channel handler

Table 9-1 2B1Q line card diagnostic tests (Sheet 2 of 2)

Diagnostic tests	Shower queue	Fast	No DCH	No MTU	No NT1	Extended
BCH continuity test	N	Y	Y	Y	N	Y
Termination test	N	N	Y	N	Y	Y
NEBE test	Y	Y	Y	Y	N	Y
FEBE test	Y	Y	Y	Y	N	Y
Error register query	Y	Y	Y	Y	Y	Y
U-loop tests	N	N	Y	N	Y	Y
Hard reset	N	N	Y	Y	Y	Y
Restore (LC and NT1)	N	N	Y	Y	N	Y

Note: The tests run from the shower queue can also be initiated manually by specifying the INS parameter with the DIAG command.

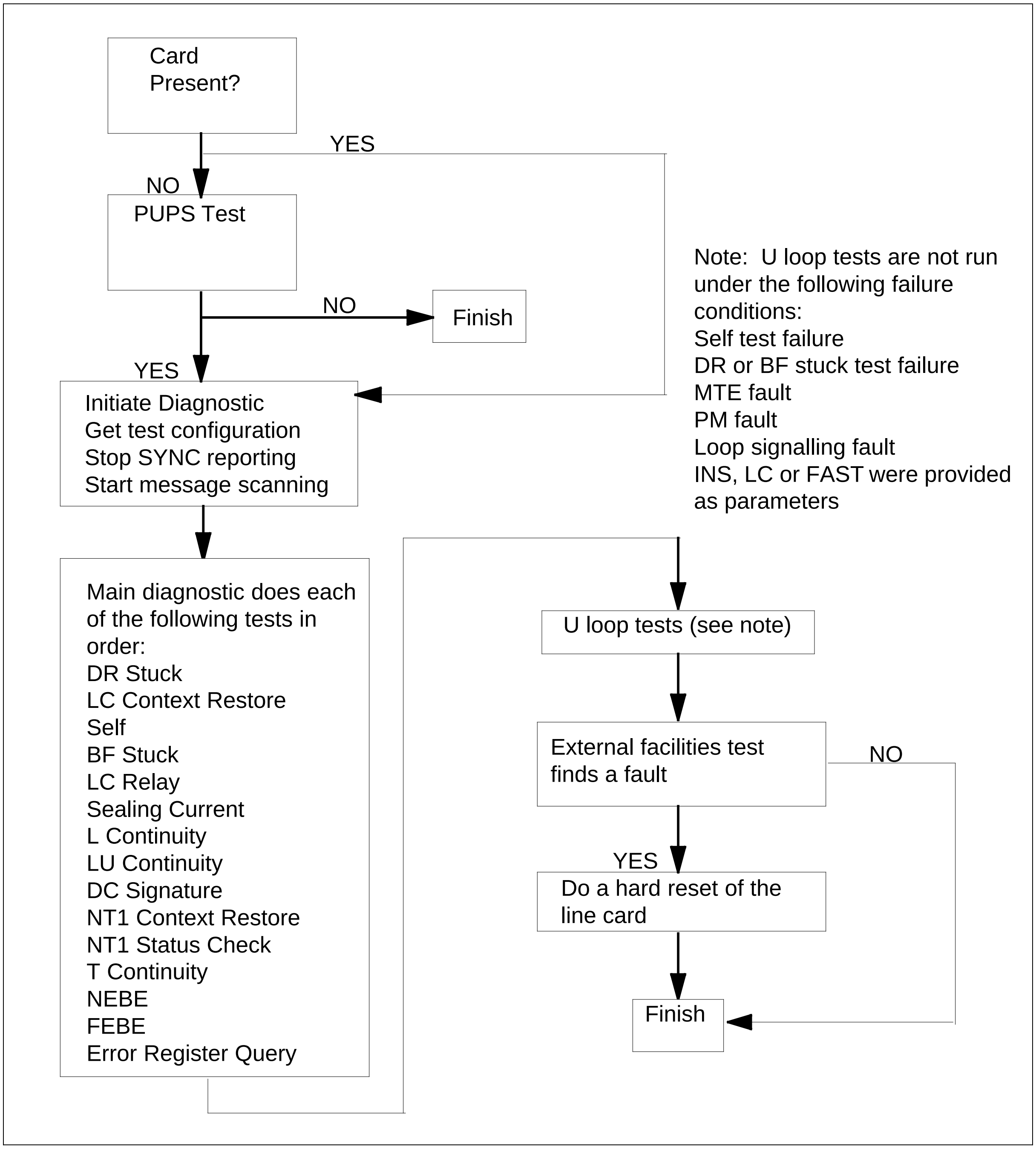
Legend

Y	test is run
N	test is not run
L	L-interface
LC	line card
LU	LU-interface
NT1	network termination 1
T	T-interface (S/T-bus side of NT1)
MTU	multiline test unit
DCH	D-channel handler

The following flowchart, Figure 9-1, "Table flow for sequence of diagnostic sub-tests" on page 9-5, illustrates the main diagnostic routine logic flow for the 2B1Q line card diagnostic tests. Ranges for the values displayed during the execution of these diagnostic tests may be found in appendix A.

This flow chart depicts the sequence of diagnostic sub-tests that are performed when a diagnostic with parameter FULL is run on a 2B1Q loop. A subset of the main diagnostic tests are run depending on the parameters chosen.

Figure 9-1 Table flow for sequence of diagnostic sub-tests



2B1Q U-type line card diagnostic tests

The diagnostic tests, described as follows, apply only to U-type line cards using the 2B1Q line coding protocol. The tests are conducted in the following order:

1. The card occupancy test sends a message to the Enhanced ISDN Line Concentrating Module (LCME) to test if the slot is occupied. If card occupancy fails, the M flag is set. The M flag indicates that an ISDN line card is missing.
2. The point-of-use power supply (PUPS) power failure test is run only if the card occupancy test fails. This test sends a message to the LCME to determine if the PUPS for the drawer of the line in question has failed.
3. The data-ready (DR) stuck test determines if the DR bit of the L-interface chip is set to high or low.
4. The line card context restore test reads and validates the line card relay status and U-interface frame synchronization after a soft reset of the card. The reset clears the data registers and releases the relays.
5. The self test (LC) is a test of the line card executed by the card's firmware. The test includes an internal read-only memory (ROM) test, an internal random access memory (RAM) test, an L-bus subsystem test, and a U-interface subsystem test. Failure of this test requires line card replacement.
6. The buffer-full (BF) stuck test determines if the BF bit of the L-bus is set to high or low.
7. The relay test checks that the cutoff, TEST-IN, and TEST-OUT relays on the ISDN line card are working. The cutoff relay is activated and the line test equipment (LTE) is used to measure the tip-and-ring voltage.
8. The sealing current test helps identify line card failures when the line card is generating insufficient sealing current. This current is used to maintain loop integrity.
9. The continuity test (L) performs a D-channel continuity test to determine if a path has been established between the D-channel handler (DCH) or enhanced D-channel handler (EDCH) and the L-interface of the Bus Interface Card (BIC).
10. The continuity test (LU) performs a D-channel continuity test to determine if a path has been established between the DCH or EDCH and the LU-interface on the line card. A full-frame analog loopback is used during this test.
11. The direct current (DC) signature test detects the presence of the 2B1QNT1 on the subscriber loop by means of its DC signature.
12. The NT1 context restore test sets a 2B+D loopback at the NT1 or T-interface to check whether the NT1 restore (restore to normal) is

working correctly. The restore should clear the loopback. A soft reset is performed on the NT1 to return it to normal and to clear the 2B+D loopback. The NT1 context restore test is performed only if the U-interface frame is synchronized.

13. The status test of the NT1 performs a series of data checks. This test is performed only if the U-interface frame is synchronized. The test performs the following functions:
    a. checks that no loopbacks are set
    b. checks that the restore function is working
    c. verifies the synchronization status of the T-interface
    d. checks if the network termination maintenance (NTM) bit in the NT1 status byte is set, indicating customer-initiated maintenance
    e. reports on the status of NT1 power based on the value of primary and battery power bits.
14. The continuity test (T) performs a D-channel continuity test to determine if a path has been established between the DCH or EDCH and the T- or S/T-bus side of the NT1. This test is performed only if the U-interface frame is synchronized.
15. The BCH continuity test sets up and runs a continuity test between the XLIU (XSG Channel) and the T-interface of an ISDN line card. This test is performed only if the U-interface frame is synchronized. This test is available if the DMS packet handler is present.
16. The near-end block error (NEBE) test verifies the operation of the NEBE checking mechanism in the line card firmware. The test causes the NT1 to inject a cyclical redundancy check (CRC) and the firmware checks that it has been detected.
17. The far-end block error (FEBE) test verifies the operation of the FEBE checking mechanism in the line card firmware. The test causes the NT1 to inject a CRC and the firmware checks that it has been detected.
18. The error register query determines if errored second(ES) and severely errored second (SES) performance thresholds have been exceeded. One message queries the performance thresholds and another message reads the current and previous hour ES and SES values for comparison.
19. U-loop tests use the LTE to measure the loop parameters (DC voltage, AC voltage, resistance, and capacitance). This test is performed if a failure has been detected by a previous test, except for the following cases:
    a. the self test failed
    b. the DR or BF stuck test failed
    c. an MTE fault was found

d. a PM fault was found

e. a loop signalling fault was found

f. an in-service (INS), fast diagnostic (FAST), or line card only (LC) option was provided by the user.

20. A hard reset is performed on the line card if an INS was not provided by the user, and if one of the following faults was detected:

a. the line card related fault was found

b. a relay fault was found

c. the self test failed

d. the error register query test failed

e. the DR or BF stuck test failed

f. a loop signalling fault was found

g. a synchronization fault was found.

Table 9-2 S/T line card diagnostic tests (Sheet 1 of 2)

Diagnostic tests	Shower queue	Fast	No DCH	Extended
Line card occupancy	Y	Y	Y	Y
DR stuck test (see note)	Y	Y	Y	Y
Context restore (L-chip)	Y	Y	Y	Y
Context restore (T-chip)	N	Y	Y	Y
Test register test (L-chip)	Y	Y	Y	Y
Status check (L-chip, T-chip, maintenance processor)	Y	Y	Y	Y
Self-test (T-chip and maintenance processor)	N	N	Y	Y
Phantom power test	N	N	Y	Y
Continuity test (L and T interface)	N	Y	N	Y
CO relay test (T interface)	N	Y	N	Y
Error register query	Y	Y	Y	Y

Table 9-2 S/T line card diagnostic tests (Sheet 2 of 2)

Diagnostic tests	Shower queue	Fast	No DCH	Extended
ISDN line card hard reset	N	N	Y	Y
Legend				
Y test is run				
N test is not run				
DCH D-channel handler				

S/T-type line card diagnostic tests

The diagnostic tests, described as follows, apply only to S/T-type line cards and are conducted in the following order:

1. The PUPS power failure test sends a message to the LCME to determine if the PUPS for the LCME line drawer containing the line under test has failed.
2. The ISDN line card occupancy test sends a message to the LCME to determine if a line card is properly seated.
3. The DR stuck test determines if the DR bit of the L-interface chip is set to high or low.
4. The line card context restore L- and T-chip tests perform a return-to-normal on the line card. If the context restore test is done on the L-chip, the loopbacks and relays are released. If the context restore is done on the T-chip, only the loopback is released. If a 96-kHz test tone is set, it is also released.
5. The line card status test checks the L-bus, the S/T-bus subsystem, and the status of the maintenance processor, and determines the validity of each. The check includes the synchronization status, the loopback status, and the cutoff relay.
6. The L-chip test register test sends a test pattern to the L-chip test registers and verifies the test pattern.
7. The self-test on the S/T-bus subsystem and the maintenance processor is initiated by the maintenance processor. The test checks the S/T-bus subsystem, the ROM, and the serial control part interface. The loop is out of service while this test is running.
8. The phantom power test checks for phantom power on the bus. The loop is out of service while this test is running.
9. The continuity test performs a D-channel continuity test to determine if a path has been established between the DCH or EDCH and the LCME interface on the ISDN line card. The test is performed from the DCH or

EDCH to the L- and T-interfaces of the S/T-ISLC. If there is a line card problem, the test fails.

10. The cutoff relay test runs only after the D-channel continuity test to the T-interface passes. A loopback is set at the T-interface and the cutoff relay is released. A D-channel continuity test to the T-interface is performed. If the cutoff relay is released properly, the D-channel continuity test fails. This failure indicates a successful cutoff relay test.
11. The error register test queries the error registers that keep track of the status of error counters. The status of the loop (quiescent, degraded, or unacceptable) is displayed as part of the diagnostic report.
12. The ISDN line card hard reset forces reinitialization of the ISDN line card circuit only if a service-affecting fault is detected after the diagnostic has been run. The system also reinitializes an ISDN line card when it is inserted into a slot.

No test trunk testing

No test trunk (NTT) testing on ISDN lines is similar to that for plain ordinary telephone service (POTS), Meridian Digital Centrex (MDC), 500-type lines, and 2500-type lines. The NTT provides an interface through which external test equipment can be used to test subscriber lines.

Before tests are made from the test equipment, the ISDN line is connected through the test access network (TAN) to the NT2X90AD NTT circuit. A combination of the cutoff and test access (TA) relays, or TA relays only, on the line card are operated during the test. The relays and connections are released following NTT testing. Refer to the configuration in Figure 9-2, "NTT configuration for ISDN lines" on page 9-12.

The external test equipment provides the following functions:

- measuring voltage, resistance, and capacitance between tip, ring, and ground
- measuring loop length
- counting rings
- monitoring talk on the subscriber line
- drawing dial tone and dial on the subscriber line
- testing digits on the subscriber line
- ringing the subscriber telephone set

Line card relays

Although the 2B1Q line card is equipped with a cutoff relay and two TA relays, NTT uses only its TA relays. The TA relays are designated as TEST_IN and TEST_OUT.

The S/T-line card is not equipped with TA relays. If an attempt is made to test an S/T-line, the system returns the intercept tone to the test equipment.

NTT and line card states

NTT tests can be performed on ISDN lines that are in the following states:

- cut (CUT)
- D-channel maintenance busy (DMB)
- idle (IDL)
- lock out (LO)

If an attempt is made to test an ISDN line in another state, the reorder tone is sent to the test equipment. This stops a bridged connection from disrupting transmission on call processing busy (CPB) lines.

NTT testing causes the state of the ISDN line to change to MB, and seizes the line to prevent interference from other ISDN line maintenance operations.

Line testing configurations for NTT

Bridged connections for U-type line cards release the cutoff relay and operate both the TEST_IN and TEST_OUT relays. Configurations that operate only the TEST_IN relay on the 2B1Q line card are not used.

NTT line testing restrictions

The following restrictions apply to NTT tests on ISDN lines:

- Analog test functions are not applicable. Only voltage, resistance, and capacitance measurements between tip, ring, and ground are supported.

  Note: NTT access to 2B1Q lines requires that test equipment apply no more than 30 V dc when measuring the resistance of the line. This limit is imposed by the 2B1Q NT1 which meets the standard nonactivation voltage threshold of 30 V dc.

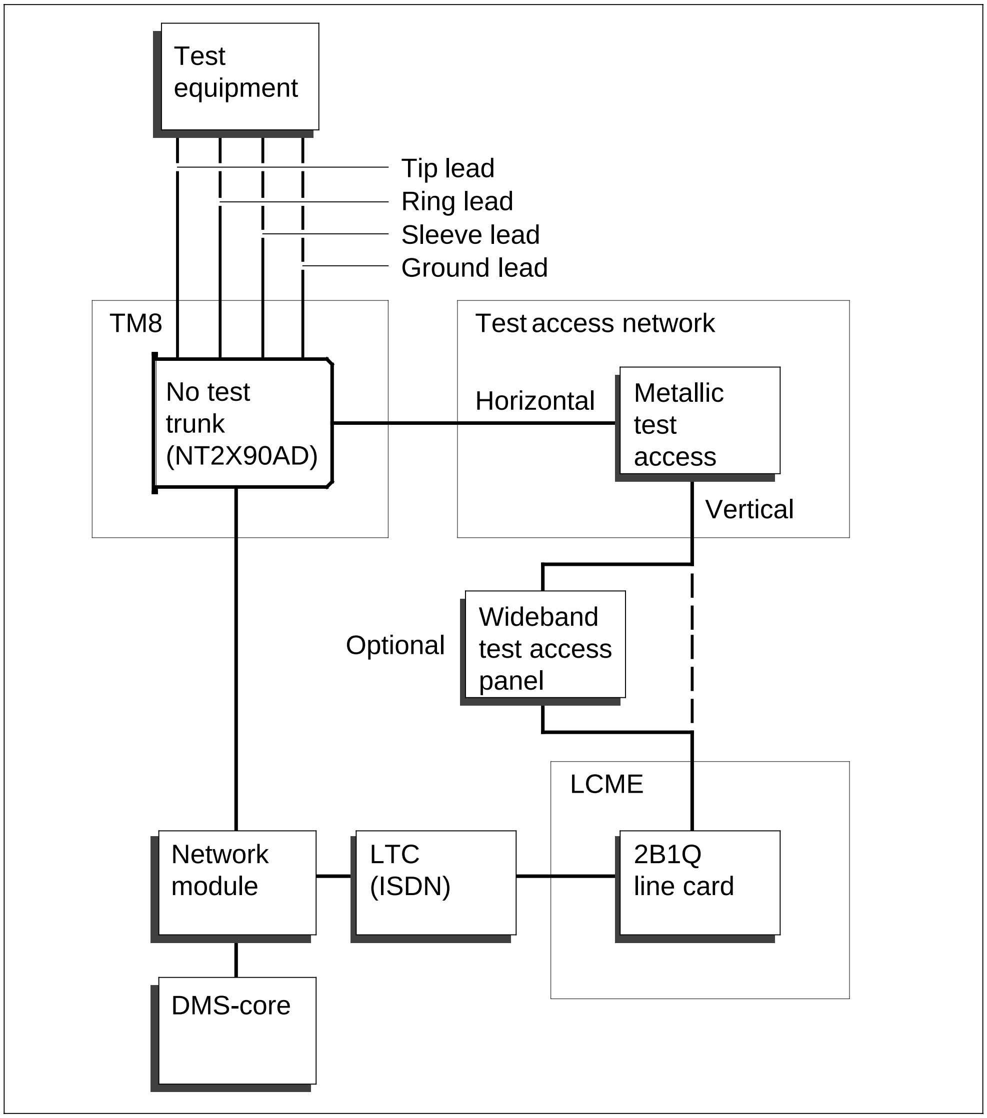
- Test sessions initiated by outgoing calls from an ISDN line to the external test equipment are not supported.
- The following POTS line test options are not applicable:
  - denied origination (DOR)
  - denied termination (DTM)
  - plug up (PLP)
  - remote make busy (RMB)

— requested suspension (RSUS)

— suspended service (SUS)

- NTT access to ISDN lines is cut off after a restart.

