Critical Release Notice

Publication number: 297-1001-592
Publication release: Standard 12.04

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

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

Bookmark Color Legend

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

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

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

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

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

Publication History

November 2005

Standard release 12.04 for software release SN06 (DMS) and ISN06 (TDM).

Chapter 4, Single-shelf PM related logs, description of PM110 modified for CR Q01023866.

Chapter 38, LPP related logs, description of PM110 modified for CR Q01023866.

March 2004

Standard release 12.03 for software release SN06 (DMS) and ISN06 (TDM).

Card NT9X30AB is Manufacture Discontinued and is replaced by new card NT9X30AC.

297-1001-592

DMS-100 Family

Peripheral Modules

Maintenance Guide

TELECOM 15 Standard 12.02 February 2001

NORTEL NETWORKS™

How the world shares ideas.

DMS-100 Family

Peripheral Modules

Maintenance Guide

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February 2001

TL15 Standard 12.02 Made editorial changes to backmatter.

February 2001

TL15 Standard 12.01

- added information on the data functionality for the Universal Edge 9000 DMS to Chapter 24
- added information on the NTNP35AA DS3 ATM control card in the UEN to Chapter 24
- added information on the LOADFW command used to load and upgrade UEN firmware in Chapter 29

October 2000

TL14 Standard 11.01

- added information on the Universal Edge 9000 (UEN) to Chapter 23 through Chapter 33.

August 1999

TL12 Standard 10.02

- defined CLF in chapter 33

February 1999

TL11 Standard 10.01

- added information on the NTSX05AA processor card to Chapter 13, "Dual-shelf PM maintenance overview"

TL09 Standard 09.05

- added information on XBERTBIC and XBERTDCC testing to Chapter 20, "Dual-shelf PM trouble isolation and correction" and Chapter 32, "LCM trouble isolation and correction”
- NTT-requested changes

November 1998

TL09 Standard 09.04

- updated references to NTPs

August 1998

TL09 Standard 09.03

- editing changes
- added ISM information to Chapter 2, "Single-shelf PM maintenance overview"
- added information on in-service firmware downloading to Chapters 13, "Dual-shelf PM maintenance overview" and Chapter 18, "Dual-shelf PM related user interface commands" (feature AX0970)

June 1998

TL09 Standard 09.02

- editing changes

February 1998

TL08 Standard 08.03

- editing changes
- new chapter added (“VLCM maintenance overview" in this document) for feature AU2455
- added information on provisioning backup D-channels for LGCI and LTCI in Chapter 13, "Dual-shelf PM maintenance overview" for feature AF6860
- revised the Maintenance Arbitrator section in Chapter 13 "Dual-shelf PM maintenance overview" for features AF6949 and AF7143

December 1997

TL08 Standard 08.02

- editing changes

August 1997

TL08 Standard 08.01

- revisions to Chapters 13, "Dual-shelf PM maintenance overview" and 20, "Dual-shelf PM trouble isolation and correction" associated with feature AF6231 and the NTAS74 cellular access processor card

March 1997

TL07 Standard 08.02

- revisions associated with Ethernet link interface unit (ELIU)

September 1996

TL06 Standard 06.02

- made editorial changes
- removed one of the commands supporting SWACT back in Chapter 11, "Single-shelf PM advanced problem solving procedures”

August 1996

TL06 Standard 06.01

- added information on peripheral remote loader in Chapter 11, "Single-shelf PM advanced problem solving procedures”
- added XPMSTOR and IMAGE command descriptions in Chapter 16, "Dual-shelf PM related operational measurements”
- added description of MTCARB in Chapter 11, "Single-shelf PM advanced problem solving procedures”

November 1995

TL05 Standard 05.01

- added XLIU five congestion conditions
- included XLIU congestion frequency as cause of minor alarm
- faults caused by congestion within the XLIU

May 1995

TL04 Standard 04.01

- revised affected chapters to incorporate CSP04 features
- revised references for agreement with current NTP numbers and titles.

January 1995

TL03 Standard 03.01

- added preliminary feature information

December 1993

BCS36 Standard 02.02. There are editorial and formatting changes in the guide. The new information found in the guide is as follows:

- removing and returning to original connection of line drawers (chapter 28)
- maintaining the link peripheral processor (chapters 31 through 40)
- handling a loss of ringing (chapter 28)
- reconfiguring of ringing data (chapter 21)

October 1993

BCS36 Preliminary 02.01. There are editorial and formatting changes in the guide. You will find new information on DS-1 link maintenance for single-shelf peripheral modules.

March 1993

BCS35 Standard 01.01. First release.

Contents

About this document

When to use this document

The *Peripheral Modules Maintenance Guide*, 297-1001-592, provides maintenance information on peripheral modules (PM) in the DMS-100 Family. The DMS-100 Family resides in the host office. This guide is for maintenance personnel with experience and offers background information to assist in troubleshooting and maintenance of these PMs.

This guide provides information on four types of PMs: single-shelf PMs, two-shelf PMs, the line concentrating module (LCM), and the link peripheral processor (LPP). These PMs and the correct chapters, appear in the following list:

- Single-shelf PMs reside on a single-shelf. These PMs include trunk modules, maintenance trunk modules, service trunk modules, office alarm units, digital-recorded announcement machines, and digital carrier modules. Chapter 1 through 11 describe maintenance activities for single-shelf PMs.
- Two-shelf PMs reside on two shelves. These PMs have two redundant units, unit 0 and unit 1. These units operate in hot standby mode. Two-shelf PMs include line group controllers, line trunk controllers, digital trunk controllers, and message and switch buffers. Chapter 12 through 22 describe maintenance activities for two-shelf PMs.
- The LCM is a two-shelf PM with two redundant units that operate in a load-sharing mode. Chapter 23 through 34 describe maintenance activities for the LCM.
- The LPP is an equipment package consisting of two types of PMs: a link interface module (LIM) and application specific units (ASU). The LPP allows a DMS SuperNode switch to support a range of applications and services. Chapter 35 through 45 describe maintenance activities for the LPP.

References in this document

This document refers to the following documents:

- *Product Documentation Directory*, 297-8991-001
- *Input/Output System Reference Manual*, 297-1001-129
- *Basic Administration Procedures*, 297-1001-300
- *Service Problem Analysis Administration Procedures,* 297-1001-318
- *DMS-100 Family Commands Reference Manual*, 297-1001-822
- *Alarm and Performance Monitoring Procedures*
- *Card Replacement Procedures*
- *Routine Maintenance Procedures*
- *Trouble Locating and Clearing Procedures*
- *Operational Measurements Reference Manual*
- *Log Report Reference Manual*
- *How to List Technical Assistance Manuals,* TAM-1001-000
- *TAS Nonresident Tool Listing*, TAM-1001-001
- *BCS Maintenance Synopsis,* TAM-1001-005
- *Universal Edge-9000 DMS Data OAM&P User Guide*, 297-8391-302

As of NA011 (LEC and LET) and EUR010 (EUR) releases, any references to the data schema section of the *Translations Guide* will be mapped to the *Customer Data Schema Reference Manual*.

How to check the version and issue of this document

Numbers indicate the version and issue of this document. The following is an example of how numbers indicate the version and issue of this document: 01.01.

The first two digits indicate the version. The version number increases as 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 as the document is revised, but rereleased in the *same* software release cycle. An example is as follows: the second release of a document in the same software release cycle is 01.02.

You can determine which version of this document applies to the software in your office. Check the release information in *Product Documentation*

Directory, 297-8991-001. The release information in this document can show you how Nortel (Northern Telecom) organizes documentation for your product.

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

The following are examples of the precautionary messages:

ATTENTION
Information that you need to perform a task

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

DANGER
Possibility of personal injury

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

WARNING
Possibility of equipment damage

WARNING
Damage to the backplane connector pins
Align the card before you seat it so that the backplane connector pins do not bend. 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 you continue, confirm that you remove the card from the inactive unit of the peripheral module. If you remove a card from the active unit, you will lose subscriber service.

How commands, parameters, and responses are represented

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

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 appear in uppercase letters:

>BSY CTRL

Variables

Variables appear in lowercase letters:

>BSY CTRL ctrl_no

Enter the letters or numbers that the variable represents. The list that follows the command string explains each variable.

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 section from a procedure shows the command syntax used in this document:

1 To manually busy the CTRL on the inactive plane, type

>BSY CTRL ctrl_no

and press 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 Single-shelf PM peripheral modules

Chapter 2 through 11 describe maintenance activities for single-shelf PMs. These chapters provide information on the following:

- Chapter 2, "Single-shelf PM maintenance overview," describes the basic maintenance plan for single-shelf PMs The chapter describes functions, potential fault conditions, and system actions that attempt to correct the fault conditions. The chapter explains when to increase activities to manual maintenance.
- Chapter 3, "Single-shelf PM preventive maintenance strategies," describes routine maintenance procedures and schedules for single-shelf PMs.
- Chapter 4, "Single-shelf PM related logs," identifies log reports that you can generate for single-shelf PMs.
- Chapter 5, "Single-shelf PM related operational measurements," identifies operational measurement group names that associate with single-shelf PMs.
- Chapter 6, "Single–shelf PM related data structures," identifies data structures that associate with single-shelf PMs.
- Chapter 7, "Single–shelf PM related user interface commands,", "Single-shelf PM related user interface commands", describes how maintenance personnel can use the MAP system to support single-shelf PMs. The chapter describes appropriate MAP levels, system status displays, and menu commands.
- Chapter 8, "Single–shelf PM related card requirements," provides information on card replacement procedures for single-shelf PMs.
- Chapter 9, "Single-shelf PM problem isolation and correction," describes the procedures to correct defects in single-shelf PMs. The chapter describes fault isolation tests and diagnostic tests that you can use to support single-shelf PMs.

- Chapter 10, "Single–shelf PM problem solving chart," is a high-level table that lists symptoms of single-shelf PM problems. The table lists the actions you can perform to correct single-shelf PM problems.
- Chapter 11, "Single-shelf PM advanced problem solving procedures," describes the procedures to correct more difficult problems in single-shelf PMs.