Figure 9-2 NTT configuration for ISDN lines



Metallic test access

MTA can be used to isolate an ISDN line fault by running a series of tests on the line. These tests can verify either analog or digital functionality, depending on the test equipment connected by the MTA.

MTA can be configured in either of the following two ways:

- an NT2X46AB Minibar switch mounted in a miscellaneous equipment frame used in conjunction with an NT2X50AB driver card mounted in an maintenance trunk module (MTM)
- an NT3X09BA driver card (mounted in an MTM) equipped with a network of relays comprising a matrix with eight horizontal connections for test equipment and eight vertical connections for LCDs

To provide analog testing, MTA uses the test access bus to provide a metallic path between the ISDN line circuit and the test equipment, such as an multiline test unit (MTU) or a #14 local test desk (LTD).

Table 9-3 describes the commands used with MTA for analog testing of ISDN lines.

Table 9-3 MTA commands

Command	Description
CAP	Makes a quick capacitance measurement without disconnecting the NT1 from the line at the U-interface.
LNTST	Connects the line test access (LTA) to a line card and performs resistance, capacitance, ac voltage tests, and dc voltage tests on the ISDN line.
LTA	Sets the test configuration to IN, OUT, or BRIDGED (for 2B1Q) and releases the LTA from the line card.
RES	Performs resistance measurements on a subscriber line.
VAC	Measures ac voltage without disconnecting the NT1 from the line at the U-interface.
VDC	Measures dc voltage without disconnecting the NT1 from the line at the U-interface.
CKTTST	Sends test messages to the line card or the terminal. The messages are looped back to the LCME.
LIT	Detects foreign potential and inadequate conductor leakage resistance on the loop.
CKTTST	Sends test messages to the line card or the terminal. The messages are looped back to the LCME.

During troubleshooting, if an electrical problem is suspected, the VAC, VDC, and RES tests can be performed collectively by using the LNTST command at the LTPLTA level of the MAP display.

For more information on these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Wideband test access cross-connect panel

The WTA cross-connect panel consists of an NT7X75AA panel or an NT7X75BA panel mounted on a miscellaneous equipment frame. The WTA is used to test wideband services such as Datapath and ISDN, as well as existing voice frequency subscriber services. Both types of WTA panels consist of an array of connectors that replace the main distribution frame (MDF) for cross-connecting the MTA cables, the test access cables to line equipment, the line test unit (LTU) or MTU (or other types of test equipment) cables, and the monitor cables (MONTALK).

The WTA panel cross-connects 30 NT3X09BA MTA cards so that they form a 3 by 10 matrix. The NT7X75BA panel is similar to the NT7X75AA panel, except that the NT7X75BA provides additional connectors for dedicated LTUs or MTUs. Figure NTT configuration for ISDN lines shows the optional use of the WTA panel. A maximum of three WTA panels can be provided in each DMS-100 office.

The WTA panel significantly reduces the overall cable length between the test equipment and the subscriber lines. Excessive cable length can affect the accuracy of test measurements, particularly for digital lines such as ISDN lines. The WTA panel is also equipped with connectors for horizontal and vertical expansion to other WTA panels.

ISDN line testing from the MAP

The ISDN 2B1Q loop access technology provides a variety of maintenance and surveillance capabilities. The layer 1 maintenance approach is based heavily on performance monitoring, and in particular, basic line monitoring (BLM). Performance monitoring, basic line monitoring, and other additional tests are available using the enhanced ISDN line testing capability from the LTPISDN level of the MAP display.

> ***Note:*** Enhanced line testing from the MAP is an option provided as part of functional group NI0 NI-1 BRI Enhanced Maintenance, NI000009.

The following loop testing capabilities are available:

- multimeter measurements
  - NT1 signature detection
  - ac resistance
- cold start capability verification
- basic line monitoring tests, which
  - detect and count block errors (BE), errored seconds (ES), and severely errored seconds (SES)
  - set thresholds for ES and SES
  - report alarms for loss of signal (LOS) without "dying gasp"
- noise measurements for impulse noise and wideband noise
- insertion loss measurement

You can run all the tests, except for the ac resistance measurement test, by entering the command TEST at the LTPISDN level of the MAP display. The system presents options so that you can select a particular test. To start the ac resistance measurement test, enter the RES command at the LTPISDN level of the MAP display.

Note: All commands are potentially service affecting.

Table 9-4 describes the commands used for enhanced line testing. All these commands, except the RES command, are options used with the TEST command at the LTPISDN level of the MAP display.

Table 9-4 Enhanced line testing commands (Sheet 1 of 2)

Command	Description
TEST	Allows layer 1 tests to be performed on a 2B1Q loop posted in the control position of the MAP. The options available with the TEST command are described below.
TEST DCSIG	Detects the presence of the NT1 using its direct current signature.
TEST COLDST	Verifies the establishment of U-sync when the 2B1Q line card and the NT1 are first connected.
TEST SCUR	Measures the sealing current of the 2B1Q loop to determine if it's within the acceptable range.

Table 9-4 Enhanced line testing commands (Sheet 2 of 2)

Command	Description
TEST DET	Verifies that basic line monitoring (BLM) is operating correctly.
TEST THR	Confirms the thresholds set for errored seconds (ES) and severely errored seconds (SES).
TEST ALM	Verifies that the DMS-100 switch can detect and report loss of signal without an NT1 "dying gasp.
TEST IMP	Measures impulse noise interference, that is, bursts or spikes much higher than the normal peaks of background noise that can degrade the transmission of digital signals over the ISDN U-loop.
TEST NSE	Measures wideband noise, that is, background noise caused primarily by near-end crosstalk.
TEST ILOSS	Performs an insertion loss measurement test that detects the presence of load coils on the loop and verifies whether the amount of loss on the loop is acceptable.
RES	Performs ac or dc resistance measurements on the subscriber line.

For more information on these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Integrated TL1 line testing

Limitations

Integrated TL1 line testing is not supported for GSF call processing.

Overview

Integrated TL1 line testing allows ISDN 2B1Q lines to be maintained using transaction language 1 (TL1) commands from an operations system (OS) over an X.25 data link. The OS is located at an operating company's maintenance operations center and is not part of the DMS-100 switch. The test system controller (TSC) is integrated with the DMS-100 switch. This architecture is more reliable and provides more capabilities than a stand-alone TSC. It also allows the OS and local user interface to use the same metallic test equipment (MTE). TL1 is an option provided as part of functional group NI0 NI-1 BRI Enhanced Maintenance for ISDN, NI000009.

Some of the line tests require an enhanced services test unit (ESTU). The tests available with ISDN TL1 line testing are also available through the enhanced ISDN line testing capability at the LTPISDN level of the MAP display.

TL1 is the command interface between the OS and the DMS-100 switch. There are four types of commands:

- TL1 protocol commands that perform the following functions:
  - initiate digital and metallic test access to the ISDN BRI line under test
  - disconnect the lines under test
  - indicate the end of a test session
  - indicate when one or more test sessions have failed
  - initialize the data link between the OS and the DMS-100 switch
  - report on the status of the data link between the OS and the DMS-100 switch
- information request commands that retrieve information from the DMS-100 switch. This information is sent as a response to the OS and includes:
  - the current state and standing condition of an ISDN line
  - the directory number and call types associated with one ISDN line
  - provisioning information associated with an ISDN line
  - performance monitoring data, such as block error rate (BER), errored seconds (ES), and severely errored seconds (SES)
- action commands that change the state of a line either by placing a line out of service for maintenance or by returning a line to service
- test commands associated with a test session number that use test resources in the DMS-100 switch and perform the following functions:
  - test the ability of the line card to synchronize to a test NT1
  - perform standard resistance, capacitance, and voltage (RCV) measurements on an ISDN BRI line
  - perform a bit error rate test on an ISDN BRI line
  - measure the amount of sealing current on the digital subscriber loop (DSL)
  - measure impulse noise (bursts or spikes) and background noise on the DSL
  - measure 2B1Q signal levels to detect load coils on the loop
  - test the ability of a specific line unit to detect and count BER, ES, and SES
  - perform an extended set of loop measurements
  - test the thresholds of a specific line unit
  - perform a diagnostic on the line card and loop

Integrated TL1 line testing commands

Table 9-5 describes the ISDN integrated line testing commands.

Table 9-5 ISDN integrated TL1 line testing commands (Sheet 1 of 3)

Command	Description
CHG-PTRST (Change port restore)	Removes any previously applied port condition, and restores the transmission and signaling pairs. The circuit under test is restored to its initial state.
CONN-DTAC-ISDN (Connect digital test access)	Initiates digital test access to the ISDN BRI line being tested, specifying either a B1, B2, or 2B+D channel, and marks the beginning of a test session.
CONN-MTAC-ISDN (Connect metallic test access)	Initiates metallic test access to the ISDN BRI line being tested and marks the beginning of a test session.
DGN-DET-TOTS (Diagnostic detail ISDNL2)	Performs diagnostic routines that determine whether a fault exists in any of the ISDN 2B1Q components (line card, NT1, loop, or D-channel path).
DISC-TACC (Disconnect test access)	Releases access to the circuit being tested, returns the circuit to its normal state, and frees any test unit currently allocated to the test session.
MEAS-LOOP-LOSS (Measure loop loss)	Performs an insertion loss measurement test that detects the presence of load coils on the loop and verifies whether the amount of loss on the loop is acceptable.
MEAS-NSE (Measure noise)	Measures wideband noise, that is, background noise caused primarily by near-end crosstalk.
MEAS-IMPNSE (Measure noise impulse)	Measures impulse noise interference, that is, bursts or spikes much higher than the normal peaks of background noise that can degrade the transmission of digital signals over the ISDN U-loop.
MEAS-SCUR-DSL (Measure sealing current DSL)	Initiates the sealing current test which measures the sealing current generated by the line card.
REPT-ALM-TST (Report alarm test)	Generated by the DMS-100 switch, indicates to the operation system (OS) that one or more test sessions has failed.
REPT-INITZN (Report initialization)	Sent from the OS to the DMS-100 switch to indicate that the OS has initialized. The DMS-100 switch disconnects all test sessions associated with the OS.

Table 9-5 ISDN integrated TL1 line testing commands (Sheet 2 of 3)

Command	Description
REPT-STAT (Report status)	Sent by the OS to the DMS-100 switch to check datalink operation. If the DMS-100 switch does not receive a message from the OS in 75 s, then the DMS-100 switch disconnects all test sessions associated with the OS.
RMV-TOTS (Remove ISDNL2)	Removes the line from an in-service state and places it in an out-of-service state so that maintenance activities can be performed.
RST-TOTS (Restore ISDNL2)	Restores the line to service, placing it back in an in-service state.
RTRV-COND-ISDNL2 (Retrieve condition ISDNL2)	Provides the current state of a line. This command may be used to query the status of a DMS-100 line by providing the line state before or after DMS-100 maintenance operations.
RTRV-DNCT (Retrieve directory number and call type)	Retrieves DN information, which is extracted from the DMS-100 tables and returned as line equipment number (LEN) information.
RTRV-PM-TOTS (Retrieve performance monitoring)	Retrieves current levels of layer 1 performance monitoring data made available through the QLAYER command at the LTPISDN MAP level.
RTRV-TRNSL (Retrieve translation)	Retrieves information about ISDN BRI circuits and allows the OS operator to determine whether the data in the DMS-100 switch matches the OS data records for the LEN.
TST-CLDSTRT (Test cold start)	Confirms the ability of the line termination (LT) to synchronize with a test NT1. This test is performed by splitting the circuit, if it is not already split, connecting a test NT1, and determining whether synchronization is possible.
TST-LPBK-ISDN (Test loopback ISDN)	Provides a digital loopback of any specified intermediate element of an MP-EOC loop except CONNT1 and initiates a bit error rate test (BERT) to either a B1, B2, or 2B+D channel. The command CONN-DTAC-ISDN must be entered before this command. This test uses the BERT facilities of the DMS-100 switch.
TST-PM (Test performance monitoring)	Tests the ability of a specific line unit to detect and count block errors (BE), errored seconds (ES), and severely errored seconds (SES) for a specific direction of transmission.

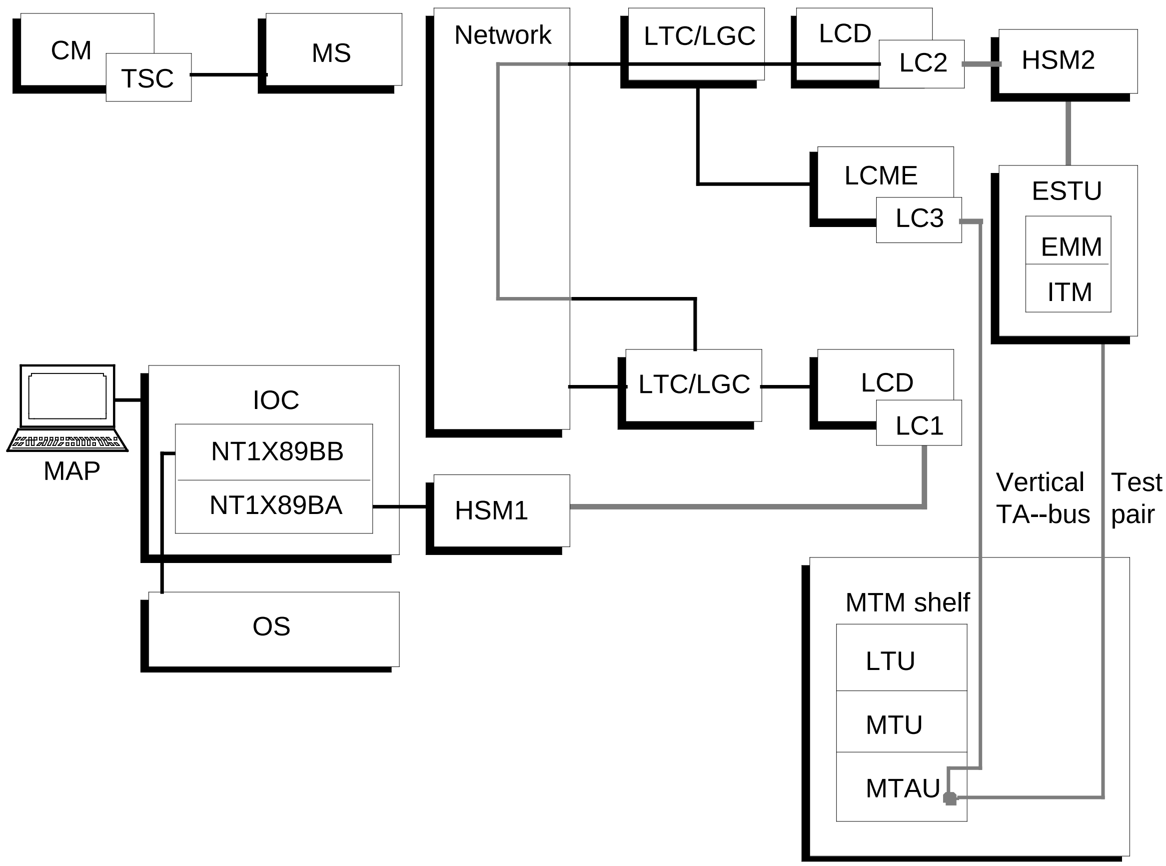
Table 9-5 ISDN integrated TL1 line testing commands (Sheet 3 of 3)

Command	Description
TST-QISDN (Test quick ISDN)	Initiates a limited set of loop measurements on an ISDN line, which include: • hazardous potential • longitudinal balance • two-terminal ac capacitance, resistances, and voltages • two-terminal dc capacitance, resistances, and voltages • NT1 dc signature • LT or LULT dc signature
TST-THRS (Test thresholds)	Tests the ability of a specific line unit to detect thresholds and to generate threshold crossing alerts for errored seconds (ES) and severely errored seconds (SES) for a specified direction of transmission.

Enhanced services test unit

The enhanced services test unit (ESTU) can perform metallic and digital line tests for ISDN services (see Figure 9-3 and 9-4). The ESTU unit, which consists of an ESTU master module (EMM) and an ESTU ISDN test module (ITM), occupies its own miscellaneous shelf space at remote or host sites instead of being integrated into the maintenance trunk module (MTM). The equipment is designed to be accessed through existing line test equipment (LTE) gates. The ESTU is required for some of the enhanced line testing capabilities.

Figure 9-3 ESTU host site configuration

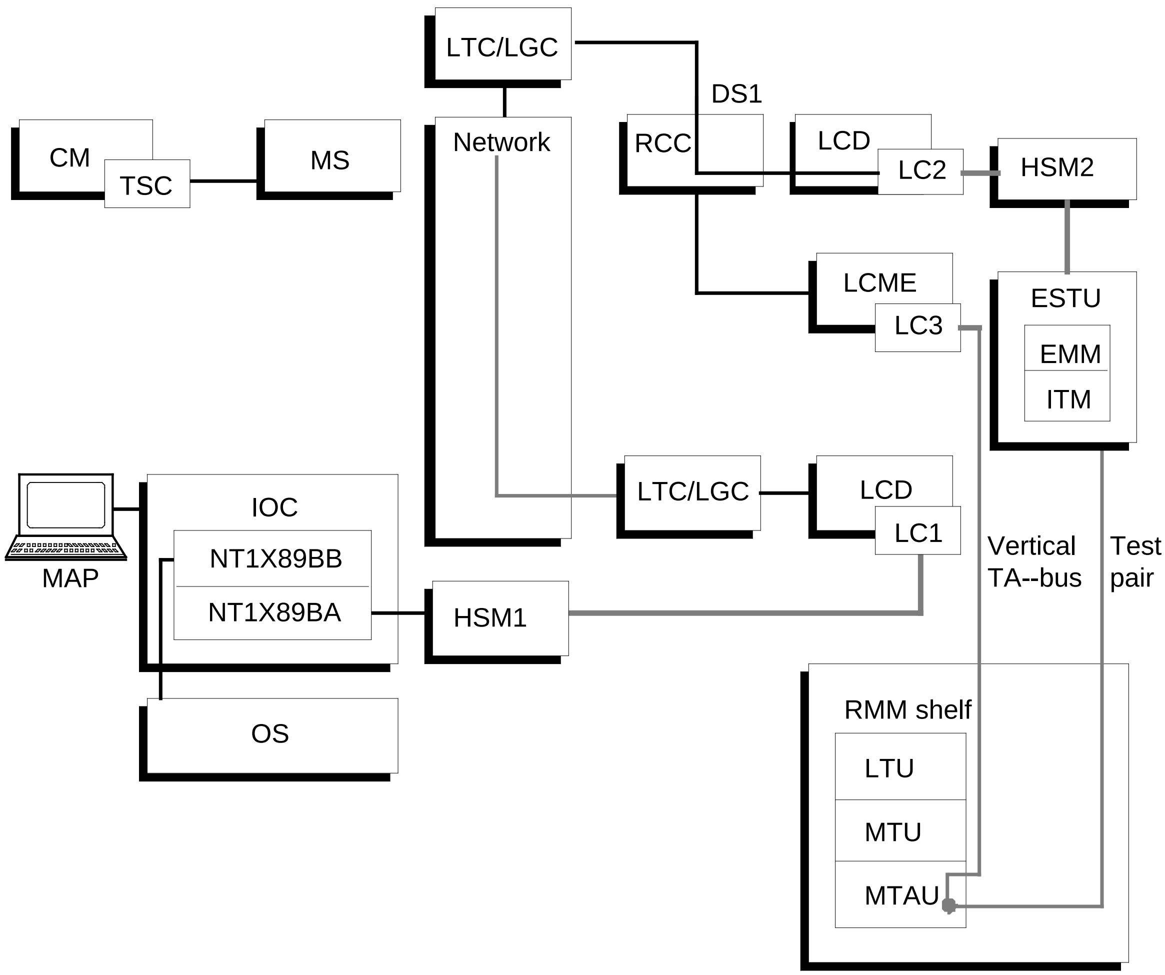


Legend:

CM	Computing module
HSM	High Speed Modem 9600 baud dataset
EMM	ESTU master module
ESTU	Enhanced services test unit
IOC	Input/output controller
ITM	ISDN test module
LC1	Line cad (for communications)
LC2	Line card for HSM interface
LC3	Line card (under test)
LCD	Line concentrating device
LCME	Enhanced ISDN line concentrating module
LGC	ISDN line group controller

LTC	ISDN line trunk controller
LTU	Line test unit
MAP	Maintenance and administration position
MS	Message switch
MTAU	Metallic test access unit
MTM	Metallic test unit
NT1X89BA/BB	Enhanced multi-protocol controller
OS	Operating system
TA-bus	Test access bus
TSC	Test system controller
———	Communications path
———	Metallic access

Figure 9-4 ESTU remote site configuration



Legend:

CM	Computing module	LTC	ISDN line trunk controller
HSM	High Speed Modem 9600 baud dataset	LTU	Line test unit
EMM	ESTU master module	MAP	Maintenance and administration position
ESTU	Enhanced services test unit	MS	Message switch
IOC	Input/output controller	MTAU	Metallic test access unit
ITM	ISDN test module	MTM	Metallic test unit
LC1	Line cad (for communications)	NT1X89BA/BB	Enhanced multi-protocol controller
LC2	Line card for HSM interface	OS	Operating system
LC3	Line card (under test)	TA-bus	Test access bus
LCD	Line concentrating device	TSC	Test system controller
LCME	Enhanced ISDN line concentrating module	———	Communications path
		——— (grey)	Metallic access
LGC	ISDN line group controller		

The Multiple Protocol Card (MPC) transmits messages to and from the ESTU at 9600 baud. Messages for the ESTU are sent by the computing module (CM) through the message switch (MS) to the input/output controller (IOC). The IOC then, through the NT1X89BB EMPC card, transfers messages to a high speed modem (HSM) dataset. A dedicated line card makes a call connection to another dedicated line card. A second HSM dataset then transmits and receives the messages to and from the ESTU.

The ESTU software performs the following procedures:

- applications requirements, including
  - selecting, reserving, opening, closing, and releasing an ESTU
  - starting and stopping tests
  - connecting and disconnecting the ESTU from the line under test
  - translating and providing test results
- maintenance requirements from the MAP to the ESTU, including
  - running diagnostics on the ESTU (TST)
  - returning the ESTU to service (RTS)
  - manually busying the ESTU (BSY)
  - placing the ESTU offline (OFFL)
  - downloading the whole ESTU system or one of the units: EMM or ITM (LOADTE)

ISDN test module (ITM)

An ESTU consists of two modules: the ESTU Master Module (EMM) and the ISDN test module (ITM). The ITM permits operating personnel to isolate a line problem to a fault. The ITM provides the same function as a captive NT1 connected at a maximum loop length of 15000 ft. The ITM connects only to the EMM and does not need a separate MTA connection.

The ESTU established a metallic connection between a test NT1 in its ITM and an ISDN 2B1Q line card. The line card's ability to synchronize with the test NT1 over the maximum loop length can be verified. For example, when a customer reports loss of synchronization, the test NT1 is connected to the customer's line card. The customer's NT1 is not working properly if this newly attached test NT1 establishes synchronization with the line card.

When an ISDN line card is first connected to an NT1, the equalizers and echo cancellers of the NT1 and line card are synchronized. A successful link between the line card and the NT1 depends on the correct operation of the line card and the NT1.

Hardware configuration

The ITM is mounted alongside the EMM in the ESTU, housed on a miscellaneous shelf space at a remote or host site. Operating personnel must datafill table TSTEQUIP for every additional ESTU that is installed.

ITM maintenance

Maintenance for the ITM can be performed as part of the ESTU to which it belongs. The ITM can be tested using the BSY, TST, and RTS commands, similar to the ESTU itself. It can also be loaded with the LoadTE command. The ESTU must be posted first. Maintenance commands on the ITM are dependent on the maintenance state of the EMM. Table 9-6 contains a brief overview of the commands used for the ESTU. The ESTU level of the MAP display is accessed from the TSTEQUIP level.

Table 9-6 ESTU commands

Command	Description
MTCNA level	
TSTEQUIP	Provides access to the TSTEQUIP level of the MAP.
TSTEQUIP level	
POST	Selects the ESTU MAP level when "ESTU" is provided as a parameter with the POST command.
DISP	Displays the number of test equipment type (ESTUs, if the ESTU option is chosen) in the specified state.
ESTU level	
POST	Posts the ESTU and displays information on the posted ESTU unit.
TST	Performs diagnostics on the posted ESTU or one of the units.
BSY	Manually busies the posted ESTU or one of the units.
RTS	Returns the posted ESTU or one of the units to service.
OFFL	Places the posted ESTU or one of the units in an offline state.
LOADTE	Downloads files to the ESTU or one of the units.

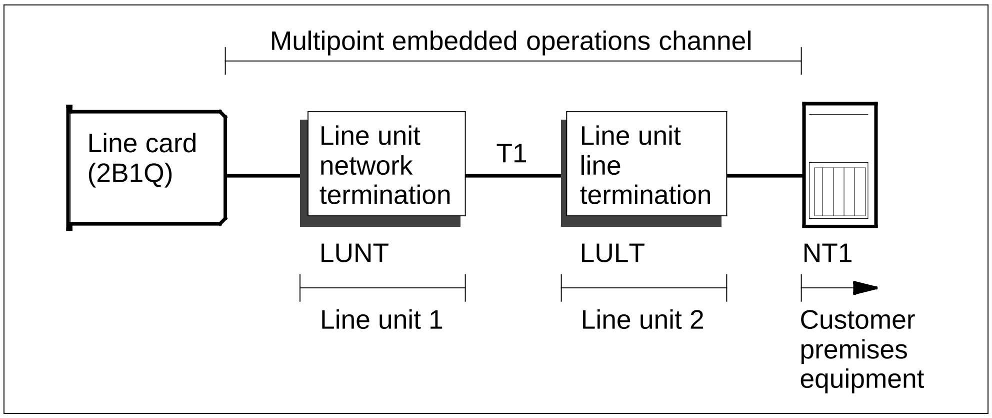
For the syntax and parameters of these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822. Also refer to the chapter "User interface" in this document.

Multipoint embedded operations channel configuration

The embedded operations channels and the control bits are contained in the M-channel. The M-channel provides the maintenance interface between the line card and the NT1.

In an MP-EOC configuration, DS-1 channel bank line units are placed on the 2B1Q loop between the line card and the NT1 (refer to Figure 9-5). A line unit network termination (LUNT) is connected on the 2B1Q line card side. The LUNT is an NT1-like line unit that transfers unaltered EOC signals from the ISDN line to the T1.

Figure 9-5 Multipoint EOC configuration



A line unit line termination (LULT) is connected on the NT1 side. The LULT transfers unaltered EOC signals from the T1 to the ISDN line. Up to eight line units or four sets (LUNT and LULT) can be provided on an ISDN 2B1Q loop. You can display the number of line units on a MP-EOC LEN by entering the QLEN command.

When you are analyzing 2B1Q loop problems, the line units provide another point from which to test continuity. A fourth loopback point, the MP-EOC interface, is available in addition to the L, LU, and T interfaces already used in bit error rate testing.

Enhanced EOC messaging allows data to be transferred between these line units and the line card. This messaging allows the DMS-100 switch to monitor the performance of an ISDN 2B1Q loop at a particular line unit, or to instruct a particular line unit to set a loopback on a specified channel.

Loopbacks on MP-EOC line units

Use the LOOPBK command to set a B1, B2, or 2B+D loopback at any one of the line units on a MP-EOC-equipped line. Use the parameter MPLU with the number of the line unit (1 to 6) to set the loopback at a particular MP-EOC unit. Only one loopback is allowed for each loop.

Display of MP-EOC line unit status

Use the SUSTATE command to display information about the MP-EOC line units. The status of each line unit for a particular LEN is displayed. If a line equipped with MP-EOC line units has a loopback set at any of the line units, this information is also displayed.

The ES per hour and the ES per day counts displayed differ depending on whether or not the 2B1Q loop is equipped with MP-EOC line units. For a 2B1Q loop without MP-EOC line units, the counts represent the errors detected by the line card on the loop between the line card and the NT1. For a 2B1Q loop with MP-EOC line units, the counts represent the errors detected by the line card and the first line unit.

Loopback facilities

Loopback facilities provide a means for creating a signal at a test generating point along a signal's path, and reflecting it back from another point, called a loopback point. By comparing the signal sent to a loopback point with the signal reflected, the source of a transmission error on the signal's path can be pinpointed. This type of procedure is known as a loopback test. Both the DMS and DPN have facilities for

- establishing loopback points along pathways used for carrying circuit-switched voice or data, and packet data
- generating either continuity tests or bit error rate tests (BERT) at various points along these pathways

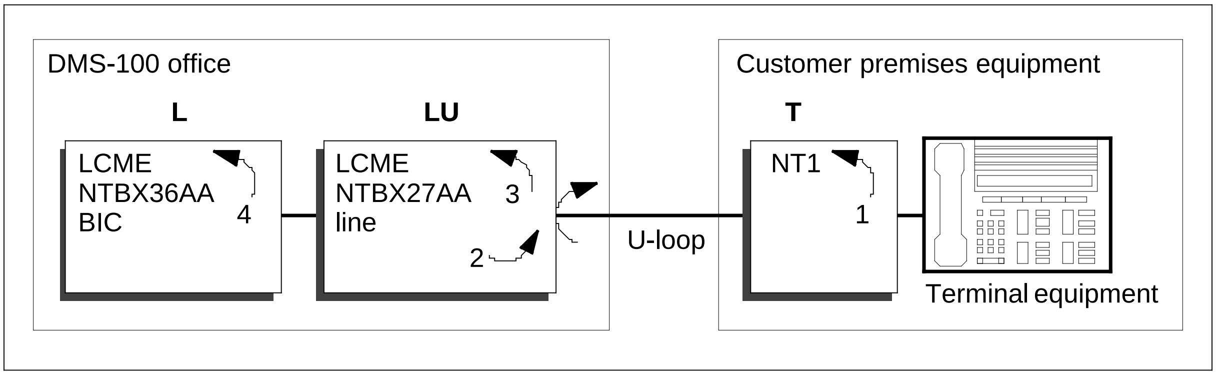
Faulty components that are a source of transmission errors can be pinpointed by operating different loopback points progressively along a pathway, then transmitting signals from the same BERT or continuity test generation point.

Loopback points for ISDN line BERT testing

To perform a BERT on an ISDN line, use the LOOPBK command to set a loopback point and then run the BERT test using the BERT command. Figure 9-6 illustrates the three loopback points used for BERT testing, which are the

- T interface
- LU interface
- L interface

Figure 9-6 2B1Q line and NT1 loopback points



> ***Note:*** A fourth loopback point is available if the 2B1Q lines are equipped with MP-EOC line units. Use a BERT to verify the low-level operation of the line to the CPE. The M5317T and M5209T sets can operate the loopback functions without any of the service profile identifiers (SPID), terminal endpoint identifiers (TEI), or DNs programmed on the set.

Use the LOOPBK command at the LTPDATA level to set, release, and query loopback points. The following sections discuss the loopback points used for ISDN 2B1Q lines and S/T-lines.

Loopback points for ISDN 2B1Q lines The following loopback points are available for 2B1Q lines (refer to figure 2B1Q line and NT1 loopback points):

- Loopback (1) toward the DMS-100 switch inside the NT1. The loopbacks provided are
  - — single B-channel loopback towards the DMS-100 switch
  - — simultaneous (full-frame) loopback of the two B-channels and the D-channel

  Use the LOOPBK T command at the LTPDATA level to operate this loopback point.
- Single channel loopback (2) towards the subscriber at the U-loop side of the ISDN 2B1Q line card.

  Use the LOOPBK LU command at the LTPDATA level, specifying the B1, B2, or 2B- and D-channel in the OUT direction, to set this loopback point.

- Loopbacks (3) toward the DMS-100 switch inside the line card. The loopbacks provided are
  - — full-frame loopback at the U-loop side of the ISDN 2B1Q line card

    Use the LOOPBK LU command at the LTPDATA level to operate this loopback point.
  - — single-channel loopback at the U-loop side of the ISDN 2B1Q line card

    Use the LOOPBK LU command at the LTPDATA level, specifying the B1, B2, or 2B- and D-channel, to operate this loopback point.
- Full-frame loopback (4) toward the DMS-100 switch at the L-interface on the bus interface card (BIC). Simultaneous loopback of the two B-channels and the D-channel is provided. Use the LOOPBK L command at the LTPDATA level to set this loopback point.