These chapters include descriptions of single-shelf PMs. The following are single-shelf PMs:

- trunk module
- maintenance trunk module
- service trunk module
- office alarm unit
- digital recorded announcement machine
- digital carrier module

2 Single-shelf PM maintenance overview

This chapter provides the maintenance plan for single-shelf peripheral modules (PM). This chapter provides qualified maintenance personnel with background information to use in the problem solving and the maintenance of these PMs.

The following list contains a description of the type of information in each section of this chapter.

- The section "Functional description" describes the configurations, components, and cards of single-shelf PMs. This section describes how single-shelf PMs interact with other DMS-100 Family components.
- The section "Fault conditions" describes hardware and software faults that occur with single-shelf PMs and related components.
- The section "Automatic maintenance" describes actions the system takes to diagnose and repair these faults.
- The section "Increase to manual maintenance" describes the reason you perform manual maintenance.

Functional description

Peripheral modules are shelf-mounted or frame-mounted units. These modules provide an interface between the network and analog or digital transmission facilities, service circuits, or auxiliary PMs. These different transmission facilities require several types of PMs to adapt the characteristics of the transmission facilities to the network. These PMs operate separately or together to provide services and other functions.

Single-shelf PMs refer to first-generation PMs. Single-shelf PMs support trunk functions. Single-shelf PMs are on a single shelf and support call processing, system control, and testing.

Single-shelf PMs have non-duplicated processor cards. Other PMs do not have non-duplicated processor cards. Other PMs and single-shelf PMs have duplicated DS30 links to plane 0 and 1 in the network. If an active link interfacing plane 0 fails, the link interfacing plane 1 carries the full set of speech and messages.

Trunk module

A trunk module (TM) provides speech and signaling interfaces between a DS30 network port and analog trunks. The different types of trunk modules share the same primary functions and features. These TMs are cabled and named for different types of trunk facilities. The name of a TM cabled for two-wire trunks is TM2. The name of a TM cabled for four-wire trunks is TM4. The name of a TM cabled for eight-wire trunks is TM8.

The primary functions of the TM are the following:

- converts analog trunk speech and signaling information to or from a 2.56 megabits per second digital stream
- connects a maximum of 30 analog voice trunks to the network ports with the use of a DS30 link to the network

The primary features of the TM are the following:

- a maximum of 15 trunk cards
- shelf modular design
- no concentration
- digital and analog loopback circuits facilitate maintenance
- firmware control of supervision and signaling functions
- storage and control of a maximum of 15 incoming and outgoing digits
- message error checking
- automatic switchover between network planes in the event of integrity message discontinuity
- digitally derived tones supplied to precise tone plan

Maintenance trunk module

A maintenance trunk module (MTM) provides an interface between the switch and test and service equipment. The MTM has test and service cards and contains special buses to accommodate test cards for maintenance.

The primary functions of the MTM are the following:

- converts analog trunk speech and signaling information to or from a 2.56 megabits per second digital stream
- connects a maximum of 28 analog test trunks to network ports with a DS30 link to the network
- acts as a switching center for control messages. These control messages exchange between central control (CC) and individual test or service cards

The primary features of the MTM are the following:

- a maximum of 14 service cards such as enhanced digital recorded announcement machine (EDRAM), depending on shelf configuration.
- shelf modular design with odd-even slot intercard connections
- no concentration
- digital and analog loopback circuits to facilitate maintenance
- firmware control of supervision and signaling functions
- control and storage of up to 15 incoming and outgoing digits
- message error checking
- automatic switchover between network planes in the event of integrity message discontinuity
- digitally derived tones supplied to a precise tone plan
- configures digital recorded announcement machine
- configures as an OAU or a standby MTM.

Service trunk module

A service trunk module (STM) consists of two compact MTMs. The primary functions of the STM are the following:

- converts analog trunk speech and signaling information to or from a 2.56 megabits per second digital stream
- connects a variable number of analog trunks to network ports with the use of a DS30 link to network. The number of trunks is related to the type of STM configuration, NT1X58 or NT7X30.

The primary features of the STM are the following:

- a maximum of seven service cards, depending on shelf configuration
- shelf modular design can contain two STMs
- there is no concentration
- digital and analog loopback circuits facilitate maintenance

- firmware control of supervision and signaling functions
- storage and control of up to 15 incoming and outgoing digits
- message error checking
- automatic switchgear between network planes in the event of integrity message discontinuity
- digitally derived tones supply to precise tone plan

You can provision the primary and standby OAUs in an STM.

Integrated services module

The integrated services module (ISM) is a single shelf that replaces the TM or MTM shelf. The ISM shelf mounts on one of the following frames:

- cabinetized ISM (CISM)
- ISM equipment (ISME)
- cabinetized metallic test access (CMTA)
- metallic test access equipment (MTAE)

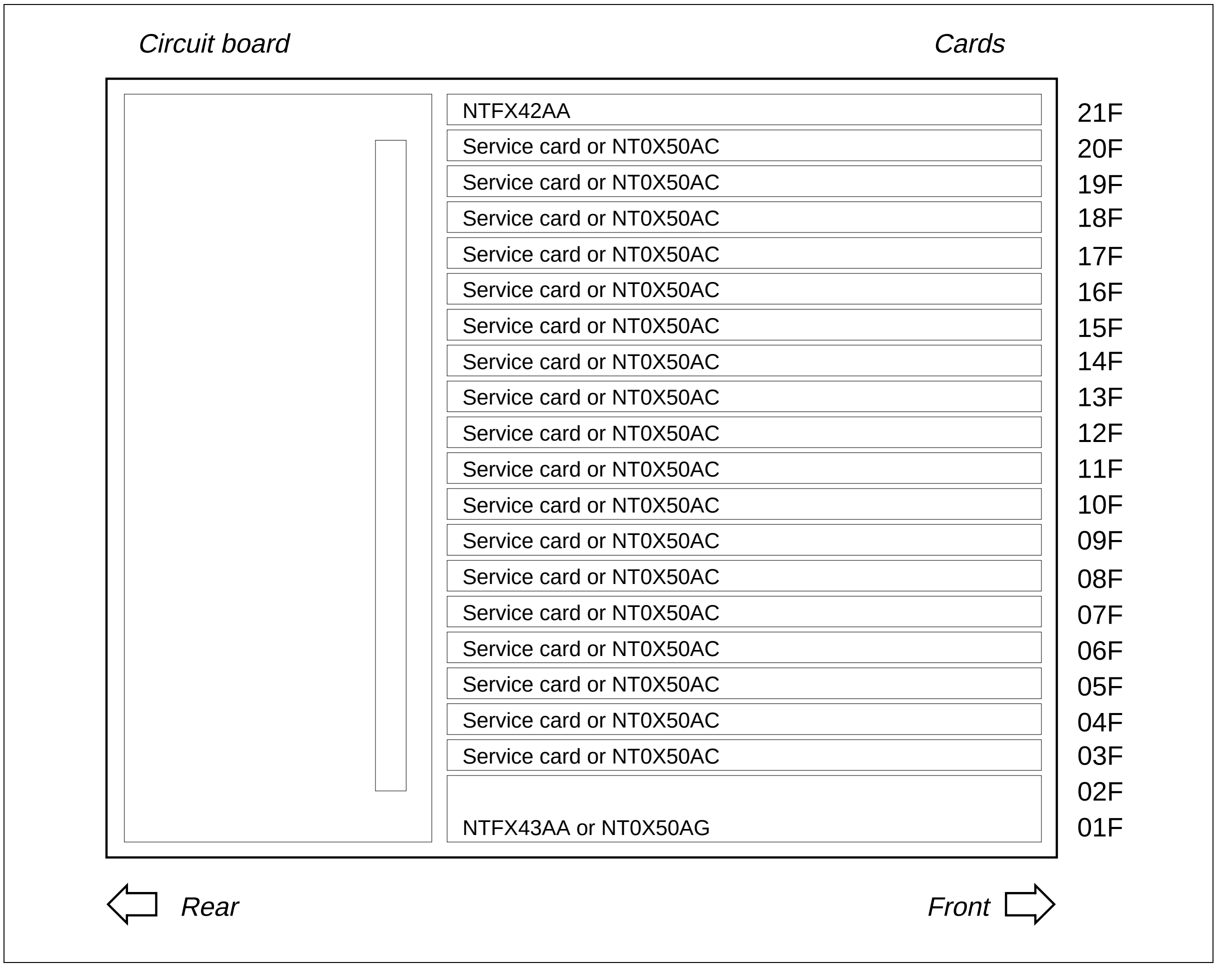
The ISM shelf contains an ISM DC converter, an ISM processor, and a maximum of 18 slots for service cards. You do not need these cards if you use the shelf only for conference trunk module (CTM) applications.

Of the 18 service card slots, PM service cards that require power conversion can use only the slots 05 through 17. PM service cards that do not require power conversion can use only the slots 03 through 17. An example is the conference trunk module (CTM). Slot 05 is available for one of the non-PM cards in a dual-card device. An example is the metallic test unit (MTU).

The ISM shelf connects to the DMS switch in the same way as the TM and MTM shelves. The ISM processor card has a DS30 link interface to the network and bus connections with service cards using the back panel. (one link to each plane of the network) The service circuits determine the type of P-side interface on the ISM shelf. The ISM can coexist with TM or MTM (located in another frame or cabinet) and other PM in a DMS switch.

The cards in the ISM shelf are side-by-side and work in pairs. The main card on the right and its mate is on the left. This configuration is opposite to the configuration in the TM or MTM. For ISM service cards that work in pairs, the mate is on the left of the main card. The exception is the transmission test trunk (TTT), which has the mate located on the right of the main card.

Figure 2-1 ISM shelf layout



Office alarm system

The office alarm system (OAS) consists of alarm software, two MTM or ISM, and other alarm system hardware.

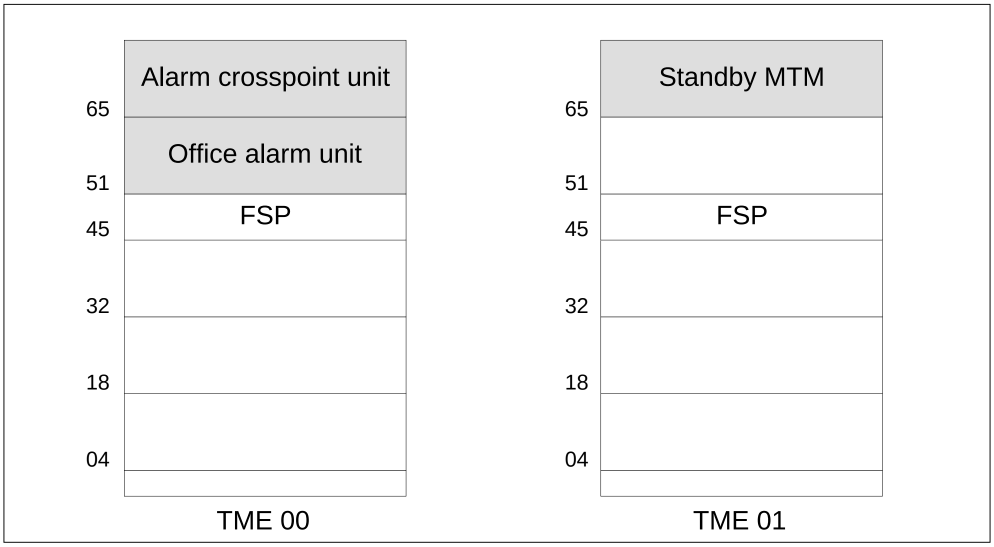
Office alarm unit

The office alarm unit (OAU) is an MTM or ISM shelf equipped with a transmission, a processor, a control, and a power converter card. The OAU has slots for up to 12 interface cards.

In the AOS, the OAU and the standby MTM or ISM contain most of alarm detection and control hardware. The OAU is dedicated to the alarm system. The standby MTM or ISM contains the alarm system backup circuits that generate an alarm if the OAU fails. The standby MTM or ISM can also contain test and service circuits that are not part of the alarm system.

Figure 2-2 shows the major hardware components of the OAS and their shelf locations (in inches from the floor).

Figure 2-2 Alarm system hardware



The primary functions of the OAU are the following:

- converts analog trunk speech and signaling information to or from a 2.56 megabits per second digital stream
- connects as many as 28 analog trunks to network ports with the use of a DS30 link to the network

The following are the primary features of the OAU:

- a maximum of 11 OAU cards, including scan (SC), signal distribution (SD), OAU alarm group, and OAU dead system cards
- modular shelf design
- no line concentration
- digital and analog loopback circuits to facilitate maintenance
- firmware control of supervision and signaling functions
- control and storage of up to 15 incoming and outgoing digits
- message error checking
- automatic switchover between network planes in the event of integrity message discontinuity
- digitally derived tones supplied to a precise tone plan

Digital recorded announcement machine

The digital recorded announcement machine (DRAM) stores voice messages in digital format. The DRAM provides access for up to 30 different service voice announcements. The primary functions of the DRAM are the following:

- converts analog trunk speech and signaling information to or from a 2.56 megabits per second digital stream
- connects a maximum of 28 analog trunks to network ports with the use of a DS30 link to network
- provides digital recorded announcements

The primary features of the DRAM are the following:

- a maximum of eight memory cards
- modular shelf design with an intercard bus that links the first ten card slots
- no line concentration
- digital and analog loopback circuits that facilitate maintenance
- firmware control of supervision and signaling functions
- storage and control of up to 15 incoming and outgoing digits
- message error checking
- automatic switchover between network planes in the event of integrity message discontinuity
- digitally derived tones supplied to a precise tone plan

Digital carrier module

The digital carrier module (DCM) provides speech and signaling interfaces between a DS30 network port and digital trunks. A DCM has a maximum of five line cards.

The primary functions of the DCM are the following:

- converts the 8-bit, 24-channel, DS-1 digital signal to the 10-bit, 32-channel DS30 digital format
- connects a maximum of 120 analog trunks to network ports by means of a DS30 link to the network
- interfaces the AB bits signaling method of the DS-1 links with the SD scan methods of the DMS-100 Switch
- used for remote traffic operator position system (TOPS) applications

The primary features of the DCM are the following:

- shelf modular design available as DCM-B (basic configuration), DCM-S (basic with clock synchronization), and DCM-R (remote interface).
- there is no concentration
- digital and analog loopback circuits facilitate maintenance
- firmware control of supervision and signaling functions
- storage and control of incoming and outgoing digits (up to 15 digits)
- message error checking
- automatic switchover between network planes in the event of integrity message discontinuity
- digitally derived tones supplied to precise tone plan

Configurations

TM, MTM, STM, DRAM, and OAU configurations

The TM, MTM, STM, DRAM, and OAU share a common function and a common configuration. These configurations provide interfaces between central side (C-side) and peripheral side (P-side) links.

Each of these PMs is on a single shelf. Each shelf has a common control section. The common control section performs the following four functions:

- network interface
- processor
- control
- group coder/decoder (CODEC)

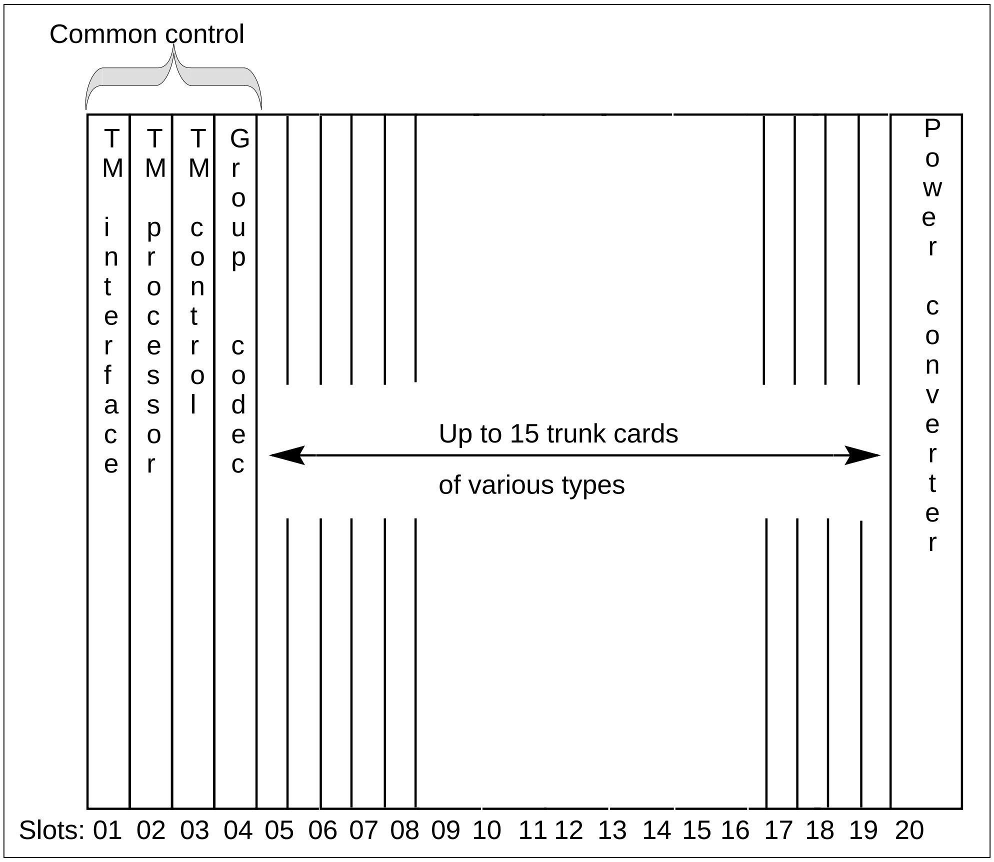
The group CODEC supports pulse code modulation (PCM) and pulse amplification modulation (PAM).

The following cards provide common control functions:

- TM interface card
- TM processor card
- TM control card
- group CODEC card

Figure 2-3 shows this common configuration in a trunk-module shelf.

Figure 2-3 Layout of trunk module shelf



DCM configuration

The DCM, like the other single-shelf PMs, has a single-shelf configuration that supports call processing and system control. The DCM provides an interface between C-side and P-side links. The P-side link connects with a maximum of five DS-1 links.

The DCM control section performs the following functions:

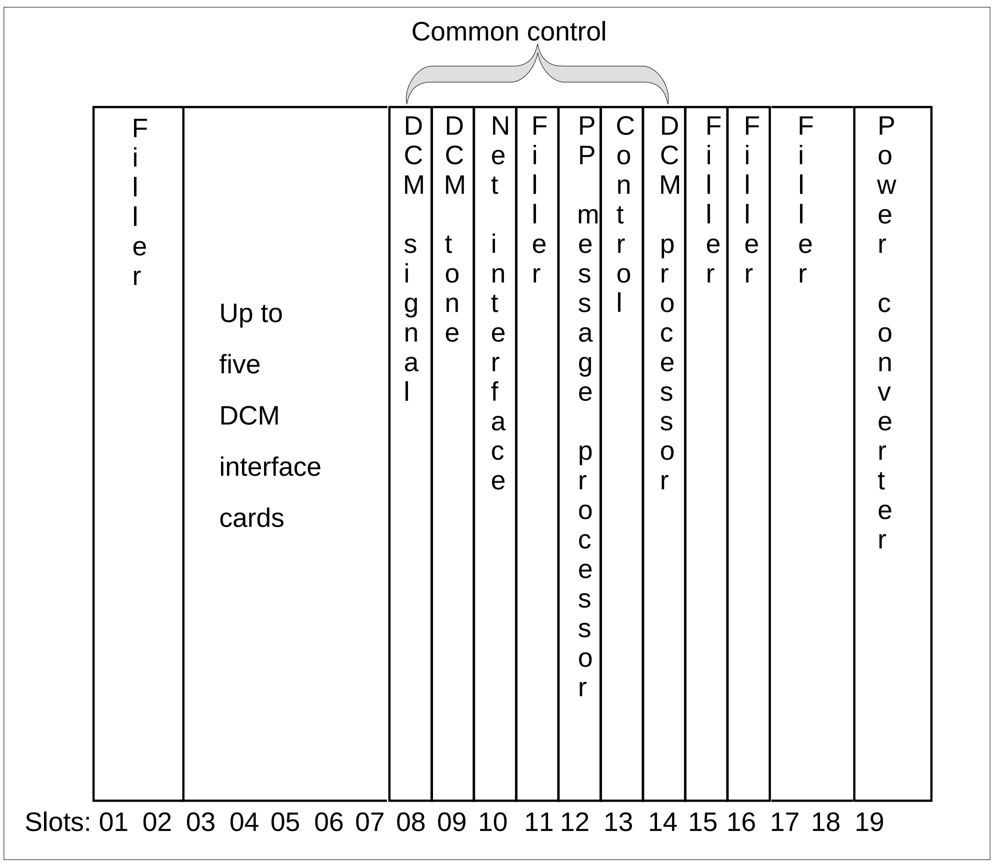
- signaling
- tone generation
- network interface
- messaging
- controller
- processor

The following cards provide the preceding functions:

- DCM signaling card
- DCM tone card
- network interface card
- peripheral processor (PP) message processor card
- control card
- DCM processor card

Figure 2-4 shows the standard shelf layout for a DCM shelf.