Loopback points for S/T-lines The following loopback points are available for S/T-lines (refer to Figure 9-7):

- Loopback (1) toward a terminal on an S/T-bus from the line card.
- Only a single B-channel (B1 or B2) can be looped back toward a terminal at any one time. Use the LOOPBK T command at the LTPDATA level to set this loopback point.
- Loopback (2) toward the DMS-100 switch at the IDL-interface inside the S/T-line card. Loopbacks provided are
  - — single B-channel (B1 or B2) loopback toward the DMS
  - — simultaneous (full frame) loopback of the two B-channels and the D-channel

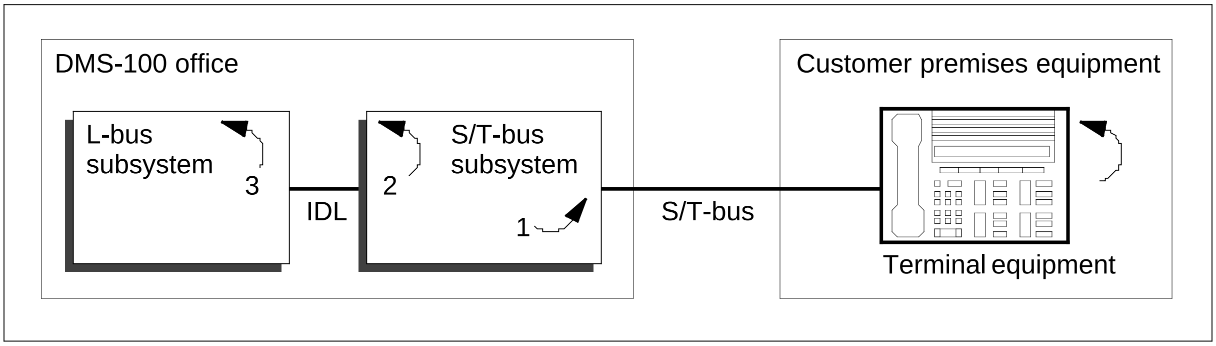
    Use the LOOPBK T command at the LTPDATA level to set this loopback point.

  Note: The LOOPBK LU command and the LU-interface are not applicable to an ISDN line on an S/T-line card.

- Loopback (3) toward the DMS-100 switch at the LCME side of the L-chip in the ISDN line card. Simultaneous (full-frame) loopback of the two B-channels and the D-channel is provided.

  Use the LOOPBK L command at the LTPDATA level to set this loopback point.

Figure 9-7 S/T line loopback points



Note: Use a BERT to verify the low-level operation of the line to the CPE. The M5317T and M5209T sets can operate the loopback functions without any of the SPIDs, TEIs, or directory numbers programmed on the set.

BERT and BERP testing

Bit error rate testing from the exchange termination tests for the data transmission quality of B-channels from the switching network to the T-interface. During the exchange termination bit error rate test (BERT), the following events occur:

- A known stream of data is sent from an integrated bit error rate tester located in the DMS-100 switch.

  Note: The integrated bit error rate tester can reside in a LCM, RLCM, or an LCME.

- Under optimal conditions, the data is looped back error-free at the T, LU, or L-interface point, and a MAP display indicates that the bit error rate (BER) is 0.
- Under less-than-optimal conditions, errored data is looped back at either the T, LU, or L-interface point, and a MAP display indicates that the bit error rate (BER) is a number other than 0.

Before running an ET BERT, set a loopback point at the T, LU, or L-interface point. When the ET BERT test is stopped, the loopback is automatically released.

Set the loopback point on the posted line by entering the LOOPBK command and the appropriate parameters. Enter the BERT command with the START parameter and channel and speed options. For more information on these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Bit error rate performance (BERP) testing assesses the bit error rate performance of the switch. It is composed of many individual bit error rate tests.

BERP testing uses a free B-channel on the ISDN line to perform a bit error rate test. A single-channel loopback is set at the T-interface while the line is being tested. If both B-channels of the line are in use, a seize failure is recorded.

Dial-up B-channel loopback testing

The dial-up B-channel loopback testing feature allows testing of B-channels from the customer's premises. This capability can be used for the following reasons:

- to allow the installer to test an ISDN line to verify the T-bus/U-loop without central office intervention
- to determine whether trouble is located in the CPE by running a BERT after a trouble report is received
- to test an ISDN line after a reported fault has been fixed

To implement a dial-up B-channel loopback, a 108 test line is used. The 108 test line is dialed from the customer's premise and a B-channel loopback is applied at the line card. The customer's loop is tested from the CPE to the line card in the central office. The test line is restricted to the same office in which the ISDN BRI line terminates.

> ***Note:*** More than one test line is known as the 108 test line. 108 test lines can be used as digital circuit loopback test lines and as dialed loopbacks on trunks. For this application, the 108 test line refers to the dialed digital loopback for ISDN BRI lines.

Call setup

In order for an ISDN 108 test line call to be set up, the following conditions must be met:

- layer 3 must be established on a CPE test line phone on the customer's loop that is being tested
- test equipment must be available to perform BERTs
- one idle B-channel must be available for call processing

The dial-up B-channel loopback testing feature uses normal call processing to set up and take down a 108 test line call. A confirmation tone indicates that the test line is available.

MAP display

"T108ISDN" is displayed as the terminating party if one or more of the LTIDs associated with a line is making a 108 test line call and the DN is displayed as “CPB.”

If the DN making the 108 test line call is datafilled with additional functional call (AFC), the MAP display is affected by the rules of AFC. For example, if the 108 test line call is the only call on the AFC DN, the state of the line would be “CPB” in inverse video, whether posted by DN or LEN. If the call was made from a BRAMFT set, then the terminating DN would display "T108ISDN." If the call was made from a BRAFS set, the terminating DN would be blank.

Call take-down

The test call is released as determined by the timeout value (the default timeout is 20 min). The call is also cleared if the call is terminated by the ISDN terminal on the customer's loop.

Restrictions

The following restrictions apply to the dial-up B-channel loopback testing feature:

- Dial-up B-channel testing is not supported for GSF call processing.
- B-channel loopbacks are supported only on LTCs and LGCs that have a unified processor (UP).
- The loopback is applied at the line card in the central office toward the customer's equipment.
- The B-channel used for loopback testing is the same channel that is used for B-channel voice calls.
- The CLLI "T108ISDN" is reserved for the ISDN 108 test line call. If it is used for any other purpose, the dial-up B-channel loopback testing feature is disabled.
- Only one loopback for each ISDN loop is allowed.

- The B-channel loopback does not work in emergency stand alone (ESA) mode.
- The ISDN 108 test line call is canceled under the following conditions:
  - when an attempt is made to return to a call put on hold on another DN on the same phone
  - when an attempt is made to make another call on another DN on the same phone
  - during a COLD restart of the computing module (CM)
  - during a RELOAD restart of the CM
  - during a COLD SWACT of the controlling XPM
  - if power is removed from the phone
  - if U-sync is lost to the NT1
  - if the call is force-released
  - if the controlling LCME is no longer providing service to the line

Performance monitoring

The various layers of the ISDN protocol are continuously monitored. This section discusses performance monitoring for the following ISDN layers:

- layer 1 (physical layer)—carries 2B+D channels
- layer 2 (data link layer)—ensures signaling and packet data integrity
- layer 3 (network layer)—carries network connection information

Layer 1 basic line monitoring for 2B1Q loops

Performance monitoring and basic line monitoring (BLM) capabilities are available through the enhanced line testing capability from the MAP display and from the operations system (OS) using the TL1 interface. The information provided by these features helps to analyze ISDN troubles by providing specific information about particular 2B1Q loops.

Two types of layer 1 BLM are supported by the 2B1Q line card:

- performance monitoring based on
  - block errors (BE)
  - errored seconds (ES)
  - severely errored seconds (SES)
- loop failure monitoring based on the following parameters:
- U-interface synchronization word status (LOSW)
- U-interface signal status (LOS)

- NT1 power supply performance (PS1 and PS2)
- NT1 test mode (NTM) indication
- loop activation (indicates data transparency between the line card and an ISDN terminal on the S/T interface)

BLM provides the following functions:

- detects changes in the parameters described above and generates appropriate logs for
  - loss of signal without "dying gasp" (LOS)
  - loss of signal with "dying gasp" (LOSDG)
  - loss of synchronization word (LOSW)
  - change of NT1 test mode (NTM)
  - change of S/T interface synchronization
- provides information in response to query requests made by maintenance personnel

Layer 1 performance monitoring

Table 9-7, "Layer 1 performance monitoring parameters" on page 9-34, lists the parameters used for layer 1 performance monitoring. Near end (NE) refers to the parameters collected for the NT1-to-line card direction of digital data transmission on the U-loop. Far end (FE) refers to the parameters collected from the opposite direction of transmission.

In normal operation, block errors (BE) are identified using a cyclical redundancy check (CRC) code embedded in the U-loop signal format. These errors are counted for the current second in each direction of transmission. The following criteria are used to determine if the second is errored or severely errored:

- errored seconds - one or more CRC violations measured in a single direction of transmission during a 1-s interval
- severely errored seconds - "s" or more CRC violations measured in a single direction of transmission during a 1-s interval. The parameter value "s" for digital subscriber lines is 3 (provisional value).

The timebase reference for these computations is a clock located in the line card and synchronized with the L-bus. When hourly and daily boundaries are crossed, the current time period values are shifted into the previous time storage period. In the case of hourly totals, data is maintained for the previous hour and the seven hours preceding the previous for ES (NE and FE).

The eight quantities with asterisks in table Layer 1 performance monitoring parameters are compared against thresholds in the line card. If a threshold crossing is detected by the line card, an autonomous message is sent to the DMS-core so that the event may be reported. This activity allows

- the setting of the four common threshold values indicated in table 9-7 for each 2B1Q loop in the office
- the setting of the common date and time reference, which controls the updating of performance monitoring parameters
- the detection of incorrect thresholds and time-of-day values on individual line cards by means of periodic line audits
- additional threshold values to be assigned for individual loops through table BLMTHRSH or the L1THRSH command from the LTPISDN level of the MAP display

Table 9-7 Layer 1 performance monitoring parameters (Sheet 1 of 2)

Parameter	Near end (NE)	Threshold common to NE and FE	Far end (FE)
Block errors (BE)	Current hour	N/A	Current hour
	Previous hour	N/A	Previous hour
Errored seconds (ES)	Current hour*	1 to 4095	Current hour*
	Current day*	1 to 16383	Current day *
	Previous hour	N/A	Previous hour
	Previous day	N/A	Previous day
Severely errored seconds (SES)	Current hour*	1 to 4095	Current hour*
	Current day*	1 to 16383	Current day *
Severely errored seconds (SES) (cont'd)	Previous hour	N/A	Previous hour
	Previous day	N/A	Previous day

Note: N/A indicates that the parameter does not have a threshold.

An asterisk (*) indicates that the parameter does have a threshold and the ranges indicated are equal to the ranges of the parameters that are sent from the DMS-core.

Table 9-7 Layer 1 performance monitoring parameters (Sheet 2 of 2)

Parameter	Near end (NE)	Threshold common to NE and FE	Far end (FE)
Errored second history	Seven most recent hours	N/A	Seven most recent hours
Common date and time reference Date: 0 to 255 Time: Hours 0 to 23 Minutes 0 to 59 Seconds 0 to 29 (units are two-second "ticks")			
Note: N/A indicates that the parameter does not have a threshold. An asterisk (*) indicates that the parameter does have a threshold and the ranges indicated are equal to the ranges of the parameters that are sent from the DMS-core.			

Performance alert handling If any of the eight parameters with thresholds meets or exceeds the threshold level on the line card, a Line 131 log is produced. The command L1BLMALM from the LTPISDN level is used to control the reporting of performance alerts. Default values for the office are set by office parameters. The following events can be set up and reported as logs:

- loss of signal without "dying gasp" (LOS)
- loss of signal with "dying gasp" (LOSDG)
- loss of synchronization word (LOSW)
- change of NT1 test mode (NTM)
- change of S/T-interface synchronization
- performance monitoring alerts

Table 9-8 describes the logs that are generated when any of the performance monitoring thresholds are exceeded.

Table 9-8 Layer 1 basic line monitoring and performance monitoring logs (Sheet 1 of 2)

Log	Description
Line 131	Generated when the errored seconds (ES) and severely errored seconds (SES) counts are exceeded for a 2B1Q loop. This log indicates which threshold was exceeded, the current ES and SES counter values, and potential service degradation. Use the QLAYER L1 command to obtain more layer 1 performance monitoring data on the loop. If necessary, use line diagnostics to isolate loop failures. ***Note:*** This log is also generated to report threshold violations for the S/T-line card.
Line 145	Reports layer 1 events for 2B1Q loops: loss of synchronization word (LOSW), loss of signal with "dying gasp" (LOSDG), and loss of signal without "dying gasp" (LOS). This log indicates disruption or recovery of communications on the U-loop. If the log specifies an LOS, then services are disrupted for reasons other than power loss to the NT1. If the log indicates an LOSDG, the U-loop failure was caused by the failure of the NT1 power supply. If the log indicates LOSW, the synchronization word exchanged between the NT1 and line card has been corrupted. In all three cases, the signal is lost at layer 1. If the log indicates a recovery of signal, this log an informational log.
Line 147	Reports changes in the NT1 test mode. This log indicates that the customer has initiated maintenance action on the NT1, and therefore service can be disrupted.
Note: The log descriptions above contain information relevant to basic line and performance monitoring only. These logs can contain additional information.	

Table 9-8 Layer 1 basic line monitoring and performance monitoring logs (Sheet 2 of 2)

Log	Description
Line 148	Reports that the layer 1 thresholds have been refreshed on the 2B1Q line card to which the given LEN applies. An audit in the DMS-core detects erroneous performance monitoring thresholds or time-of-day values on individual 2B1Q line cards. If an error is detected, the mismatching parameter is refreshed on the line card and this log is produced.
PM181	Reports failures in downloading performance monitoring data to the LCME when it is returned to service.
Note: The log descriptions above contain information relevant to basic line and performance monitoring only. These logs can contain additional information.	

Table 9-9 describes the commands used to query, reset, and change layer 1 performance monitoring and BLM thresholds.

Table 9-9 Layer 1 performance monitoring and BLM commands (Sheet 1 of 2)

Command	Description
CI level	
QCOUNTS	Queries or resets protocol and protocol abnormality counts for layer 1, layer 2, layer 3 of the X.25 and X.75 protocol.
LTPISDN level	
QLAYER	Queries layer 1 performance monitoring data and/or the layer 2 protocol abnormality data of an ISDN LEN.
RLAYER	Resets layer 1 performance monitoring data and/or the layer 2 protocol abnormality data of an ISDN LEN.

Table 9-9 Layer 1 performance monitoring and BLM commands (Sheet 2 of 2)

Command	Description
L1THRSH	Modifies or queries layer 1 performance monitoring threshold information for the posted 2B1Q loop. Thresholds are assigned to a loop as a set of four values. The four values (ES/Hr, ES/Day, SES/Hr, and SES/Day) are set in table BLMTHRSH and are assigned to the posted 2B1Q loop using a sequential index number (0 to 15). The index is an offset into table BLMTHRSH that has entries for all four parameters at the specified index number. The threshold set can be modified for a given 2B1Q loop by using L1THRSH and changing the index number.
L1BLMALM	Modifies or queries the automatic log reporting capabilities for the posted 2B1Q loop, which include • loss of signal without "dying gasp" (LOS) • loss of signal with "dying gasp" (LOSDG) • loss of synchronization word (LOSW) • change of NT1 test mode (NTM) • change of S/T interface synchronization (TSYNC) • performance monitoring alerts (PERF)

For more information on these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Layer 2 protocol abnormality monitoring

A number of DMS logs and layer 2 performance data provide monitoring for layer 2 protocol abnormalities. Layer 2 monitoring includes the following activities:

- Layer 2 transmission performance measurements—counts the number of layer 2 frames sent and received, the number of frame retransmissions, and the number of frames received with bad frame checking sequence (FCS)
- Layer 2 protocol abnormality monitoring—counts the number of layer 2 abnormalities that occur and detects high abnormality rates
- Layer 2 protocol abnormality registers—stores information about layer 2 signaling errors, which can help to determine the cause of signaling problems
- Layer 2 service disruptions monitoring—stores the count of service disruptions for a LEN and a service-disruption threshold value

The following layer 2 information is displayed when the QLAYER command is issued at the LTPISDN level of the MAP:

- the number of frames received by the LEN
- the number of frames received with errors
- the number of frames transmitted by the LEN
- the number of frames retransmitted
- the percentage of frames received with errors out of the total number of frames sent
- the percentage of frames retransmitted out of the total number of frames sent
- ten layer 2 error counts
  - disconnect mode (DM) frames received in response to set asynchronous balanced mode extended (SABME) frames
  - DM frames sent in response to SABME frames received
  - frames received that have undefined or unimplemented control fields
  - frames received that have information fields that are not permitted or supervisory or unnumbered frames of incorrect length
  - frames received that have invalid sequence numbers
  - frames that have information fields that exceed the established length
  - unexpected frames received
  - FRMR frames received
  - proper response not received to establish or reset the link, after N200 SABME sent
  - invalid frames received other than those that contain an FCS error
- the number of layer 2 service disruptions in current 24-h period
- the length of time of layer 2 service disruptions
- a flag indicating whether the LEN is currently disrupted or not

Limitations Layer 2 information is displayed by the QLAYER and RLAYER commands for GSF call processing even though layer 2 functionality is not fully supported at the MAP terminal.

Table 9-10 describes logs that generate from layer 2 abnormality monitoring.