Figure 2-4 Layout of DCM shelf



Messages and data flow

TM, MTM, STM, DRAM, and OAU operations

The path of data flow divided into receive paths and transmit paths describe the operation of the PMs. When the network module (NM) sends data, a network interface card on the shelf of the PM receives the data. The data passes through the receive path of the shelf to a personality card or the peripheral processor (PP). From a personality card or PP in the shelf, the data passes through the transmit path of the shelf to the network.

> ***Note:*** Personality cards refer to the single-shelf circuit cards that provide a PM with a unique identity.

The receive path in the TM, MTM, STM, DRAM, and OAU shelves operates as follows:

1. Data enters the shelf on the receive channels of the speech links. The data comes from the NM plane 0 or plane 1 through the network interface card.
2. The network interface card aligns and formats the data again. The PCM speech samples are separated from the control messages. The PCM speech samples go through automatic level adjustment.
3. The PCM speech samples pass through the speech bus to the CODEC card. The PCM decodes into PAM speech samples and are placed on the receive PAM (RPAM) bus.
4. A trunk interface, service circuit, or other personality card receives the PAM speech samples and constructs the original analog signal again.
5. The original analog signal passes to the trunk transmission facilities.
6. The network places control messages on the digital receive data bus (RDAT) or on the data bus to the PP. Either of these processes occur while the network places speech on the RPAM bus.
7. Some control messages pass through the RDAT bus to a trunk interface, service circuit, or other personality card. Either of these processes translates the data into signals compatible with the signaling method of the associated trunk facility. Other control messages pass through the data bus to the PP.

The transmit path in the TM, MTM, STM, DRAM, and OAU shelves operate as follows:

1. Analog speech samples from trunk transmission facilities enter the analog side of a trunk interface, service circuit, or other personality card.
2. These speech samples convert to PAM samples that are multiplexed onto the transmit pulse amplitude modulation (XPAM) bus.
3. The PAM samples pass from the XPAM bus to the CODEC card, where PCM samples contain encoded PM samples.
4. The PCM samples pass through the speech bus to the network interface card. The network interface card passes the PCM samples to the network.
5. At the same time, data from a trunk transmission facility converts into digital data.

6. The transmit data (XDAT) bus receives this digital data. The digital data goes to the network interface card.
7. At the network interface card, the PCM samples and the associated digital data combine. The PCM samples and the associated PCM samples format again into a data stream.
8. The network places this data stream on the speech link transmit path.
9. A control circuit handles responses from the PP to messages from the CM and transmission of the channel supervision message (CSM). These responses pass through the data bus to the network interface card for insertion in the speech link transmit message channel.

DCM operations

The operation of this PM includes the following.

- An algorithm distributes the channels evenly over the four speech links to the network. An algorithm determines where to assign DS-1 speech channels on the DS-1 links to an equal number of DS30 channels.
- A maximum of five DCM interface cards provide interfaces between the five DS-1 facilities and the DCM. The network card connects with the four speech links to the DMS network. The DCM interface cards and the network interface card connect through a bidirectional, 2.56 megabits per second speech bus. These cards have four paths in each direction. Each two-way path associates with one of the four duplicated speech links.
- The CM, PP message processor, tone, and signaling cards perform the common control for the DCM.
- The speech bus provides access for the insertion and removal of the following cards on to the correct paths and channels: according to the assignment algorithm and bit mapping.
  - — tones (tone card)
  - — AB bits (signaling card)
  - — the CSM (PP message processor card)

The speech bus places these cards on the correct paths and channels, in according to the assignment algorithm and bit mapping.

- The maintenance bus links the DCM interface cards and the signaling card. The maintenance bus provides a separate path for monitoring the performance of the DS-1 channels. The detected DS-1 conditions include slips, reframing, sustained loss of synchronization, and bipolar violations. Each DS-1 card has a card present signal. The signaling card communicates this maintenance information to the DCM processor. A message to the DMS maintenance system reports DS-1 conditions that are not normal. You can test the DCM DS-1 carriers at the carrier level of the MAP terminal.

The DS-1 links connect to the DCM at the DCM interface card. Each DCM shelf contains a variable number of DCM interface cards. A DS-1 link carries 24 channels. Each channel contains eight bits of PCM data. A maximum of five DS-1 links connect to the DCM.

Shelf slots three through seven, used for DCM interface cards, appear in Figure 2-4. The DCM converts the 8-bit 24-channel DS-1 digital signal to the 10-bit 32-channel DS30 digital format. The DCM connects the AB bits signaling method of the DS-1 links with the signal distribution scan methods of the DMS-100 switch.

The DCM channel mapping schema appears in Figure 2-5.

Figure 2-5 Cross-reference of DCM carrier and timeslot to terminal number

CCT	TN	CCT	TN	CCT	TN	CCT	TN	CCT	TN
0-01	01	1-01	31	2-01	61	3-01	91	4-01	02
0-02	32	1-02	62	2-02	92	3-02	03	4-02	33
0-03	63	1-03	93	2-03	04	3-03	34	4-03	64
0-04	94	1-04	05	2-04	35	3-04	65	4-04	95
0-05	06	1-05	36	2-05	66	3-05	96	4-05	07
0-06	37	1-06	67	2-06	97	3-06	08	4-06	38
0-07	68	1-07	98	2-07	09	3-07	39	4-07	69
0-08	99	1-08	10	2-08	40	3-08	70	4-08	100
0-09	11	1-09	41	2-09	71	3-09	101	4-09	12
0-10	42	1-10	72	2-10	102	3-10	13	4-10	43
0-11	73	1-11	103	2-11	14	3-11	44	4-11	74
0-12	104	1-12	15	2-12	45	3-12	75	4-12	105
0-13	16	1-13	46	2-13	76	3-13	106	4-13	17
0-14	47	1-14	77	2-14	107	3-14	18	4-14	48
0-15	78	1-15	108	2-15	19	3-15	49	4-15	79
0-16	109	1-16	20	2-16	50	3-16	80	4-16	110
0-17	21	1-17	51	2-17	81	3-17	111	4-17	24
0-18	52	1-18	82	2-18	112	3-18	23	4-18	53
0-19	83	1-19	113	2-19	24	3-19	54	4-19	84
0-20	114	1-20	25	2-20	55	3-20	85	4-20	115
0-21	26	1-21	56	2-21	86	3-21	116	4-21	27
0-22	57	1-22	87	2-22	117	3-22	28	4-22	58
0-23	88	1-23	118	2-23	29	3-23	59	4-23	89
0-24	119	1-24	30	2-24	60	3-24	90	4-24	120

Maintenance states

The system can automatically assign a maintenance state to each single-shelf PM. You can manually assign a maintenance state to each single-shelf PM when you enter commands at the MAP terminal. Table 2-1 lists and describes the different single-shelf PM maintenance states.

Table 2-1 PM maintenance states

PM state	Code	Description
Central side busy	CBsy	The PM cannot communicate with the CM. The DS30 links used to carry messages between the PM and the DMS-100 switch are not available.
In service	InSv	The PM is free of service-affecting faults and can support any intended process, such as call processing.
In-service trouble	ISTb	The PM is in service (InSv). The PM has a minor fault.
Manual busy	ManB	The PM is busy. The switch operator issued the Busy (BSY) command from the MAP position.
Offline	OffL	The switch operator removed the PM from service to allow commissioning testing. The switch operator performed this procedure to hold the PM out of service (OOS) temporarily.
System busy	SysB	The system maintenance removed the PM from service as a result of faults.

This guide refers to these maintenance states and codes.

Checksums

For single-shelf PMs, use a number to calculate the checksum (header CHKSUM) for each software load. After you load and test the PM, compare the checksum total with the expected checksum total. If the totals match, the load is accepted. If the totals do not match, use the LOADPM command to load the load again. Each PM type has a different checksum value for each load. The QUERYPM command displays a checksum value for the load of the PM.

Fault conditions

Common control cards that have faults

Fault conditions for single-shelf PMs can associate with defects in the four control section cards. For information on how to clear defects in common control cards, refer to Chapter 9, "Single-shelf PM problem isolation and correction."

Incorrect parity

An incorrect parity condition interrupts the PP.

Problem message paths

A fault in the message paths between the PM and NM can cause the system to change that PM to SysB.

Automatic maintenance

Incorrect parity

Bit-0 of each speech channel provides a parity check over each 10-bit speech sample on the speech links. The system initiates automatic maintenance actions when it detects a parity condition that is not correct.

Problem message paths

The transmit and receive paths of the PM are looped-around. You can test and maintain all message paths for a PM. A tone generator card, located in the MTM, feeds known PCM samples to the PM under test. A comparison of the original and received samples provides a test of all the circuits in the route.

Increase to manual maintenance

Automatic maintenance activities, like audits and tests, diagnose and repair many of the faults that develop in the single-shelf PMs. Conditions can arise when these faults require manual maintenance. Qualified maintenance personnel receive the MAP system status displays, log reports, and operational measurements (OMs). The MAP system status displays, log reports, and OMs specify the occurrences and the activities when the PMs require manual maintenance.

3 Single-shelf PM preventive maintenance strategies

This chapter describes the routine procedures and schedules for the maintenance of a single-shelf peripheral module (PM). This chapter provides information to assist qualified maintenance personnel in problem solving and maintaining single-shelf PMs.

The information in this chapter complements step-by-step documents. Refer to "Routine Maintenance Procedures" for more information.

Routine maintenance procedures

Routine maintenance procedures are tasks performed according to a known schedule. Some of these tasks are as follows:

- inspecting cooling unit filters
- testing wrist-strap grounding cords
- testing dead system alarm for digital recorded announcement machine (DRAM)
- replacing cooling unit filters
- testing power converter voltages
- returning cards or assemblies for replacement or repair

Routine maintenance schedules

The operating company personnel perform routine maintenance procedures at normal intervals. Table 3-1 contains a list of routine maintenance tasks and their performance intervals.

Table 3-1 Schedule of routine maintenance tasks for single-shelf PMs

Performance interval	Maintenance task
2 weeks	Inspect the cooling unit filters. Test or replace the filters if required.
1 month	Test wrist-strap grounding cords.
1 month	Test the dead system alarm for DRAM.
3 months	Replace the cooling unit filters.
3 months	Test power converter voltages.
As required	Return cards or assemblies for replacement or repair.

4 Single-shelf PM related logs

This chapter identifies logs that associate with single-shelf peripheral modules (PM). For additional information, refer to ***Log Report Reference Manual***.

The DMS-100 switch software uses logs to record all important events that occur. The DMS-100 switch uses logs to make these events visible to the operating company personnel at the MAP terminal. An equipment fault, a change in state of equipment, and the failure or completion of a test are examples of important events. The log system in the DMS-100 switch software creates a report that contains the information. The log system in the DMS-100 switch software stores the report in data store (DS) for online retrieval. When the report is in DS, the log system distributes the report to a minimum of one output device. The output device displays the report.

Log reports appear in the order that the reports occur. The log prioritizing feature displays the log reports that begin with the highest alarm level first.

The system generates PM reports when the following occurs:

- a PM with a fault condition
- a PM state changes
- a PM passes or fails a test

PM logs 179 and 180 are the most important PM maintenance logs. A change in the PM state generates these logs. Table 0-1 describes the causes for these important logs. This table provides descriptions of additional logs. Table 0-1 shows the correct actions operating company personnel can follow in response to the logs.

Table 0-1 Single-shelf PM related logs

Log name	Causes	Response
PM106	The PM returned to service.	Do not take action.
PM110	A change occurred in the carrier service count level.	If the limit clears, there is no response. If the maintenance limit is set, perform facility maintenance. Use operating company facility maintenance and repair manuals for digital trunks. ***Note:*** Frame loss Maintenance Limit (ML) and slip loss ML do not clear automatically, thus no PM110 Clear message is output. They are cleared at 2400 hours each day by an audit. This is confirmed when a log PM186 Audit Clear message is output. They are also cleared whenever a link is RTS'd. The frame loss ML and slip ML conditions are meant to be an early warning of a potential problem. Generally, you will want this to be reported a couple of times before taking any action. A single report requires only noting and no action. If the out-of-service limit is set, deload trunks and perform facility maintenance.
PM126	The switch encountered a hardware exception.	Retain for trend analysis. A higher level of maintenance personnel uses this log to troubleshoot maintenance trunk module (MTM) hardware conditions.
PM179	A hardware condition affected normal PM operations.	Refer to ***Log Report Reference Manual*** for problems and responses indicated by this report.

Table 0-1 Single-shelf PM related logs

Log name	Causes	Response
PM180	The switch encountered a PM software exception, or the wrong execution of software.	Retain for trend analysis. Software experts use this log to troubleshoot software defects.
PM186	A change occurred in the carrier service count level, and a threshold reached.	If a limit clears, do not take action. If the maintenance limit is set, perform facility maintenance. If the OOS limit is set, deload trunks if necessary and perform facilities maintenance.

5 Single-shelf PM related operational measurements

This chapter lists the operational measurement (OM) group names that associate with single-shelf peripheral modules (PM). For information on OMs, refer to *Operational Measurements Reference Manual*, *Basic Administration Procedures*, 297-1001-300, and *Service Problem Analysis Administration Guide*, 297-1001-318.

The OMs are data that contain records of events during a given time period. Three types of measurements are as follows: peg counts, use, and overflow. You can use OMs as service-level indicators. You can use OMs as input for maintenance, hardware and software assignment, accounting, and provisioning decisions.

Table 5-1 lists the OM groups for single-shelf PMs.

Table 5-1 Single-shelf PM OM groups

PM Type	OM Groups
Digital carrier module (DCM)	DCM, PM, PMTYP
Digital recorded announcement machine (DRAM)	ANN
Maintenance trunk module (MTM)	TM, PM
Office alarm unit (OAU)	not applicable
Service trunk module (STM)	TM
Trunk module with 2-wire circuits (TM2)	TM
Trunk module with 4-wire circuits (TM4)	TM
Trunk module with 8-wire circuits (TM8)	TM
Trunk module with 8-wire circuits and with MTA bus (TM8A)	TM

Table 5-2 lists the OM groups and identifies the logs that associate with the OM groups.

Table 5-2 Single-shelf PM OM groups overview

Group	Information
DCM	**Description:** Provides maintenance measurements for DCMs. **Associated logs:** There are no associated logs
PM	**Description:** Counts errors, faults, and maintenance state changes for DMS switch PMs with node numbers. **Associated logs:** NET101, NET102, PM100,PM101, PM102, PM107, PM108, PM109, PM114, PM115, PM116, PM117, PM118, PM119, PM122, PM124, PM125, PM126, PM128, PM152, PM180, PM181, PM183, and PM185
PMTYP	**Description:** Counts the PM errors, faults, and system and manual busy states for a group of PMs of the same type. **Associated logs:** NET101, NET102, PM101, PM102, PM107, PM108, PM109, PM110, PM113, PM114, PM115, PM116, PM117, PM118, PM119, PM122, PM124, PM125, PM126, PM128, PM180, PM181, PM183, PM185, PM190, and PM192
PM1	**Description:** Counts errors, faults, and system and manual busy states for single unit PMs without node numbers. **Associated logs:** ISDN104, PM190, PM192, PM194, PM198, and PM199
TM	**Description:** Counts errors, faults, and maintenance state changes for TMs and MTMs. **Associated logs:** There are no associated logs

6 Single–shelf PM related data structures

Data structures do not apply to the problem solving and the maintenance of single–shelf peripheral modules (PM).

7 Single–shelf PM related user interface commands

This chapter describes how maintenance personnel can use the MAP terminal to support a single–shelf peripheral module (PM). This chapter describes correct MAP levels, system status displays, menu commands, and nonmenu commands.

The following list contains a description of the type of information in each section of this chapter.

- The section “MAP user interface” describes the MAP levels, command structure, and system status displays.
- The section “Menu commands” details the menu commands that support single–shelf PMs at the PM level.
- The section “Nonmenu commands” details the nonmenu commands that support single–shelf PMs at the PM level.

This chapter provides information about the MAP user interface and single–shelf PM commands. This chapter assists qualified maintenance personnel in the problem solving and the maintenance of single–shelf PMs. For additional information on single–shelf PMs, refer to *DMS–100 Family Commands Reference Manual*, 297–1001–822.

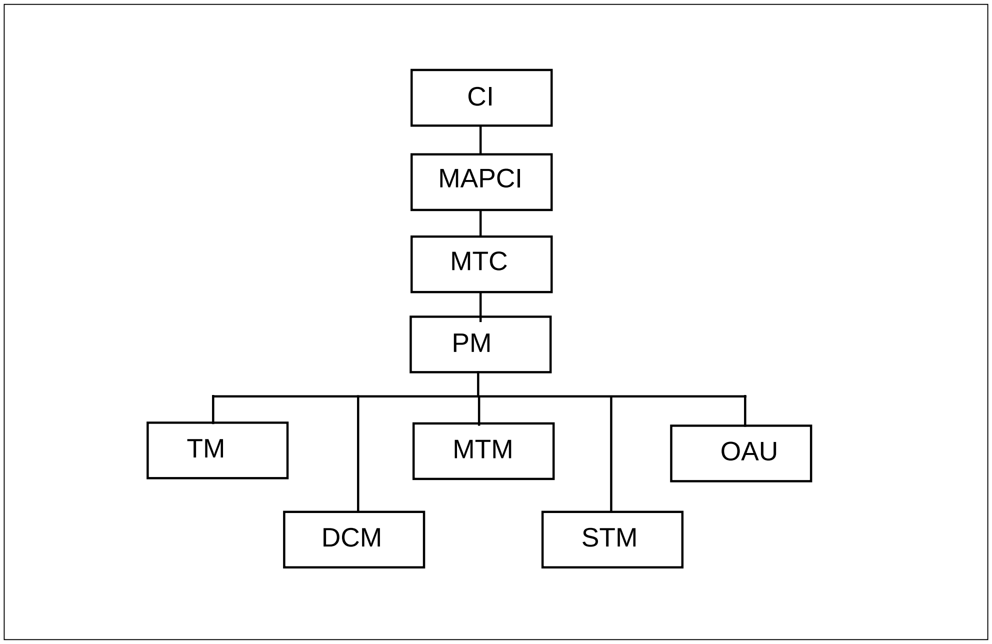
MAP user interface

Information at the MAP terminal forms an ordered series of display levels that start at the command interpreter (CI) level. You can access the CI level automatically when you log on at a MAP terminal. At the CI level, the MAPCI command accesses the next highest level. From the MAPCI level, you can telescope into other levels.