Table 9-10 Layer 2 performance monitoring logs

Log	Description
ISDN200	Identifies up to ten faulty ISDN D-channel lines for each log, including peg counts and percentages of frames received in error and retransmitted.
ISDN201	Indicates the overall switch percentage of frames that were received in error and retransmitted. Also, identifies the number of LENs on the switch that are reporting these errors, and the number of LENs experiencing high protocol abnormality rates.
ISDN203	Identifies up to ten LENs for each log that have a high protocol abnormality rate, listing the abnormality count and the number of minutes of service disruption for each LEN. This log also lists LENs that exceed the designated threshold value for protocol abnormalities.
ISDN205	Identifies the transmission performance threshold and the transmission performance in layer 2.
ISDN306	Identifies LENs where layer 2 packet abnormality counters exceed capacity.
ISDN307	Identifies LENs where the HDLC frame processor (HFP) encounters a layer 3 packet abnormality.
ISDN308	Identifies the threshold value for service disruptions, the LEN, and the count of service disruptions.

Table 9-11 describes the commands used to query and reset layer 2 performance monitoring thresholds.

Table 9-11 Layer 2 performance monitoring commands (Sheet 1 of 2)

Command	Description
CI level	
QCOUNTS	Identifies up to ten faulty ISDN D-channel lines per log, including peg counts and percentages of frames received in error and retransmitted.
LTPISDN level	

Table 9-11 Layer 2 performance monitoring commands (Sheet 2 of 2)

Command	Description
QLAYER	Queries layer 1 performance monitoring data and/or the layer 2 protocol abnormality data of an ISDN LEN.
RLAYER	Resets layer 1 performance monitoring data and/or the layer 2 protocol abnormality data of an ISDN LEN.

TEI management

Each device connected to a BRI line is assigned a terminal endpoint identifier (TEI), which distinguishes it from other devices connected to the same BRI line. A TEI is always required as part of the data link layer address to identify a terminal.

The four TEI management procedures are

- TEI assignment—allows dynamic TEI terminals to request that the network assign a TEI value that the terminal can use to establish a layer 2 datalink
- TEI check—allows the network to check whether or not a TEI is in use and whether multiple TEI assignment has occurred
- TEI identify and verify—allows user equipment to request that the network invoke TEI check procedures
- TEI removal—allows the network to remove a previously assigned TEI value from specific equipment or from all user equipment

Various TEI management logs and commands are available to help identify problems with TEIs.

Table 9-12 describes the logs generated for TEI problems.

Limitations TEI information is displayed by the TEI and SUSTATE commands for GSF call processing even though layer 2 functionality is not fully supported at the MAP terminal.

Table 9-12 TEI management logs

Log	Description
ISDN 100	The DCH channel associated with an ISDN line cannot be put into traffic level because a terminal is unavailable for message traffic. This situation occurs when there is no terminal response to a TEI check or audit.
ISDN 102	The DCH or EDCH detected duplicated TEIs on the same ISDN line and removed the line from service.
ISDN 107	The system failed to restore the TEI.
ISDN 108	The TEI was restored by the system.
ISDN 115	A dynamic TEI assignment has exceeded the maximum allowable number of links for a specific set of TEI values. This condition causes the switch to perform a TEI audit.

Table 9-13 describes the commands used to query, check, and restore the status of a TEI.

Table 9-13 TEI management commands

Command	Description
LTPISDN level	
SUSTATE	Queries the status of the ISDN line card, NT1, or TEI.
TEI	Checks the status of the TEIs on the line or restores a TEI to service if it has been removed from service as a result of duplication.

Layer 3 performance monitoring

Layer 3, the network layer, defines the procedures for establishing, maintaining and clearing calls, and controlling access to supplementary services.

Layer 3 performance monitoring includes

- service disruption conditions on the D-channel and B-channel packet data, for each BRI line
- protocol abnormality conditions on the D-channel and B-channel packet data, for each BRI line

Limitations Layer 3 information is not supported for GSF call processing.

Table 9-14 describes logs that generate from layer 2 abnormality monitoring.

Table 9-14 Layer 3 performance monitoring logs

Log	Description
ISDN204	Identifies LENs with high abnormality and packet abnormality counts.
ISDN301	Identifies layer 3 abnormalities for voice services and abnormalities for packet data.
ISDN303	Identifies LENs where layer 3 packet abnormality counters exceed capacity.
ISDN309	Identifies the threshold value for service disruptions, the LEN, and the count of service disruptions for the LEN.

Table 9-15 lists the layer 3 performance monitoring command.

Table 9-15 Layer 3 performance monitoring command

Command	Description
CI level	
QCOUNTS	Queries or resets layer 3 protocol counts, protocol abnormality counts, service-disruption counts, and overload counts.

CPE common error codes

In addition to the available layer 1, layer 2, and layer 3 information, CPE error codes provide information that can be used to further define ISDN line problems. Although CPE maintenance is not described in this document, the list of common error codes for the M5317T and M5209T telephones in Table

9-16 are useful. The table does not contain all possible codes. For more information, see *M5209T Installation Guide*.

Table 9-16 Common error codes for M5317T and M5209T telephones

Code	Description
Error code 10	S/T-loop synchronization loss or frame loss. The U-loop can be open or faulty. Verify the U-loop and S/T-bus connection and the CPE setup.
Error code 11	The L1 transmit timer expired. Layer 1 connectivity is established. There may be S/T polarity or transposition or faulty CPE. Verify the U-loop and S/T-bus connection and CPE setup, and then run a BERT test on the CPE.
Error code 21	The voice TEI is missing. Verify the TEI type and its assignment in the datafill tables. Verify the CPE setup.
Error code 22	The data TEI is missing. Verify the TEI type and its assignment in datafill tables. Verify the CPE setup.
Error code 23	The voice and data TEI are missing. This code also appears when the DCH BRI port is out of service. Verify that the ISDN line is idle, that the TEIs are correct, and that the DCH BRI port is in service.
Error code 31	There is a voice SPID mismatch. Verify the voice SPID and the voice SPID suffix for the CPE and the datafill tables.
Error code 32	There is a data SPID mismatch. Verify the data SPID and the data SPID suffix for the CPE and the datafill tables.
Error code 90	The restricted power mode is in use. This error code appears only when the M5317TDX is used with rack mounted NT1 units operating on backup battery supply.

DCH and EDCH troubleshooting

This section describes D-channel (DCH) handler and enhanced D-channel handler (EDCH) troubleshooting.

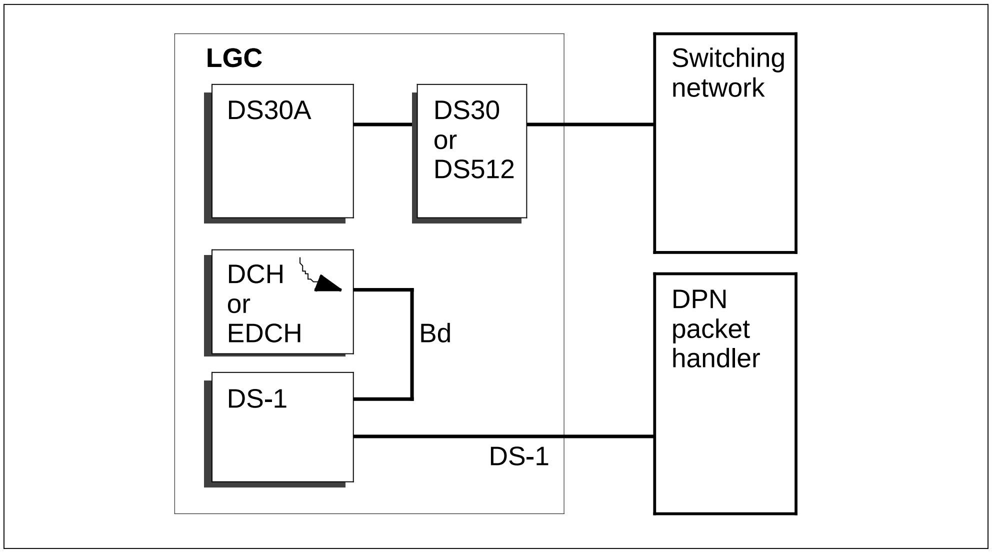
Loopback points for Bd channels

The logical loopback capability in the DCH or EDCH detects faults within and outside the DCH or EDCH for an LTID of the Bd channel. Use the LTLOOPBK command to set up a loopback point in the DCH or EDCH for the given LTID, and to query and take down the loopback (refer to Figure 9-8).

Limitations

GSF call processing supports the EDCH, but not the DCH.

Figure 9-8 DCH or EDCH loopback point



D-channel continuity test (DCHCON)

The purpose of the D-channel continuity test is to test for D-channel continuity from a DCH or EDCH card to the T-interface in an NT1. During a DCHCON test, the following events occur:

- a test signal is sent from the DCH or EDCH card that serves the posted LEN
- if continuity exists, the test signal is looped back at the T, LU, or L interface (refer to figure 2B1Q line and NT1 loopback points), and a "test passed" message appears on the MAP display
- if continuity does not exist, the test signal never reaches the loopback point and a "test failed" message appears on the MAP display

Do not set a loopback point in the DCH or EDCH. The DCHCON command automatically sets the required loopback point.

> ***Note:*** This test cannot be performed on ISDN lines equipped only with provisioned B-channel packet service because these lines do not use a DCH or EDCH.

Bd channel continuity test (CONT)

The Bd channel continuity test checks the continuity from a Bd channel to a PI port in the AM. Use CONT to run tests from

- a DCH channel toward the DS-1 card
- a DCH channel toward any loopback point set in the DPN

During a CONT test, the following events occur:

- a test signal is sent from the DCH or EDCH card that serves the Bd channel
- if continuity exists, the test signal is looped back at the PI port, the TIMPC channel, the DS-1 card, or the ISG channel, and a "test passed" message appears on the MAP display
- if continuity does not exist, the test signal never reaches the loopback point, and a "test failed" message appears on the MAP display

EDCH patches

A patch contains enhancements which can be loaded onto the switch, replacing existing software. Patches can be applied to the DCH devices by

- using the Auto-Apply process,
- reloading the peripheral with a loadset, or
- manually applying the patch using the Patcher command interpreter (CI) utility.

Auto-Apply process

The Auto-Apply process allows the user to set up the time when a patch can be applied to the DCH device automatically.

For more information on the Auto-Apply process, refer to *DMS SuperNode Patching Procedures*, 297-5001-540.

Automatic reload

A loadset is created when a patch is applied for the first time to a peripheral load. The loadset contains the name of the load and a list of patches and patch statuses that have been applied to the load. Once the EDCH is reloaded, this list is used to determine which patches should be applied.

Patching is performed after the loading of an EDCH only if a loadset is allocated for that load. The LOADPM command, invoked from the DCH level of the MAP, outputs messages that appear during the loading and patching of an EDCH.

Use the QUERYPM command, invoked from the DCH level of the MAP, to display the patch status for the posted EDCH. The QUERYPM FLT command displays an in-service trouble (ISTB) fault reason if a patch mismatch occurs.

PATCHER CI utility

The PATCHER CI utility allows the the user to apply, remove, and check patches on the EDCH. The PATCHER CI utility and the related commands now have the ability to apply patches to the enhanced DCH devices.

Restrictions Before applying a patch to an EDCH, ensure that the EDCH and the XPM containing the EDCH are not system busy (SYSB), manually busy (MANB), C-side busy (CBSY), or off-line (OFFL).

The EDCH device being patched must

- be an enhanced DCH,
- be present on a supported XPM Plus peripheral,
- contain a valid enhanced DCH load,
- and be located in a port less than port 23 on the XPM.

The PATCHER CI utility can be accessed from the CI level of the MAP by typing PATCHER. Table 9-17 contains a list of PATCHER commands.

Table 9-17 PATCHER commands for EDCH (Sheet 1 of 2)

Command	Description
APPLY	Performs the application of a patch. The patch can be applied to one or several XPM units.
REMOVE	Performs the removal of a patch. A patch can be removed from one EDCH device or a nodeset of devices.
CHECK	Verifies the validity of applying a patch.
INFORM LIST	Displays the number of EDCHs patched and the number of EDCHs eligible to be patched
INFORM LIST FULL	Displays the same information as command INFORM LIST along with the list of the EDCHs that the patch has been applied to.
INFORM PM	Displays the status of the patches being applied in a specified EDCH.
INFORM PMALL	Displays the status of patches applied to all EDCHs.
INFORM SUMMARY	Displays a summary of the patch actions over the last 24 hours.
INFORM PMLOAD	Displays a list of patchable loads in the system.
MATCH PM	Determines if there is a mismatch between the CM patch database records for a specific EDCH and the actual list of patches present in the EDCH.
Note: If a patch in the loadset fails, the remainder of the patches are not applied to the EDCH.	

Table 9-17 PATCHER commands for EDCH (Sheet 2 of 2)

Command	Description
MATCHALL XPM	Determines if there is a mismatch between the CM patch database records for all the EDCHs and the actual list of patches present in the all of the EDCHs.
NODESET ADD	Adds a single EDCH device or a range of EDCH devices to a nodeset.
Note: If a patch in the loadset fails, the remainder of the patches are not applied to the EDCH.	

For more information on applying patches, refer to *DMS SuperNode Patching Procedures*, 297-5001-540.

ISG troubleshooting

This section describes ISDN service group (ISG) troubleshooting.

Loopback test to the DS-1

To test the continuity from an ISG channel to the the DS-1 card, post the ISG number at the ISG level of the MAP to display the ISG channels. Then enter the command CONT X INT, where X is the channel number.

Do not set a loopback point inside the DS-1 card. The CONT command sets the required loopback point. For all other applicable loopback points, first set the loopback, and then enter the CONT command.

> ***Note:*** This test cannot be performed on lines that do not have packet service assigned on the D-channel.

Loopback test to the DPN

To run a continuity test from the ISG channel toward a loopback point in the DPN, set a loopback point in the DPN. Post the ISG number at the ISG level of the MAP to display the ISG channels. Then enter the command CONT X EXT, where X is the channel number.

Limitations GSF call processing does not support the DPN packet handler.

Peripheral module troubleshooting

This section describes peripheral module (PM) troubleshooting.

PERFORM tool

Customer troubles are sometimes the result of overloaded PMs. The PERFORM tool can be used to analyze the processors of a particular PM. PERFORM displays information about the processors of a posted LGC, LTC, or DTCI. The PERFORM level of the MAP display can be accessed from the PM level by posting a PM and entering the PERFORM command.

PERFORM level status display When the PERFORM level is accessed, the performance status of the posted PM is added to the PM status display. The MAP display is updated every minute. The timers are updated every 15 s, so the data collected and displayed is the average over the 15-s interval. The following display appears at all of the PERFORM levels:

```
LOAD NAME: load_name

STATUS: status  REASON: reason

LOGS: o/o  TIME: hh.mm.ss
```

The headers and variable fields are described as follows:

`load_name`
is the name of the load in the active unit of the posted XPM.

`status`
is one of the following states:

RUNNING
indicates that the process is active

START_PEND
indicates that the measurements begin when the next DMS-core minute starts

STOP_PEND
indicates that the measurements begin when the next DMS-core minute ends

STOPPED
indicates that the process is inactive

`reason`
is one of the following:

COMMAND
indicates that the command STRT has started the performance process

DCH_DROP
indicates that the process stopped because the DCH or EDCH is not InSv or IsTb

DCH or EDCH_SPARE
indicates that the process stopped because DCH or EDCH sparing has occurred

NOT_STARTED
indicates that the process has not been started

NO_STORE
indicates that the PM has no temporary store available

TIMEOUT
indicates that a PM process has timed out, causing one of the states described above

UNKNOWN
indicates that an unknown or unrecognized condition is preventing the PERFORM tool from continuing

XPM DROP
indicates that the process stopped because of a warm or cold SWACT in the PM

`o/o`

is either ON, or OFF

For ON, logs are generated when

15 min (or duration) has expired

the command STOP has been entered

a warm or cold SWACT has occurred

the time for the run has expired

For OFF, logs are generated only when a warm or cold SWACT occurs.

hh.mm.ss
denotes the hours, minutes, and seconds remaining for the countdown of the performance process. When the time expires, the process automatically stops

PERFORM level commands and responses At the PERFORM level, commands are available to access two other sub-levels, PMACT and ISGACT, and to indicate which PMs are being monitored by the performance process. The MAP levels for PMACT and ISGACT are described in the chapter 6, "User interface" on page -1

For more information on any of these commands, refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822.

DMS packet handler troubleshooting

This section describes DMS packet handler troubleshooting.

Bd-channel maintenance

The CONT command at the ISG level of the MAP is used to perform continuity tests on a Bd channel from an DCH or EDCH ISG channel through the NET and NIU to an XLIU XSG channel. It is not necessary to set a loopback point to perform this continuity test, the switch will automatically sets a loopback point on the corresponding XSG. The QUERYCH command is used to obtain ISG and XSG channel information.

B-channel maintenance

The BCHCON command at the LTPISDN level of the MAP is used to perform continuity tests on a B-channel from an XLIU XSG channel through the NET, NIU, LTC, and LCME to the T-interface of the NT1 at the customer premises.

X.75/X.75' trunk maintenance

X.75 trunks support two continuity tests: an internal and an external one. The TST X75I command at the X75TTP level of the MAP performs an internal continuity test from an XLIU to a loopback point set on a trunk PM. The TST X75E command at the X75TTP level of the MAP performs an external continuity test over an X75 trunk to a loopback point set on an XLIU at the far end office.

X.75 trunks with DMS PH PVC traffic are CPB for long periods of time; this makes them unavailable for maintenance. These trunks may be manually busied using the FRLS command but this action takes the call down.

User testing

User testing is a call origination test that operates on an ISDN BRI, where a point-to-multipoint access can support several packet-mode terminals, and multiple B channels and a D channel can support a packet-mode data bearer capability.

The capabilities of user testing allows the customer premises equipment (CPE) to place a virtual packet call on an X.25 direct access interface to its own address.

Own address capability The ISDN CPE [calling directory number (DN)] places a virtual call on an X.25 direct access interface to its own address called DN. The PHF then performs the incoming call logical channel selection, routing the call back to the originating DN. This form of loopback testing results in normal call termination treatment for the called DN.

The call can also be placed if the calling DN is configured for the Incoming Calls Barred facility.

A user test call placed on ISDN interfaces where the calling or called DN is a Hunt DN for packet-mode data is processed by the appropriate hunting algorithm and directed to the selected hunt-terminal on the ISDN terminal selected by the algorithm. The hunting algorithm can direct the call to a hunt terminal different from the ISDN interface which originated the call, or direct the call to the same interface, but a different terminal.

DPN packet handler troubleshooting

This section describes DPN packet handler troubleshooting.

Limitations

The DPN packet handler is not supported for GSF call processing.

Loopback points

Set DPN loopback points using local operator commands. The loopback points shown in Figure 9-9 are provided in the digital interworking unit (DIU) and in the access modules (AM) of the DPN switch. The loopback points are as follows:

- Loopback (1) toward the synchronous interface module (SIM) at the DIU side of a port on a peripheral interface card in the AM. All channels on the port are affected.

  At an NCS terminal connected to the AM, disable the port of the PI facing the DIU by typing

  > pin portno DISABLE

  Set the loopback point by typing

  > pino portno TEST LOOP ON

- Loopback (2) toward an AM port in the DIU.

  At an NCS terminal connected to the AM, disable a port on a SIM toward the AM by typing

  > DIU diuno simslotno portno DISABLE

  Set the loopback point by typing

  > DIU diuno simslotno portno LOOP

- Loopback (3) toward the DMS at a T1 port inside a T1 interface module (TIM) card in the DIU.

  At an NCS terminal connected to the AM, disable a port on a SIM toward the AM by typing

  > DIU diuno timslotno portno DISABLE

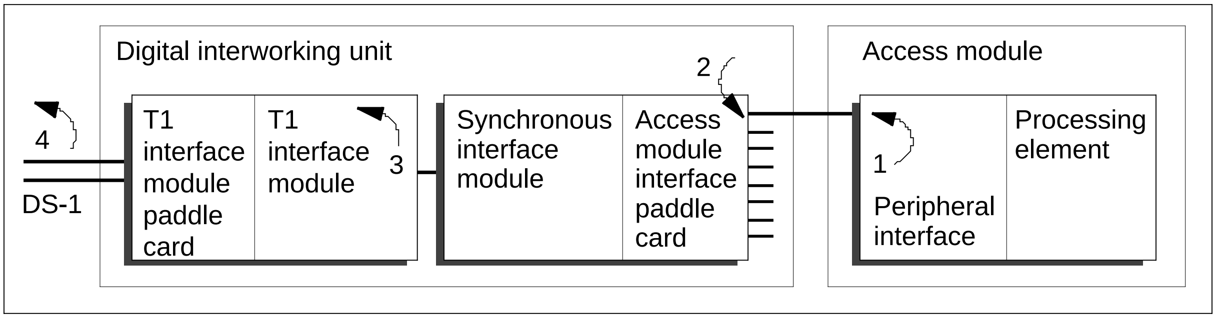
  Set the loopback point by typing

  > DIU diuno timslotno portno LOOP

- Loopback (4) toward the DMS at the entrance to the TIM of the DIU.

  Set this point manually by disconnecting the T1 cable from the DMS at the TIM and connecting a special loopback connector to the free end of the cable.

Figure 9-9 DPN loopback points



Set all the software-controlled loopback points using the operator commands at the network control system (NCS) operator console or at the AM local operator console.

Bit error rate testing

Bit error rate testing from the DPN packet handler checks the data transmission quality as follows:

- for LAPB/X.25 service, from a PE/PI port to the T-interface
- for LAPD/X.25 service, from a PE/PI port to the DCH or EDCH card

During the packet handler BERT, the following events occur:

- A known stream of data is sent from the AM through the PE/PI port of the circuit being tested.
- Under optimal conditions, the data is looped back error-free at one of the following:
  - for LAPB/X.25 service, T-, LU-, L-interface, DS-1 card, AMIPC, or PE/PI card
  - for LAPD/X.25 service, DCH or EDCH, DS-1 card, AMIPC, or PE/PI card
- Under optimal conditions, a local operator display indicates that the bit error rate (BER) is 0.
- Under less-than-optimal conditions, errored data is looped back, and a local operator display indicates that the BER is a number other than 0.

Before running a PH BERT test, set a loopback point in either the exchange termination or the packet handler.

Digital test access

Digital test access (DTA) is an option provided as part of functional group NI0 ISDN Base, NI000007. DTA is a digital monitoring method for ISDN BRI loops and Bd connections. DTA provides a refined method of accessing the subscriber loop information. Instead of using a metallic path between the subscriber line and the test equipment, access is established by replicating the digital data streams on the line.

DTA allows the following data on an ISDN BRI loop to be monitored:

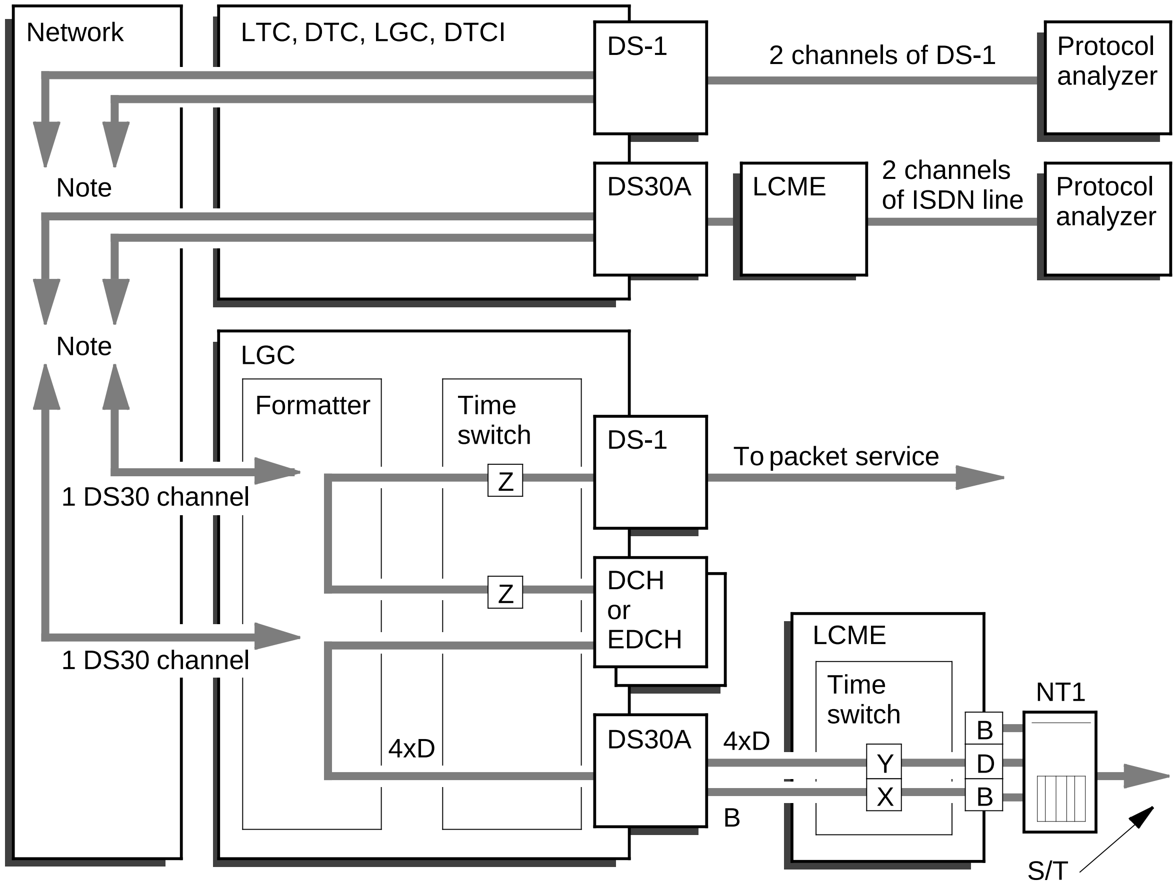
- provisioned B-channel (PB) service
- TDM D-channels
- circuit-switched B-channels
- Bd channels

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 and has no effect on the streams being monitored.

Monitoring is performed with a commercially available protocol analyzer. The monitoring point for the upstream and downstream data of the loop channels (B or D) is the timeswitch of the LCME, at the point where it connects to the line card. The monitoring point for the upstream data of the Bd channels is the timeswitch of the XPM, at the point where it connects to the DCH or EDCH. The downstream data is derived from the timeswitch at the DS-1, which interfaces to the packet handler (refer to Figure 9-10). 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
- the B1 and B2 channels of an ISDN line card

Figure 9-10 DTA access points - monitoring Bd connections



Legend:
X = DTA (B)
Y = DTA (D)
Z = DTA (Bd)

Note: DTA monitor connections are established through the network using the CONNECT command in the LTPDATAlevel of the MAP display. Connections terminate at points X, Y or Z, depending on the service being monitored.

Each loop is allowed only one DTA Bd connection at a time. However, there can be multiple taps on one Bd connection so that different loops using the same Bd connection have DTA Bd connections.

The protocol analyzer allows the D-channel for the line being monitored to be distinguished from the three other member D-channels in the TDM group. The TDM group member number (1, 2, 3, or 4) is indicated to the operating company personnel in the line data area of the MAP display. The LTPDATA level of the MAP display is used for all user interface with this feature. The DTA connection is established and can 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. In addition, it must be able to recognize the individual D-channel members from the TDM group, using the group member number presented at the MAP display. It must also be able to decode Q.921, Q.931, and X.25 protocols.

Test tools

The following section describes resident and non-resident test tools. The translation verification (TRAVER) utility is a resident utility provided for the DMS-100 switch. The following test tools are non-resident 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 verifies that BRI 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 can 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 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 functionality has been extended to include 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
- displays the ICMO line shower queue counts

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.

10 Troubleshooting chart

This chapter is a guide to integrated services digital network (ISDN) basic rate interface (BRI) maintenance procedures in this document and in other documents.

Guide to maintenance procedures in this document

This section lists ISDN BRI maintenance procedures in this document.

Troubleshooting by symptom

Table 10-1 lists and describes typical ISDN BRI trouble symptoms and indicates the action to be taken.

Table 10-1 Troubleshooting by symptom (Sheet 1 of 3)

Trouble	Description	Action
No dial tone	Fault in NT1 or ISDN terminal, no datafill or incorrect datafill, overloaded DMS-100 switch, overloaded or faulty LGC, or DCH or EDCH, speech and message links not available, loss of U-sync, problems with translations	Perform the “No dial tone” procedure module , "Troubleshooting B-channel circuit-switched voice" on page -22 .
Call cut off while talking	CPE or NT1 power failure, faulty line card, line drawer or LCME, loss of U-sync, network problems, problems with carrier/trunks	Perform the “Call cut while talking” procedure module , "Troubleshotting B-channel circuit-switched voice" on page -24.
Note: Generic services framework (GSF) call processing does not support the DPN packet handler or the DCH.		

Table 10-1 Troubleshooting by symptom (Sheet 2 of 3)

Trouble	Description	Action
Noise	Faulty ISDN terminal, defective battery, faulty line card, line drawer or LCME, network problems, defective PM, speech/message links not available or defective, problems with carrier/trunks	Perform the “Noise” procedure module , "Troubleshooting B-channel circuit-switched voice" on page -26
Delay in getting dial tone	DMS overload, PM, or DCH or EDCH overload, P-side or C-side links down or defective	Perform the “Delay in getting dial tone” procedure module , "Troubleshooting B-channel circuit-switched voice" on page -28.
Call routed to treatment	Fault in ISDN terminal, problems with features or translations, faulty line card, line drawer or LCME	Perform the “Call routed to treatment” procedure module , "Troubleshooting B-channel circuit-switched voice" on page -29.
Phone never rings	Fault in NT1 or ISDN terminal, terminal not connected to ISDN line, no datafill or incorrect datafill, loss of U-sync, problems with features, faulty line, line card, LCME, LGC, DCH, or EDCH	Perform the “Phone never rings” procedure module , "Troubleshooting B-channel circuit-switch voice" on page -20
Common voice service problems	Phone never rings, no dial tone, call cut while talking, noise, delay in getting dial tone, call routed to treatment, tones, or wrong destination	Perform the “Common voice service problems” procedure module , "Troubleshooting B-channel circuit switched voice" on page -18.
No data service (Provisioned B-channel, line-to-DPN)	Fault in NT1 or ISDN terminal, fault in B-channel path through DMS-100 switch (faulty LCME or LGC, faulty DS30A, DS30 link, or DS-1 link), problems with SPECCONN connections, network or datalink layer problems, hardware or software failures in DPN	Perform the procedure module , "Troubleshooting B-channel packet, ISDN line-to-DPN" on page -14
Note: Generic services framework (GSF) call processing does not support the DPN packet handler or the DCH.		

Table 10-1 Troubleshooting by symptom (Sheet 3 of 3)

Trouble	Description	Action
No data service (Provisioned B-channel, line-to-line)	Fault in NT1 or ISDN terminal, fault in B-channel path through DMS-100 switch (faulty LCME or LGC, faulty DS30A), problems with datafill	Perform the procedure module , "Troubleshooting B-channel data between ISDN lines" on page -12
No data service (Circuit switched B-channel service)	Fault in NT1 or ISDN terminal, fault in B-channel path through DMS-100 switch (faulty LCME or LGC, faulty DS30A or DS30 link), problems with datafill	Perform the procedure module , "Troubleshooting B-channel circuit-switched data" on page -9.
No data service, D-channel errors (D-channel packet service)	Fault in NT1 or ISDN terminal, fault in D-channel path through DMS-100 switch (faulty LCME, LGC, DCH or EDCH, ISG or faulty DS30A, DS30, DS-1 link), network or datalink layer problems, hardware or software failures in DPN	Perform the procedure module , "Troubleshooting DPN PH D-channel packet service" on page -2.
Note: Generic services framework (GSF) call processing does not support the DPN packet handler or the DCH.		

Guide to maintenance procedures in other documents

This section lists ISDN BRI line trouble and peripheral module trouble, and indicates the corresponding maintenance procedures in other documents.

Line maintenance procedures

Table 10-2 lists ISDN BRI line maintenance procedures in other documents.

Table 10-2 Line maintenance procedures (Sheet 1 of 2)

Trouble	Procedure
Line state is CPB	Perform Line state is Call processing busy (CPB) in *Trouble Locating and Clearing Procedures*.
Line state is CUT	Perform Line state is Cut (CUT) in *Trouble Locating and Clearing Procedures*.
Line state is DMB	Perform Line state is D-channel maintenance busy (DMB) in *Trouble Locating and Clearing Procedures*.
Line state is IDL	Perform Line state is Idle (IDL) in *Trouble Locating and Clearing Procedures*.

Table 10-2 Line maintenance procedures (Sheet 2 of 2)

Trouble	Procedure
Line state is INB	Perform Line state is Installation busy (INB) in *Trouble Locating and Clearing Procedures*.
Line state is LMB	Perform Line state is Line module busy (LMB) in *Trouble Locating and Clearing Procedures*.
Line state is Lock out (LO)	Perform Line state is Lock out (LO) in *Trouble Locating and Clearing Procedures*.
Line state is MB	Perform Line state is Manual busy (MB) in *Trouble Locating and Clearing Procedures*.
Line state is PSU	Perform Line state is PSU in *Trouble Locating and Clearing Procedures*.

Line state faults for IDL and LO

Troubleshoot lines in the LO or IDL states using appropriate procedures located in the *Trouble Locating and Clearing Procedures*. Table 10-3 lists the possible faults that appear in the form of a MAP response as a result of failed diagnostics for IDL and LO lines.

For more information on the different diagnostic tests and line relays, refer to chapter 9, "Troubleshooting" on page -1.

Table 10-3 Diagnostic test failure responses (Sheet 1 of 6)

MAP response	Description	Action
Card occupancy test		
No card present in slot.	Card not present in drawer.	Insert line card (LC) if missing. Test LC.
Card occupancy fault. Insert card.	LC can be faulty.	Test LC, and replace if the test fails again.
PUPS power test		
PUPS failure detected.	The PUPS power supply in the drawer is faulty.	Clear any LCME fuse or power alarm using the appropriate procedure located in the *Alarm and Performance Monitoring Procedures*. If no alarm exists, replace the PUPS card.
DR stuck test		
line card DR bit is stuck.	LC can be faulty.	Test LC again. Replace LC if the test fails again.

Table 10-3 Diagnostic test failure responses (Sheet 2 of 6)

MAP response	Description	Action
Line card context restore test		
Communication failed to line card.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
The relays did not release.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
LC L loopback did not release.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
LC LU loopback did not release.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
Self test		
Self test failed.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
LCD retransmit failed.	Communication error or fault with the drawer.	Wait one minute, then repeat the test. If error persists, check if the LCME is overloaded or is faulty. To clear any faults, perform the appropriate procedure located in the *Trouble Locating and Clearing Procedures*. If no faults exist, repeat the test on the LC. Replace the LC if the test fails again.
BF stuck test		
line card BF bit is stuck.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.
Relay test		
TEST_IN relay did not release.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_IN relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_OUT relay did not release.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_OUT relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
CO relay did not release.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
CO relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.