Each level of the MAP system has a set of commands and system status displays. Each level can display and access information from a previous level. For example, you can use menu commands available at the PM level as nonmenu commands at the maintenance trunk module (MTM) level. As you access lower levels, the PM level status information display continues.

Figure 7-1 illustrates the MAP levels that support single–shelf PMs.

Figure 7-1 MAP levels for single–shelf PMs



An operating reference identifies single–shelf PMs at the MAP terminal. This reference includes a operating abbreviation of the PM type. This reference also includes a discrimination number that identifies the given PM of that type. Table 7-1 lists and describes the operating reference for each type of single–shelf PM. If you enter a QUERYPM command at the MAP terminal, the terminal displays a list of operating references for all PMs.

Table 7-1 Identifiers for single–shelf PMs (Sheet 1 of 2)

PM Type	Discrimination number range	PM
DCM	0 to 511	digital carrier module
MTM	0 to 2047	maintenance trunk module
OAU	0 to 2047	office alarm unit
STM	0 to 2047	service trunk module
TM2	0 to 2047	trunk module with 30 pairs (2–wire circuits) of conductors wired to the distribution frame (DF)

Table 7-1 Identifiers for single–shelf PMs (Sheet 2 of 2)

PM Type	Discrimination number range	PM
TM4	0 to 2047	trunk module with 60 pairs (4–wire circuits) wired to the DF
TM8	0 to 2047	trunk module with 120 pairs (8–wire circuits) wired to the DF
TM8A	0 to 2047	trunk module with 120 pairs (8–wire circuits) wired to the DF with metallic test access (MTA) bus for access to CCITT circuits

System status display

The first three lines of the system status display are common across all levels of the MAP system.

The lines of the system status display identify the following:

- the maintenance state of the subsystem that has faults
- the number of PMs in the maintenance state
- the alarm code for the maintenance state

In the event of multiple faults, the system status display identifies only the most important fault.

At the PM level, the system status display provides additional information on PM links and nodes. For single–shelf PMs, the codes at the PM level are identical to the codes at the main level.

Table 7-2 describes the maintenance states for single–shelf PMs.

Table 7-2 Maintenance states for single–shelf PMs (Sheet 1 of 2)

PM state	Code	Description
Central side busy	CBsy	The PM cannot communicate with the CC. The DS30 links, which carry messages between the PM and the DMS–100 switch network, are not available.
In service	InSv	The PM is free of service–affecting faults and can support any intended process, for example call processing.

Table 7-2 Maintenance states for single–shelf PMs (Sheet 2 of 2)

PM state	Code	Description
In service trouble	ISTb	The PM is in service (InSv) and has a minor fault.
Manually busy	ManB	The PM is busy because the switch operator issued the BSY command. The BSY command allows commissioning testing, or holds the PM out of service (OOS) temporarily.
Off–line	OFFL	You removed the PM from service.
System busy	SysB	System maintenance removes the PM that has faults from service.

Refer to Chapter 9, "Single-shelf PM problem isolation and correction," for information on alarm codes for single–shelf PMs.

Circuit location display

System status displays that show the location of circuit cards use a standard display format. The basis for this display format is the DMS–100 Family equipment identification scheme. When the circuit location display is part of the response to a failed test, the circuit cards appear in order. The cards appear in order of the cause of the fault. A recommended sequence of replacement appears for the circuit cards.

If the fault lies in the line or trunk interface circuits, the PM subsystem does not maintain the cards. Fault indications appear under the lines (LNS) or trunks (TRKS) subsystems.

Menu commands

Each level of the maintenance system for single–shelf PMs supports a menu of commands. Each menu appears at the left side of the system status displays. These commands are numbered. These commands can include parameters. An underscore that follows any menu item indicates that the entry requires a parameter. An underscore that precedes a menu item indicates an optional parameter.

Enter the menu commands at any MAP level by following either of these procedures:

- use the number that precedes the menu item
- use entire item name

A space precedes the menu item number when you respond to a command prompt.

If a problem occurs when you enter a command, type ABORT, press enter and reenter the original command. For information about the syntax and parameters of a command, type HELP and the name of the command and press enter. If an error occurs, the following message appears:

Example of a MAP display

```
EITHER INCORRECT OPTIONAL PARAMETER(S) OR TOO MANY PARAMETERS
```

A description of the error follows the message.

Table 7-3 lists and describes PM–level menu commands that support single–shelf PMs. The HELP command at the MAP terminal provides a description of the syntax for each command.

Table 7-3 Menu commands for single–shelf PMs (Sheet 1 of 2)

Command	Action	Description of action
BSY	busy	Busies a posted PM to the manually–busy (ManB) state from any other PM state.
DISP	display	Displays a list of posted PM types, which are in a specified maintenance state.
LISTST	list set	Lists the discrimination numbers of the posted PM types.
LOADPM	load PM	Loads peripheral program files into the processor of a posted PM. Manually busy the PM before you enter LOADPM.
NEXT	next	Posts the next PM number of the set of posted PMs.
OFFL	off–line	Changes the state of a posted PM from manually busy to offline. You removed the PM from service.
POST	post	Selects the menu and display that correspond to the PM or PM state. Posts a given PM, all PMs in a specified state, or PMs as a group.

Table 7-3 Menu commands for single–shelf PMs (Sheet 2 of 2)

Command	Action	Description of action
QUERYPM	query PM	Displays information about a posted PM that includes location, node number, associated peripheral load name, and at times associated faults.
QUIT	quit	Changes display to the next higher level.
RTS	return to service	Changes the state of a posted PM from manually busy or system busy to in–service.
TRNSL	translate	Identifies either P–side or C–side link information of a posted PM.
TST	test	Invokes test routines on a posted PM or its P–side or C–side links.

Nonmenu commands

Table 7-4 lists the PM–level nonmenu commands that support single–shelf PMs. The HELP command at the MAP terminal provides a description of command syntax.

Table 7-4 Nonmenu commands for single–shelf PMs

Command	Code	Description
CLR	clear	A nonmenu command clears the ISTb state of the random access memory parity (RAMP). The state remains until you load the PM again.

8 Single–shelf PM related card requirements

This chapter provides information on card replacement procedures for single–shelf peripheral modules (PM). For additional information, refer to “Card Replacement Procedures”.

Circuit card removal and replacement procedures

Circuit cards with single–shelf PMs do not have special procedures for removal and replacement.

Other equipment removal and replacement procedures

Equipment other than circuit cards does not have special procedures for removal and replacement.

9 Single-shelf PM problem isolation and correction

This chapter provides descriptions of procedures, which correct problems in single-shelf peripheral modules (PM). The chapter describes problem isolation tests and diagnostic tests. These tests support single–shelf PMs.

This chapter provides information to assist qualified maintenance personnel in problem solving and maintenance of single-shelf PMs. For additional information, refer to the following documents:

- *Alarm and Performance Monitoring Procedures*
- *Operational Measurements Reference Manual*
- *Log Report Reference Manual*

Problem solving procedures

Fault condition indicator

Indications of fault conditions are as follows:

- operational measurements
- log reports
- alarms

Operational measurements

An operational measurement (OM) can monitor and count events in the system. The OM detects current and potential system problems. Use the OM thresholding to monitor and report key PM activity. Make these reports as a routine (daily or weekly). These reports are the primary method of problem detection.

Log reports

Use logs as tools of analysis. Logs provide information on call errors, diagnostic results, and system status. Logs are good indicators of fault conditions. Logs can detect the following fault conditions:

- sudden increase in volume of logs
- message not printed reports
- large number of like logs

Alarms

Audio and visual alarms indicate the requirement of correcting action. Correct system maintenance and the use of OMs and logs can minimize the occurrence of alarms.

The level of the alarm indicates if the alarm is critical. The level of the alarm also indicates the need for correcting action. Table 9-1 describes alarm codes.

Table 9-1 Alarm codes

Alarm	MAP display	Description
Critical	(*C*)	Indicates a service outage or potential service outage.
Major	(M)	Indicates a service degrading, threatening condition.
Minor	(blank)	Does *not* affect service.
None	•	The system functions correctly.

Follow the guidelines when you respond to alarms. The guidelines are as follows:

- The MAP terminal can display more than one critical alarm. If this condition occurs, clear the alarms from the left side of the screen to the right side of the screen.
- If a critical alarm occurs while you are fixing an alarm, respond to the new alarm. Do not continue attempts to clear the less critical alarm.

Locating and clearing faults

Use the following standard problem solving procedure to locate and clear faults:

1. The system causes an audio alarm. Silence the audio alarm when the system detects alarm conditions.
2. To isolate the fault, read status displays and trace the fault codes to the menu level.
3. To remove system access to the component that has faults, busy the hardware. This procedure allows you to perform maintenance activity without system interference.
4. Test the component that has faults and identify the card you will replace. Replace the card that has faults and test the card again.
5. Return the hardware to service.

TM, MTM, STM, DRAM, and OAU faults

Handling a control card that has faults

Use the following procedure to handle a control card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

Handling a group CODEC card that has faults

Use the following procedure to handle a group CODEC card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

Handling a defective network interface card

Use the following procedure to handle a defective network interface card:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.

3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

Handling a processor card that has faults

Use the following procedure to handle a processor card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

DCM faults

Handling a control card that has faults

Use the following procedure to handle a control card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

Handling a messaging card that has faults

Use the following procedure to handle a messaging card has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Power up the shelf.
4. Replace the card that has faults.
5. Turn on the shelf.
6. Load the PM.
7. Return the PM to service.

Handling a defective network interface card

Use the following procedure to handle a defective network interface card:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.
4. Load the PM.
5. Return the PM to service.

Handling a processor card that has faults

Use the following procedure to handle a processor card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Power down the shelf.
4. Replace the card that has faults.
5. Power up the shelf.
6. Load the PM.
7. Return the PM to service.

Handling a signaling card that has faults

Use the following procedure to handle a signaling card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Power down the shelf.
4. Replace the card that has faults.
5. Power up the shelf.
6. Load the PM.
7. Return the PM to service.