Table 10-3 Diagnostic test failure responses (Sheet 3 of 6)

MAP response	Description	Action
At least one relay failed.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
LCD retransmit failed.	Communication error or fault with the drawer.	Wait one minute, then repeat the test. If error persists, check if the LCME is overloaded or is faulty. To clear any faults, perform the appropriate procedure located in the *Trouble Locating and Clearing Procedures*. If no faults exist, repeat the test on the LC. Replace the LC if the test fails again.
TEST_OUT, CO, and TEST_IN relays were released.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
Sealing current test		
TEST_OUT relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_IN relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_IN relay did not release.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
Sealing current generator fault.	Sealing current measured outside acceptable range.	Clear any LCME fuse or power alarms using the appropriate procedure in the *Alarm and Performance Monitoring Procedures*. If no alarm exists, repeat the test on the LC. replace the LC if the test fails again.
Continuity test (L)		
DCH continuity failed: L interface	There could be a fault with the DCH.	Use the CKTLOC command to check the DCH status and the LC and DCH path. If status and path are okay, test the LC. Replace the LC if the test fails again.
Failed to set 2B+D Loopback: L interface	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
Continuity test (LU)		
DCH continuity failed: LU interface	There could be a fault with the LC.	Use the CKTLOC command to check the DCH status and the LC and DCH path. If status and path are okay, test the LC. Replace the LC if the test fails again.

Table 10-3 Diagnostic test failure responses (Sheet 4 of 6)

MAP response	Description	Action
Failed to set 2B+D Loopback: LU interface	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
DC signature test		
TEST_OUT relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TEST_OUT relay did not release.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
TA or CO relay did not operate.	LC can be faulty.	Test LC again. Replace the LC if the test fails again.
NT1 not present.	There could be a fault with the loop or NT1. Range for ordinary loop, which is from 300 to 4000 ohms has been surpassed. Range for multi-point extended loop, which is 100,000 to 140,000 ohms has been surpassed.	Use SUSTATE command to verify the status of the NT1. Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
Resistance xxx ohms	Problem with the loop or NT1.	Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
NT1 restore test		
Communication failed to NT1.	There could be a fault with the NT1.	Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
Status test (NT1)		
LCD is overloaded.	Heavy traffic on LCD.	Clear any PM alarms using the appropriate procedure located in the *Alarm and Performance Monitoring Procedures*.
LCD is not in service.	LCD is busy.	Clear any PM alarms using the appropriate procedure located in the *Alarm and Performance Monitoring Procedures*.

Table 10-3 Diagnostic test failure responses (Sheet 5 of 6)

MAP response	Description	Action
LCD is in mateload.	LCD is mateload.	Wait 5 minutes for mateload to complete, then repeat the test.
NT1 B1 loopback did not release.	There could be a fault with the NT1.	Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
Customer-initiated maintenance	The NT1 has been placed into test mode by the customer.	Retest after the customer test is completed.
S/T interface not active	No sync on the S/T loop.	Verify that at least one terminal is wired and powered up on the loop before checking the NT1.
NT1 B2 loopback did not release.	There could be a fault with the NT1.	Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
NT1 2B+D loopback did not release.	There could be a fault with the NT1.	Run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
Continuity test (T)		
DCH continuity failed: T interface	There could be a fault with the NT1.	Use the SUSTATE command to check the NT1 status and the LC and loop path. If status and path are fine, test the LC. If fault still persists, run the DIAG command with the FULL option. Check NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
NEBE test		
NEBE detection test failed.	LC can be faulty.	Ensure LC is properly seated. Test the LC. Replace the LC if test fails again.
FEBE test		
FEBE detection test failed.	There could be a fault with the NT1.	Run the DIAG command with the FULL option. Check the NT1 if only NT1 errors are present. Clear any other errors before checking on the NT1.
Error register query test		

Table 10-3 Diagnostic test failure responses (Sheet 6 of 6)

MAP response	Description	Action
LCD retransmit failed.	The drawer could be faulty or there could be a communication error.	Wait one minute then repeat the test. If error persists, check if the LCME is overloaded or is faulty. To clear any faults, perform the appropriate procedure located in the *Trouble Locating and Clearing Procedures*. If no faults exist, repeat the test on the LC. Replace the LC if the test fails again.
U loop test		
TA relay did not operate.	LC can be faulty.	Test the LC. Replace the LC if the test fails again.

Peripheral module maintenance procedures

Table 10-4 lists ISDN BRI peripheral module maintenance procedures in other documents.

Table 10-4 Peripheral module maintenance procedures (Sheet 1 of 2)

Trouble	Procedure
PM DCH alarm	Perform the PM DCH, Major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM LCME alarm	Perform the PM LCME, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM LGC alarm	Perform the PM LGC, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM LIM alarm	Perform the PM LIM, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM LIMF alarm	Perform the PM LIMF, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM LTC alarm	Perform the PM LTC, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM NIU alarm	Perform the PM NIU, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
PM XLIU alarm	Perform the PM LIU7, Critical, major or minor procedure in *Alarm and Performance Monitoring Procedures*.
XLIU needs to be loaded	Perform the Downloading software to an XLIU in *Routine Procedures*.

Table 10-4 Peripheral module maintenance procedures (Sheet 2 of 2)

Trouble	Procedure
XLIU image needs to be saved	Perform the Recording an EIU/FRIU/XLIU image on an SLM disk in *Routine Procedures*.
XLIU needs to be tested	Perform the Testing an XLIU in *Routine Procedures*.
need to move an XSG to a spare XLIU	Perform the Moving an XSG to a spare XLIU in *Routine Procedures*.

11 Advanced troubleshooting procedures

This chapter contains advanced troubleshooting procedures that are referenced from the troubleshooting table in chapter 10, "Troubleshooting chart."

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

Troubleshooting DPN PH D-channel packet service

Application

Use this procedure to determine the cause of problems with DPN packet handler D-channel packet service.

Definition

DPN PH D-channel packet service failures can be caused by one of the following problems:

- fault in the NT1 or in the ISDN terminal
- incorrect or mismatched X.25 parameters
- fault in the D-channel path through the DMS-100 switch caused by
  - faulty ISDN line: line in a state other than IDL, duplicate TEIs or TEI not present
  - faulty LCME, line drawer, or line card
  - faulty DS30A links or DS30A card
  - faulty LGC
  - faulty DCH or EDCH: overloaded, DCH or EDCH hardware or software failure
  - faulty ISG: ISG channel in a state other than InSv, incorrect datafill (problems with SPECCONN connections between Bd channel on DCH or EDCH and the DS-1 link)
  - faulty DS-1 card or link
- network or data link layer problems
- hardware or software failures in DPN

Limitations

The DPN packet handler is not supported for generic services framework (GSF) call processing.

Troubleshooting DPN PH D-channel packet service

> **CAUTION**
> **Loss of service**
> Perform this step only during a low-traffic period because it removes all terminals on the line from service.

Troubleshooting DPN PH D-channel packet service (continued)

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 42

2 Examine the alarm log at the NCS console.

If there are	Do
alarms	Step 3
no alarms	Step 4

3 Use *DPN Alarm Console Indications* to clear the alarm and return to this point.

Go to Step 40.

4 Failures generally fall into one of two categories:

- a data link layer protocol failure, such as the inability to set up a logical link
- a network layer protocol failure, such as the inability to set up a virtual call or a data transfer problem

If the problem is	Do
a network layer problem	Step 5
a data link layer problem or, if you are not sure of the layer the problem is associated with	Step 6

5 Run interactive tests from NCS console of the DPN and return to this point. Go to Step 40.

6 Determine if all data links associated with the D-channel are faulty or if only one of the links is faulty by inputting the following command at an NCS console:

`>pino portno DISPLAY`

If all data links are	Do
affected	Step 7
not affected	Step 23

Troubleshooting DPN PH D-channel packet service (continued)

Verify the DPN switch

7 Verify the status of the port in the AM used for this B-channel.

If the status is	Do
correct	Step 8
not correct	Step 9

8 Verify the status of the DIU.

If the status is	Do
correct, the problem is probably not in the DPN	Step 11
not correct	Step 9

9 Verify the service parameters of the DPN.

If the service parameters are	Do
correct	Step 41
not correct	Step 10

10 Correct the service parameters and then go to Step 40.

Verify the DMS switch

11 Verify whether alarms are displayed under the PM or LNS maintenance subsystem header on the MAP.

If alarms are	Do
displayed	Step 13
not displayed	Step 12

12 Use the LOGUTIL software to scan through the logs and search for the following state changes:

- logs showing a state change of the LGC or LCME through which the D-channel passes
- logs showing a state change of the LEN associated with the ISDN line
- logs showing a state change of the DS-1 link carrying the Bd channel

Troubleshooting DPN PH D-channel packet service (continued)

- logs showing a state change of the Bd channel
- logs showing a state change of the DCH or EDCH, or the occurrence of a DCH or EDCH card takeover by the assigned spare

If logs	Do
exist	Step 15
do not exist	Step 14

13 Clear the alarms using the *Alarm and Performance Monitoring Procedures*.

Return to this point and go to Step 40.

At the CARRIER level of the MAP display

14 Verify the status of the DS-1 link carrying the D-channel to the DPN. If the link is faulty, all other services using that same DS-1 link should also be faulty. A carrier fault should also be indicated at the DPN.

If the carrier is	Do
InSv	Step 16
not InSv	Step 17

15 Use MAP commands to test suspect components. Replace components as required, then return them to service. Go to Step 40.

16 Post the DCH or EDCH card at the DCH level of the MAP display and determine if the card is InSv. If the status is SysB, a reason is displayed. If the DCH or EDCH has a status other than InSV, an alarm can be displayed on the MAP.

If there is	Do
an alarm	Step 19
no alarm	Step 18

17 Use information in *Trouble Locating and Clearing Procedures* to troubleshoot the carrier.

Return to this point and go to Step 40.

18 Post the ISG number at the ISG level of the MAP display. Check that the state of the ISG channels on the DCH or EDCH is InSv.

If the Bd channel path to the DPN	Do
does not have a status of InSv	Step 20
has a status of InSv	Step 21

19 Use the information in *Alarm and Performance Monitoring Procedures*, to fix the alarm.

Troubleshooting DPN PH D-channel packet service (continued)

Return to this point and go to Step 40.

20 The reason the path is not InSv could be one of the following:

- Table SPECCONN connections between the Bd channel on the DCH or EDCH (DCHCHNL) and the DS-1 link to the DPN are incorrect. Use the table editor and verity table SPECCONN to verify connection information.
- The DCH or EDCH card may have failed. Use MAP commands to test the card and replace it if necessary.
- The DS-1 link may not be in service. Go to Step 14.

21 Set loopbacks sequentially starting at the DMS-100 switch and run loopback tests to ensure that the D-channel path from the DMS-100 switch to the DPN is continuous. Go to Step 22.

22 Set loopbacks sequentially starting at the DPN and run loopback tests in the opposite direction to ensure that the D-channel path is continuous from the DPN to the DMS-100 switch. Go to Step 40.

23 Check logs for an indication that the ISDN line associated with the D-channel has changed from an IDL state to a different state. The log reports most likely to indicate this change of state are ISDN101 and ISDN103.

If a change of status has	Do
occurred	Step 38
not occurred	Step 24

24 Check logs for the presence of an ISDN102 log indicating that the line has been removed from service due to duplication of TEIs on an ISDN line.

If an ISDN102 log is	Do
found	Step 39
not found	Step 25

Verify the D-channel path through the DPN

25 Use commands at the NCS console to verify service data for the D-channel path through the DIU to the port on the access module.

If the data is	Do
correct	Step 27
not correct	Step 26

26 Correct the data and go to Step 27.

Troubleshooting DPN PH D-channel packet service (continued)

Verify the D-channel path through the DMS-100 switch

27 Verify the information datafilled in the DMS-100 switch by means of the Query commands.

If the information is	Do
correct	Step 28
not correct	Step 33

28 Post the ISDN line associated with the D-channel by LEN at the LTP level of the MAP display and verify the status of the line.

If the status is	Do
IDL	Step 29
not IDL	Step 34

29 Input the TEI command with the CHECK parameter at the LTP level of the MAP display to verify that a TEI is present for the terminal experiencing difficulty.

If the TEI is	Do
present	Step 30
not present or is incorrect	Step 35

Verify the D-channel path from the ISDN line card to the DPN

30 Create a loopback at the L-interface using the LOOPBK command at the LTPDATA level of the MAP display. Go to step 31

31 Create a data link over this loopback by inputting commands at an NCS console of the DPN. Go toStep 33

32 A response indicating that a data link layer frame has been transmitted to the line card and returned successfully should be displayed on the NCS console.

If a response is	Do
not displayed	Step 36
displayed	Step 37

33 Correct the datafill information and then go to Step 40.

34 Use MAP commands to localize the faulty component. Replace components as necessary. Go to Step 40.

35 If the TEI is absent, the ISDN terminal of the user experiencing the problem is faulty. Try reprogramming the TEI into the terminal. If this does not solve the problem, replace the terminal. Go to Step 40.

Note: The presence of a TEI does not guarantee that the correct terminal is connected to the loop.

Troubleshooting DPN PH D-channel packet service (end)

36 Set loopbacks sequentially starting at the DCH or EDCH, and run loopback tests from the DPN to isolate the faulty component. Go to Step 40.

37 Verify the operation of the ISDN terminal and then go to Step 40.

38 Use the MAP commands to post the ISDN line associated with the D-channel. Test the NT1 and the U-loop, if a U-line card is used, and the S/T-bus and the line card to find faulty components. Replace the faulty components as necessary. Go to Step 40.

39 Disconnect both terminals with duplicated TEIs from the ISDN line. Restore the line to service by inputting the TEI RESTORE command. Go to Step 40.

40 Review the results of the procedure just performed.

If the problem	Do
still exists	Step 41
no longer exists	Step 42

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

42 You have completed this procedure.

Troubleshooting B-channel circuit-switched data

Application

Use this procedure to troubleshoot problems with B-channel circuit-switched data service.

Definition

Customers can experience problems with B-channel circuit-switched data service for one of the following reasons:

- fault in the NT1 or in the ISDN terminal
- fault in the B-channel path through the DMS-100 switch caused by
  - faulty ISDN line: line in a state other than IDL, duplicate TEIs or TEI not present
  - faulty LCME, line drawer, or line card
  - faulty DS30A links or DS30A card
  - faulty LGC
- problems with datafill, for example, incompatible bearer capability

Troubleshooting B-channel circuit-switched data

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 14

2 Verify if alarms are displayed under the PM or LNS maintenance subsystem headers on the MAP display.

If alarms are	Do
not displayed	Step 3
displayed	Step 4

Troubleshooting B-channel circuit-switched data (continued)

3 Use LOGUTIL software to scan through DMS logs and search for the following conditions:

- logs showing a status change of the LGC or LCME through which the B-channel passes
- logs showing a state change of the LEN associated with the ISDN line

If logs	Do
do not exist	Step 5
exist	Step 6

4 Clear the alarms using the *Alarm and Performance Monitoring Procedures*.

Return to this point and go to Step 12.

5 Use the query commands available in the Query subsystem to verify that datafill information is correct.

If the datafill is	Do
correct	Step 7
not correct	Step 8

6 Use MAP commands to test suspect components. Replace any components as required, then return them to service. Go to Step 12.

7 Post the ISDN line by LEN at the LTP level of the MAP display to obtain the status of the line.

If the line is	Do
faulty	Step 9
not faulty	Step 10

8 Correct datafill information and go to Step 12.

9 Set loopbacks sequentially. Start at the NT1, if the U-line card is used. If not, start at the S/T-line card. Run loopback tests. Go to Step 12.

10 Verify the B-channel path to the second NT1 or S/T-line card. Use the BERT command at the LTPDATA level of the MAP display to check data transmission quality on the two paths. Go to Step 11.

11 Verify the operation of the ISDN terminals and then go to Step 12.

12 Review the results of the procedure just performed.

If the problem	Do
still exists	Step 13
no longer exists	Step 14

Troubleshooting B-channel circuit-switched data (end)

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

14 You have completed this procedure.

Troubleshooting B-channel data between ISDN lines

Application

Use this procedure to troubleshoot problems with provisioned B-channel data service between ISDN lines.

Definition

Customers can experience problems with B-channel data service between ISDN lines for one of the following reasons:

- fault in the NT1 or in the ISDN terminal
- fault in the B-channel path through the DMS-100 switch caused by
  - — faulty ISDN line: line in a state other than IDL, duplicate TEIs, or TEI not present
  - — faulty LCME, line drawer, or line card
  - — faulty DS30A links or DS30A card
- fault in the LGC
- problems with datafill

Troubleshooting B-channel data between ISDN lines

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 14

2 Verify whether alarms are displayed under the PM or LNS maintenance subsystem headers on the MAP.

If alarms are	Do
displayed	Step 4
not displayed	Step 3

Troubleshooting B-channel data between ISDN lines (end)

3 Use LOGUTIL software to scan through DMS logs and search for the following conditions:

- logs showing a status change of the LGC or LCME through which the B-channel passes

logs showing a state change of the LEN associated with the ISDN line

If logs	Do
exist	Step 6
do not exist	Step 5

4 Clear the alarms using *Alarm and Performance Monitoring Procedures*.

Return to this point and go to Step 12.

5 Use the query commands (QDN, QLEN) available in the Query subsystem to verify that datafill information is correct.

If the datafill information is	Do
not correct	Step 8
correct	Step 6

6 Use MAP commands to test suspect components. Replace any as required, then return them to service. Go to Step 12.

7 Post the ISDN line by LEN or DN at the LTP level of the MAP to obtain the status of the line.

If the line is	Do
faulty	Step 9
not faulty	Step 10

8 Correct datafill information and go to Step 12.

9 Set loopbacks sequentially. Start at the NT1, if the U-line card is used. If not, start at the S/T-line card. Run loopback tests. Go to Step 12.

10 Verify the B-channel path to the second NT1, if provided. Go to Step 11.

11 Verify the operation of the ISDN terminals and then go to Step 12.

12 Review the results of the procedure just performed.

If the problem	Do
still exists	Step 13
no longer exists	Step 14

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

14 You have completed this procedure.

Troubleshooting B-channel packet, ISDN line-to-DPN

Application

Use this procedure to determine the cause of problems with B-channel packet service from an ISDN line to the DPN.

Definition

Customers can experience problems with B-channel packet service between an ISDN line and the DPN for one of the following reasons:

- fault in the NT1 or in the ISDN terminal
- fault in the B-channel path through the DMS-100 switch caused by
  - — faulty ISDN line: line in a state other than IDL, duplicate TEIs, or TEI not present
  - — faulty LCME, line drawer, or line card
  - — faulty DS30A links or DS30A card
  - — faulty LGC
  - — faulty DS-1 card or link
- problems with SPECCONN connections - DMS endpoint or DPN endpoint
- network or datalink layer problems
- hardware or software failures in DPN

Limitations

The DPN packet handler is not supported for generic services framework (GSF) call processing.

Troubleshooting B-channel packet, ISDN line-to-DPN

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 24

2 Examine the alarm log at the NCS console.

If alarms are	Do
displayed	Step 3

Troubleshooting B-channel packet, ISDN line-to-DPN (continued)

If alarms are	Do
not displayed	Step 4

3 Use *DPN Alarm Console Indications* to clear the alarm.

Return to this point and go to Step 22.

4 Failures generally fall into one of two categories:

- data link layer protocol failure, such as the inability to set up a logical link

network layer protocol failure, such as the inability to set up a virtual call or data transfer problem

If the problem	Do
appears to be a network layer problem	Step 5
is a data link layer problem or if you are not sure of the layer affected	Step 6

5 Run X.25 interactive protocol tests from the NCS console of the DPN. Return to this point and go to Step 22.

Verify the DPN switch

6 Verify the status of the port in the AM used for this B-channel.

If the status is	Do
correct	Step 7
not correct	Step 8

7 Verify the status of the DIU.

If the status is	Do
correct, the problem is probably not in the DPN	Step 10
not correct	Step 8

8 Verify the service parameters of the DPN.

If the parameters are	Do
correct	Step 23
not correct	Step 9

9 Correct the service parameters and go to Step 22.

Troubleshooting B-channel packet, ISDN line-to-DPN (continued)

Verify the DMS switch

10 Verify whether alarms are displayed under the PM or LNS maintenance subsystem headers on the MAP.

If alarms are	Do
displayed	Step 12
not displayed	Step 11

11 Use LOGUTIL software to scan through DMS logs and search for

- logs showing a status change of the LGC or LCME through which the B-channel passes
- logs showing a state change of the LEN associated with the ISDN line

logs showing change of state of the DS-1 link carrying the B-channel

If logs	Do
exist	Step 14
do not exist	Step 13

12 Clear the alarms using the *Alarms and Performance Monitoring Procedures*.

Return to this point and go to Step 22.

13 Use the query commands (QDN, QLEN) available in the Query subsystem to verify that datafill information is correct.

If the datafill information	Do
is correct	Step 15
is not correct	Step 16

14 Use MAP commands to test suspect components. Replace any as required, then return them to service. Go to Step 22.

15 Post the ISDN line at the LTP level of the MAP to obtain the status of the line.

If the line	Do
is faulty	Step 18
is not faulty	Step 17

16 Correct datafill information and go to Step 22.

Troubleshooting B-channel packet, ISDN line-to-DPN (end)

At the CARRIER level of the MAP

17 Verify the status of the DS-1 link carrying the B-channel to the DPN. If the link is faulty, all other services using that same DS-1 link should also be faulty. A carrier fault should also be indicated at the DPN.

If the carrier	Do
is not InSv	Step 19
is InSv	Step 20

18 Use MAP commands to localize the faulty component. Replace and repair components as necessary. Go to Step 22.

19 If the carrier is in any state other than InSv, use the information in *Trouble Locating and Clearing Procedures* to troubleshoot the fault.

Return to this point and go to Step 22.

20 Set loopbacks sequentially. Start at the NT1, if the U-line card is used. If not, start at the S/T-line card. Verify the B-channel path to the DPN. Go to Step 21.

21 Verify the operation of the ISDN terminal and then go to Step 22.

22 Review the results of the procedure just performed.

If the problem	Do
still exists	Step 23
no longer exists	Step 24

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

24 You have completed this procedure.

Troubleshooting B-channel circuit switched voice Common voice service problems

Application

Use this procedure when customers report problems with voice service. This procedure provides a list of possible customer complaints and the page number on which a particular troubleshooting procedure is described for that complaint.

Definition

Disruption of voice service can be caused by many factors. The possible customer troubles are listed on the next page. The particular procedure for the customer trouble further lists the causes for that trouble.

> ***Note:*** These procedures do not cover all possible customer troubles, but do contain common steps that can be applied for troubleshooting most voice service problems.

Troubleshooting B–channel circuit–switched voice Common voice service problems

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 4

2 Review the list below.

If	Do See page
the phone never rings	page -20
there is no dial tone	page -28
the call is cut off while talking	page -24
noise is present	page -26
there is a delay in getting a dial tone	page -28
the call is routed to treatments, tones, wrong destination	page -29
none of the above	step 3

Troubleshooting B-channel circuit switched voice
Common voice service problems (end)

If	Do See page
the problem is not solved	step 3

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

4 You have completed this procedure.

Troubleshooting B-channel circuit-switch voice Phone never rings

Application

Use this procedure to determine why the customer's telephone does not ring.

Definition

The subscriber's telephone may not ring for the following reasons:

- faulty ISDN terminal or NT1
- terminal not connected to the ISDN line
- no datafill or incorrect datafill
- problems with features (for example, Call Forwarding activated)
- loss of U-sync
- faulty line card, line drawer, or LCME
- faulty LGC/LTC
- faulty DCH or EDCH

Troubleshooting B-channel circuit-switched voice Phone never rings

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 13

2 Verify that the terminal is connected to the ISDN line and that dial tone is available.

3 Verify that the call forwarding, make set busy, or deny termination features are not activated on the terminal. Use the Query commands to verify the information datafilled for the terminal.

4 Run self tests on the terminal. See *M5209T Installation Guide* for the M5209T set.

5 Make a test call to the terminal, then run a station ringer test from the terminal. If either of the tests fail, the terminal could be faulty. Replace the terminal with one programmed with the correct TEI.

6 Use the TRAVER software to verify translations for a call to the terminal.

7 Use MAP commands CKTLOC and SUSTATE to verify the status of the S/T bus, the ISDN line card, the LCME, the LGC, and the D-channel handler, and if the U-line card is used, the NT1 and the U-loop. If the status of these components is not correct, use the MAP commands to test them and isolate the fault.

Troubleshooting B-channel circuit-switch voice
Phone never rings (end)

8 Verify that a D-channel handler is associated with this line and that it is active. Verify that the ISG channel is in service using the CKTLOC command at the LTP level of the MAP.

9 Use the DCHCON command at the LTPDATA level of the MAP to verify continuity of the path between the ISDN line card and the terminal.

10 Use the DIAG command at the LTP level of the MAP to diagnose the line card, and if provided, the U-loop and the NT1.

11 Review the results of the procedures performed.

If the problem	Do
still exists	Step 12
no longer exists	Step 13

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

13 You have completed this procedure.

Troubleshooting B-channel circuit-switched voice No dial tone

Application

Use this procedure to determine why the subscriber's ISDN terminal does not receive dial tone.

Definition

An ISDN terminal may not receive dial tone for the following reasons:

- faulty terminal or terminal not connected to ISDN line
- no datafill or incorrect datafill
- faulty line card, line drawer, or LCME
- DMS overloaded
- overloaded or faulty LGC
- speech/message links not available or defective
- loss of U-sync
- problems with translations

Troubleshooting B-channel circuit-switched voice No dial tone

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 11

2 Verify that the denied origination or the suspended service option is not activated on the terminal. Use the Query commands to verify the information datafilled for the terminal.

3 Make a test call to the terminal, then run a station ringer test from the terminal. If either of the tests fail, the terminal could be faulty. Replace the terminal with one programmed with the correct TEI.

4 Run self tests on the terminal. See *M5209T Installation Guide* for the M5209T set.

5 Post the ISDN line at the LTP level of the MAP and verify that the line has a status of IDL. If it does not, use the DIAG command to verify the line and locate the faulty component.

6 Use the MAP commands CKTLOC and SUSTATE to verify the status of the S/T-bus (SUSTATE command is used), the ISDN line card, the LCME, the LGC, and, if the U-line card is used, the NT1 and the U-loop. If the status of these components is not correct, use MAP commands to test them, and isolate the fault.

Troubleshooting B-channel circuit-switched voice
No dial tone (end)

7 Verify that an ISG channel is associated with this line and that it is active, not DMB.

8 Use TRAVER software to verify translations for a call to the terminal.

9 Review the results of the procedures performed.

If the problem	Do
still exists	Step 10
no longer exists	Step 11

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

11 You have completed this procedure.

Troubleshotting B-channel circuit-switched voice Call cut while talking

Application

Use this procedure to determine why the subscriber's call was cut while the call was in progress.

Definition

The subscriber's call may have been cut for the following reasons:

- faulty line card, line drawer, or LCME
- loss of U-sync
- network problems
- PM SWACT
- trunk/carrier problems
- CPE or NT1 power failures

Troubleshooting B-channel circuit-switched voice Call cut while talking

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 10

2 Check for the output of one, or of large numbers, of the following log reports just before, or at the time the call cutoff occurred. Then take the action recommended.

If logs	Do
NET101 and NET102 are output	Step 3
PM102, PM105, and PM107 are output	Step 4
PM190, to PM194, PM196 are output	Step 5
PM183 is output	Step 6
ISDN104 and LINE131 are output	Step 7

Troubleshooting B-channel circuit-switched voice
Call cut while talking (end)

3 Integrity loss in network; use commands at the NET level of the MAP to test the network and locate faulty components.

4 Access the PM level of the MAP and verify the status of the LGC and the LCME. Use the *Alarm and Performance Monitoring Procedures*, to fix any alarms associated with these components.

5 Access the DCH level of the MAP and verify status of the DCH. If incorrect, test the card and attempt to return it to service. If this fails to correct the problem then replace the card.

6 Use commands available at the PM level of the MAP to verify the status of links between the LGC and the LCME. Replace or repair link components as required.

7 Sync loss found on line:

- Access the LTP level of the MAP and use the DIAG command to test the ISDN line card, and if provided, the U-loop and the NT1.
- If a U-line card is used, perform tests on the external plant loop by means of the RES, CAP and VAC commands at the LTPLTA level of the MAP.
- If an S/T-line card is used, from the LTPISDN level of the MAP, use the SUSTATE command to verify the state of the ISDN line components.

Verify wiring to the main distribution frame.

8 Review the results of the procedures performed.

If the problem	Do
still exists	Step 9
no longer exists	Step 10

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

10 You have completed this procedure.

Troubleshooting B-channel circuit-switched voice Noise

Application

Use this procedure to determine why noise is present on an ISDN line.

Definition

The subscriber can hear noise on the line for the following reasons:

- faulty terminal
- defective battery
- faulty line card, line drawer, or LCME
- network problems
- defective PM
- speech/message links not available or defective
- problems with carrier/trunks

Troubleshooting B-channel circuit-switched voice Noise

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 10

2 Replace the terminal, which may be faulty.

3 Check for the output of LINE131 performance log reports for ES or SES thresholds being exceeded on the 2B1Q U-line card, and for degraded or unacceptable FER or PES performance status on an S/T-line card. A flag P is displayed at the MAP if a performance report has been received.

If the problem	Do
still exists	Step 4
no longer exists	Step 5

4 Use the DIAG command at the LTP level of the MAP to test the line. Replace any defective components.

Troubleshooting B-channel circuit-switched voice
Noise (end)

5 Run a BERT to the NT1, if provided, to verify transmission characteristics of the path.

If the problem	Do
on a U-line card	Step 6
on an S/T-line card	Step 7

6 Run an 80-kHz test on the external plant U-loop. The 80-kHz test signal can be generated by operating a DIP switch on the NT1, and is measured at the MDF.

7 At the LTPDATA level of the MAP run a TSTSGNL (96-kHz) test from the line card on the S/T-bus. The 96-kHz signal is generated by the S/T-line card and is measured at the line card and at the terminal end of the S/T-bus using external test equipment.

8 Review the results of the procedures performed.

If the problem	Do
still exists	Step 9
no longer exists	Step 10

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

10 You have completed this procedure.

Troubleshooting B-channel circuit-switched voice Delay in getting dial tone

Application

Use this procedure to determine why there is a delay in dial tone when the subscriber goes off-hook.

Definition

The subscriber can receive a delay in dial tone for the following reasons:

- DMS overload
- PM overload
- P-side or C-side links down or defective

Troubleshooting B-channel circuit-switched voice Delay in getting dial tone

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 5

2 The office may be overloaded. Use operational measurements to determine if the office is engineered correctly.

3 Review the results of the procedures performed.

If the problem	Do
still exists	Step 4
no longer exists	Step 5

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

5 You have completed this procedure.

Troubleshooting B-channel circuit-switched voice Call routed to treatment

Application

Use this procedure to determine why a call was routed to treatment, tones, or the wrong destination.

Definition

The subscriber's call can be routed to treatment, tones, or the wrong destination for one of the following reasons:

- faulty ISDN terminal
- problems with features
- problems with translations
- faulty line card, line drawer, or LCME

Troubleshooting B-channel circuit-switched voice Call routed to treatment, wrong destination

1 Review maintenance action taken to date. Repeat if necessary.

If the problem	Do
still exists	Step 2
no longer exists	Step 6

2 Use TRAVER software to verify translations for a call from the terminal.

3 Use DIAG command at the LTP level of the MAP to diagnose the line card, and if provided, the U-loop and NT1.

4 Review the results of the procedures performed.

If the problem	Do
still exists	Step 5
no longer exists	Step 6

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

6 You have completed this procedure.

Appendix A Test limits

Table A-1 Test limits (Sheet 1 of 2)

Test parameter	Conditions	Limit
AC minimum voltage tests	Tip to ring voltage	-10 V
	Tip to ground voltage	0 V
	Ring to ground voltage	0 V
AC maximum voltage tests	Tip to ring voltage	10 V
	Tip to ground voltage	120 V
	Ring to ground voltage	120 V
DC minimum voltage tests (Note)	Tip to ring voltage	-10 V
	Tip to ground voltage	-5 V
	Ring to round voltage	-5 V
DC maximum voltage tests (Note)	Tip to ring voltage	10 V
	Tip to ground voltage	5 V
	Ring to ground voltage	5 V
Resistance minimum tests	Tip to ring resistance	1 k Ω± 12% for loop
	Tip to ground resistance	1 k Ω ± 12% for loop
	Ring to ground resistance	2.2 k Ω
Resistance maximum tests	Tip to ring resistance	3.2 k Ω + 1.2 k Ω for loop
Note: An error margin of ±5 V is added to the expected values in each case.		

Table A-1 Test limits (Sheet 2 of 2)

Test parameter	Conditions	Limit
	Tip to ground resistance	4.4 k Ω
	Ring to ground resistance	4.4 k Ω
Capacitance minimum tests	Tip to ring capacitance	0µF
	Tip to ground capacitance	0µF
	Ring to ground capacitance	0µF
Capacitance maximum tests	Tip to ring capacitance	1.5µF
	Tip to ground capacitance	4.0µF
	Ring to ground capacitance	4.0µF
Sealing resistance tests	Minimum resistance	2.2 k Ω
	Maximum resistance	4.4 k Ω
Sealing current tests	Minimum current	8 mA
	Maximum current	18 mA
CO relay voltage	Operating minimum voltage	-5 V
	Operating maximum voltage	5 V
	Released minimum voltage	-60 V
	Released maximum voltage	-25 V
DC signature tests	Tip to ring minimum resistance	300 Ω
	Tip to ring maximum resistance	4 k Ω
DC signature tests with mp–eoc	Tip to ring minimum resistance	100 k Ω
	Tip to ring maximum resistance	140 k Ω
Note: An error margin of ±5 V is added to the expected values in each case.		

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 (Nortel) 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 Nortel. *See also* functional signaling.

basic rate access key set (BRAKS)

An ISDN set that uses stimulus signaling. The Meridian M2317T is the BRAKS for Nortel. *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 access (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

See basic rate access Meridian functional signaling (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

See packet handler (PH).

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 terminal

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 Nortel.

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 toward 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 Nortel 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

ISDN BRI

ISDN BRI Maintenance Guide

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