Handling a tone card that has faults

Use the following procedure to handle a tone card that has faults:

1. Post the PM with a card that has faults.
2. Manually busy the PM. If the PM is ManB, consult with maintenance personnel to determine why the PM is ManB.
3. Replace the card that has faults.

4. Load the PM.
5. Return the PM to service.

Fault isolation tests

Qualified maintenance personnel follow standard problem solving procedures to isolate faults in single-shelf PMs.

If defects appear in both the PM and Trunks subsystems, troubleshoot the PM faults first. A SysB single–shelf PM generates a SysB fault in the associated trunks.

If a single-shelf PM is CBsy, troubleshoot the connection between the PM and the network. The fault lies in the connection and not in the PM.

Handling DS-1 link defect

The DMS switch automatically executes audits of DS-1 links. A detected fault condition on DS-1 links require maintenance action. Maintenance personnel use fault isolation tests to determine the component that causes the fault and to remove the fault condition. Maintenance personnel can report the condition to the correct maintenance support group. When troubleshooting DS-1 links, operating company personnel post the link at the CARRIER level of the MAP terminal. The operating company personnel enter the DETAIL command to obtain information on the link with the fault condition. The following paragraphs provide methods to handle a specified sequence of events:

> ***Note:*** The DS–1 link fault description does not include the MSB6 and MSB7 because the MSB6 and MSB7 do not interface with DS-1 links.

Overview of carrier maintenance

The operating company personnel can perform the following operations on DS-1 carrier links at the CARRIER level of the MAP terminal:

- detail information about a specified carrier
- display carriers in a specified state
- post a carrier or group of carriers
- protection switch a carrier

> ***Note:*** Protection switching does not apply to host office PMs.

When frame losses, slips, bipolar violations (BpV), or faults occur on a carrier, transmitted PM signals do not meet specifications. The DMS-100 switch monitors these signals. When PM signals do not meet specifications, operating company personnel peg OMs and increase the maintenance limit (ML) and out-of-service (OOS) limit. Steady frame loss or too many frame losses, slips, or BpV cause a carrier to be put OOS.

> ***Note:*** The operating company personnel use the SETACTION command at the MAP terminal to allow a carrier to be put OOS when the carrier exceeds its operating system (OS) limit. How operating company personnel use the SETACTION command does not prevent a carrier to be put out of service as a result of an excess of BpVs.

For information on the SETACTION command, refer to the *DMS–100 Family Commands Reference Manual*, 297–1001–822.

Isolated or intermittent faults, like frame losses, slips, or BpVs accumulate. The ML field on the MAP display updates when the isolated or intermittent faults reach the ML. This condition warns maintenance personnel of faults that occur on the carrier.

The system places a carrier SysB for a short period of time or for a permanent period of time. The length of time the carrier is SysB depends on the number of times the system returns the carrier to service.

The system places the carrier SysB for a short period of time if both of the following requirements are satisfied:

- A steady state alarm begins for a carrier, excess BpVs occur, or the carrier exceeds the OOS for frame losses or slips.
- The SETACTION command is in use with the carrier. The carrier does not exceed the OOS limit for RTS.

If a carrier exceeds its OOS limit for RTS, the system places the carrier SysB for a permanent period of time. The maintenance personnel must manually return the carrier to service.

Local carrier group alarm (LCGA) and remote carrier group alarm (RCGA) are the two DS-1 carrier alarms. The DMS-100 switch places a carrier OOS when an LCGA begins. The DMS-100 returns the carrier to service when the alarm clears and the frame is regained. The operating company personnel can place a limit on the number of times a carrier is RTS. This limit prevents a carrier from bouncing between SysB and InSv states. The default for the consecutive number of times the system can return the carrier to service is 255.

A carrier remains SysB for a short period of time until maintenance personnel return the carrier to service. The maintenance personnel can return the carrier to service by either of the following:

- manual action -- the tests of the RTS sequence pass and indicate that no faults persist in the carrier.
- system action -- when the carrier audit finds that no alarms persist in the carrier.

Manually return a carrier to service that is SysB for a permanent amount of time.

Table 9-2 shows the ML, OS, and audit interval defaults for frame losses, BpV, slips, and RTS.

Table 9-2 Maintenance limit, out–of–service limit, and audit interval carrier defaults

Item	ML	OS	Audit interval
Frame Loss	17	511	10.0 minutes
Slip	4	255	10.0 minutes
BpV	1 in 10^6	1 in 10^3	4.8 seconds
RTS	255	255	10.0 minutes

The DMS-100 switch counts frame losses, slips, BpV, and RTS for specified time or audit intervals. At the end of an audit interval, midnight to midnight, reset the counters to zero.

A count below 1 in 10^6 bits clears bipolar violation ML. A measured long-term count that falls below 1 in 10^5 bits clears the OS limit.

Diagnostic tests

Resident diagnostic tests are not present for single-shelf PMs.

Product exact test tools

Product exact test tools are not present for single-shelf PMs.

10 Single–shelf PM problem solving chart

Chapter 10 of this document provides a problem solving chart that summarizes the single–shelf peripheral module (PM) alarms. The chart summarizes the causes of the alarms and the procedures to clear the alarms. This chart serves as an overview for qualified maintenance personnel to use in problem solving and in maintaining single–shelf PMs. For additional information, refer to *Alarm and Performance Monitoring Procedures*.

TM, MTM, STM, DRAM, and OAU

Table 10-1 lists:

- the alarms
- the cause of the alarms
- the actions for a trunk module (TM)
- the maintenance trunk module (MTM) alarms
- the service trunk module (STM)
- the digital recorded announcement machine (DRAM)
- the office alarm unit (OAU) alarms

Table 10-1 Clearing TM, MTM, STM, DRAM, and OAU alarms (Sheet 1 of 2)

Alarm condition	Cause	Procedure
Critical	Network interface card, control card, peripheral processor card, power converter card, or C–side link that has faults.	1. Identify and post the SysB PM. 2. If critical or frame supervisory panel (FSP) alarm appears under EXT heading, go to EXT MAP level and check FSP alarm. 3. If FSP alarm associates with the PM that has faults, repair FSP alarm that has faults and test PM. 4. If no critical or FSP alarm, test PM. 5. If test fails, translate C–side of the PM. 6. If C–side links are SysB, check net link status. 7. If net link status is InSv, busy and test the PM. 8. If test fails, record card list and load PM. 9. If load fails, power down power converter or converters and replace first card from card list. 10. Turn on converter or converters, load the PM. If load passes, test and try to RTS PM. 11. If load fails and you replaced all cards, see if output voltages on converter or converters are within limits. 12. If load fails and you did not replace all cards, power down power converter, or converters. Replace the next card and see if output voltages on converter, or converters are within limits. 13. If voltages are correct, replace all cards on the card list and load the PM. If the load fails, contact your maintenance support group. 14. If voltages are wrong, replace the power converter, or converters and load the PM. 15. If load fails, replace all cards on the card list and load the PM. If the load fails again, contact your maintenance support group.
Major	There is no major alarm.	

Table 10-1 Clearing TM, MTM, STM, DRAM, and OAU alarms (Sheet 2 of 2)

Alarm condition	Cause	Procedure
Minor	Group CODEC card that has faults, or network interface card	1. Identify and post the ISTb PM. 2. Execute the QUERYPM command for the PM. 3. Perform an in service test on PM. 4. Return PM to service.

DCM

Table 10-2 lists alarms, possible causes, and procedures on Clearing digital carrier module (DCM) alarms.

Table 10-2 Clearing DCM alarms (Sheet 1 of 2)

Alarm condition	Possible cause	Procedure
Critical	There is no critical DCM alarm.	
Major	Message links have faults on both network planes	1. Identify the SysB PM. 2. Post and busy the DCM that have faults. 3. Test the DCM. 4. If NO WAI response from the MAP terminal, access net level of MAP terminal and display the links. 5. If the links have faults, busy and RTS the links. 6. Access the PM level, post, load, and RTS the DCM.
Major	circuit cards have faults	1. Identify the SysB PM. 2. Post and busy the DCM that has faults. 3. Power down the SysB DCM. 4. Replace the card with correct card replacement procedures. 5. Power up the DCM. 6. Load, test, and RTS the SysB DCM.

Table 10-2 Clearing DCM alarms (Sheet 2 of 2)

Alarm condition	Possible cause	Procedure
Minor	Message links that have faults on one network plane	1. Identify the ISTb PM. 2. Post the DCM that has faults. 3. Test the DCM. 4. If the test fails, access the net level of the MAP terminal and display the links. 5. If the link has faults, busy and RTS the link.
	DS–1 link has faults	1. Identify the ISTb PM. 2. Post the DCM that has faults. 3. Test the DCM. 4. If the test fails, access the carrier level of the MAP terminal, post the DCM, and display the links. 5. Use the TRNSL command to identify the P–side link. 6. Busy, test, and RTS the DS–1 link that has faults.

11 Single-shelf PM advanced problem solving procedures

This chapter describes advanced problem solving procedures to use in the maintenance of single-shelf peripheral modules (PM).

Advanced problem solving procedures

You must busy and test a damaged unit. As a result of the test, the MAP terminal displays a list of cards. The card at the top of the list is the cause of the unit problem. When you replace the problem card, test the first damaged card again. If the unit passes this test, the unit returns to service and the problem solving procedure is complete.

If problem solving procedures did not restore the unit to service, you will require the advanced problem solving procedures. Qualified operating company personnel can use MAP terminal responses from failed problem solving attempts to formulate a maintenance plan. The operating company personnel can use advanced step action procedures to repair a problem. This chapter describes these procedures.

Powering up a single-shelf PM

Use the following procedure to power up single-shelf PMs:

1 Post the single-shelf PM.

2 Set the switch on the power converter up to the ON position.

3 While you press and hold the reset button on the power converter, flip the correct circuit breaker up. Do not hold it up. Apply power to the single-shelf PM unit and the circuit breaker will stay ON. When a problem with the power occurs, the circuit breaker trips back down to OFF.

4 Busy the single shelf PM.

5 List the PMLOADS volume at the input/output device to return the (RTS) unit to service. To list the PMLOADS volume at the input/output device, type

>DSKUT;LISTVOL volume name ALL

where

volume name
is the volume that contains the PMLOADS

or with a Supernode switch enter the following:

>DISKUT;LV S00D

>LF S00Dvolume name

where

volume name
is the volume that contains the PMLOADS

An example of listing the PMLOADS with an NT40 switch follows:

>DSKUT;LISTVOL DOOOXPM ALL

An example of listing the PMLOADS with a Supernode switch follows:

>DISKUT;LV S00D

>LF S00DPMLOAD

Note: You list the PMLOADS only one time.

6 To load the PM, type

>LOADPM

where

unit no
is the number of the PM unit

7 To test the PM, type

>TST

where

unit no
is the number of the PM unit

8 To return the PM to service, type

>RTS

where

unit no
is the number of the PM unit

Powering down a single-shelf PM

Use the following procedure to power down single-shelf PMs.

1 Enter the PM level at the MAP terminal.

2 Post the TM type or DCM peripheral.

3 To manually busy the PM, type

>BSY no

where

no
is the number of the peripheral module

4 To identify the C-side message links, type

>TRNSL C

5 Make the unit that you power down inactive. Busy one or more C-side links before you busy the PM unit that you posted in step 2.

6 Enter the network level and busy the port assigned to the link or links noted in Step 4.

—To enter the network level, type

>NET

—To identify the links, type

>LINKS pair

where

pair
is the network number

—To busy the network plane, type

>BSY plane link

where

plane
is the number of the network plane

link
is the number of the link that interfaces with the network plane

7 Enter the PM level again, and POST the single-shelf PM noted in step 2.

8 To identify the C-side links, type

>TRNSL C

(Note the status of the busied link.)

9 To remove the power from the busied single-shelf PM, set the switch on the power converter to OFF. You powered down the single-shelf PM. Repeat this procedure for the correct single-shelf PMs.

12 Dual-shelf peripheral modules

The *Peripheral Modules Maintenance Guide*, 297-1001-592, provides maintenance information on the peripheral module (PM) in the DMS-100 Family. The PM resides in the host office. This guide is for maintenance personnel with experience and offers background information to assist in problem solving and maintaining the PM.

This guide provides information on four types of PMs. The PMs are as follows: single-shelf PMs, dual-shelf PMs, the line concentrating module (LCM), and the link peripheral processor (LPP). Chapter 13 through 22 describe maintenance activities for dual-shelf PMs. Chapter 13 through 22 provide information on the following:

- Chapter 13, "Dual-shelf PM maintenance overview," describes the maintenance plan for dual-shelf PMs. This chapter describes the functions, potential fault conditions, and system actions that attempt to correct the fault conditions. This chapter explains when you can use manual maintenance procedures.
- Chapter 14, "Dual-shelf PM preventive maintenance methods," describes the routine maintenance procedures and schedules for dual-shelf PMs.
- Chapter 15, "Dual-shelf PM related logs.", identifies the logs that can be generated for dual-shelf PMs.
- Chapter 16, "Dual-shelf PM related operational measurements," identifies the operational measurement group names that associate with dual-shelf PMs.
- Chapter 17, "Dual-shelf PM related data structures," identifies the data structures that associate with dual-shelf PMs.
- Chapter 18, "Dual-shelf PM related user interface commands," describes how qualified maintenance personnel can use the MAP system to support dual-shelf PMs. This chapter describes appropriate MAP levels, system status displays, and menu commands.
- Chapter 19, "Dual-shelf PM related card requirements," provides background information on card replacement procedures for dual-shelf PMs.

- Chapter 20, "Dual-shelf PM trouble isolation and correction," provides descriptions of the procedures to correct defects in dual-shelf PMs. This chapter describes fault isolation and diagnostic tests that operating company personnel can use to support dual-shelf PMs.
- Chapter 21, "Dual-shelf PM problem solving chart," is a high-level table that lists symptoms of dual-shelf PM faults. The chart lists possible causes of these faults, and the actions taken to correct them.
- Chapter 22, "Dual-shelf PM advanced problem solving procedures," describes procedures to resolve more complex defects in dual-shelf PMs.

The following are dual-shelf PMs that these chapters describe:

- digital trunk controller
- line group controller
- line trunk controller
- message and switch buffers for common channel signaling

13 Dual-shelf PM maintenance overview

This chapter provides the complete maintenance method for two-shelf peripheral modules (PM). This chapter provides qualified maintenance personnel with background information for problem solving and for maintaining the PMs.

The following is a list of the sections in this chapter. The list also contains a short description of the type of information in each section.

- The section "Functional description" describes the configurations, components, and cards of two-shelf PMs. This section describes the way two-shelf PMs interact with other DMS-100 Family components.
- The section "Problem conditions" describes the hardware and software faults that are possible in two-shelf PMs and related components.
- The section "Automatic maintenance" describes the actions the system performs to find and repair the faults.
- The section "Escalation to manual maintenance" describes the rational for handling maintenance manually.

Functional description

Peripheral modules (PM) are shelf-mounted or frame-mounted units. The PMs provide an interface between the network modules (NM) and analog, or digital transmission facilities, service circuits, or secondary PMs. Several types of PMs must adapt the characteristics of these different transmission facilities to the NM. The PMs can work separately or together to provide these services or offer other functions.

The two-shelf PMs described in this chapter are duplicate PMs that contain two units: an active unit and an inactive unit. Separate shelves contain each unit. Each unit is identical to its mate. Each unit can support call processing and system control.

The units operate in hot standby configuration in the two-shelf PMs. One unit is active while the mate unit is on standby. The active unit gives control to the mate unit when the system detects a fault on the active unit. This unit maintains control of all central side (C-side) and peripheral side (P-side) links. Each unit of the two-shelf PMs is identical.

The XMS-based peripheral modules (XPMs) is the name of two-shelf PMs. The XPMs use the Motorola 68000 microprocessor and system software written in Bell-Northern Research Pascal. The XPMs have two processors in a hot-standby configuration: a master processor (MP), and a signaling processor (SP).

The line concentrating module (LCM) is a two-shelf PM that is not an XPM. The LCM has two units that operate in load-sharing mode. The description of the LCM begins on page 5-1 of this document.

Digital trunk controller

The digital trunk controller (DTC) uses digital trunk circuits to connect DS30 links from the network. The DTC performs the following primary functions:

- interfaces digital trunking
- provides for call processing functions that include:
  - message transmission and reception from the network
  - time switch control
  - channel supervisory message (CSM) reception and transmission
  - digit collection
  - channel assignment
  - description of computing module (CM) messages
  - AB bit scanning
  - bipolar violations and slips monitoring
  - Common Channel Interoffice Signaling (CCIS) support

Types of DTCs include:

- Austrian digital trunk controller (ADTC) for Austrian offices
- digital trunk controller offshore (DTCO), that supports pulse code modulation (PCM)-30
- digital trunk controller ISDN (DTCI)
- digital trunk controller for CCS7 (DTC7), that supports CCS7 services
- international digital trunk controller (IDTC), that operates with the digital trunks other than North American DS-1 digital trunks. The IDTC also supports the PCM-30 transmission method.
- PCM-30 digital trunk controller (PDTC), that also supports PCM-30

The IDTC and PDTC have different software loads than the DTC. The PDTC supports A-law to Mu-law conversion. This conversion process makes sure that the PDTC and the IDTC can interface with the international industry.

Line group controller

The line group controller (LGC) connects DS30 links from the network to line concentrating modules (LCM). The LGC performs the following primary functions:

- digital interface between auxiliary PMs and the network. The auxiliary PMs include:
  - LCM
  - remote line concentrating module (RLCM)
  - remote switching center (RSC)
  - outside plant module (OPM)
- provides for non-concentrating or concentrating configurations
- provides for call processing functions that include:
  - message transmission and reception from the network and auxiliary PMs
  - first-come first-serve subscriber support
  - generation of supervisory tones
  - channel supervision message (CSM) reception and transmission
  - time switch control
  - digit collection
  - channel assignment for P-side ports
  - business set function key description
  - description of CM messages

Types of LGCs include:

- international line group controller (ILGC). The ILGC uses the international message card
- line group controller ISDN (LGCI)
- PCM-30 line group controller (PLGC)

> ***Note:*** The ILGC and the PLGC support PCM-30. The ILGC and the PLGC do not support DS-1 signaling and have different software loads from the LGC.

Line trunk controller

The line trunk controller (LTC) is an LGC and a DTC. The LTC provides all services of both these PMs. The LTC performs the following primary functions:

- support for trunks and lines
- digital interface between auxiliary PMs and the network. The auxiliary PMs include the LCM, RLCM, RSC, and OPM.
- provides for non-concentrating or concentrating configurations
- provides for call processing functions that include:
  - message transmission and reception between the network and auxiliary PMs
  - dedicated channels into the network for subscribers
  - generation of supervisory tones
  - CSM reception and transmission
  - time switch control
  - digit collection
  - channel assignment for P-side ports
  - business set function key instruction
  - instruction of CM messages

Types of LTCs include:

- international line trunk controller (ILTC), that supports PCM-30
- line trunk controller ISDN

Message and switch buffer

A message and switch buffer (MSB) works with a signaling terminal (ST). An MSB connects to and operates in a CCS environment. Two MSBs are present: MSB6 supports CCS6 services, and MSB7 supports CCS7 services.

The MSB6 and MSB7 perform the following primary tasks:

- interface with common channel signaling (CCS) environment
- control movement of messages between offices that form the signaling section of a call
- associate signaling information carried on CCS signaling link with the voice and data carried on the CCS trunks
- support ST
- route all CCS messages received from ST through the network to the DTC

The MSBs have different configurations, commands, and maintenance requirements than other two-shelf PMs. For additional information on MSBs, refer to page 13-33 in this guide.

Configurations

LGC, LTC, DTC configurations

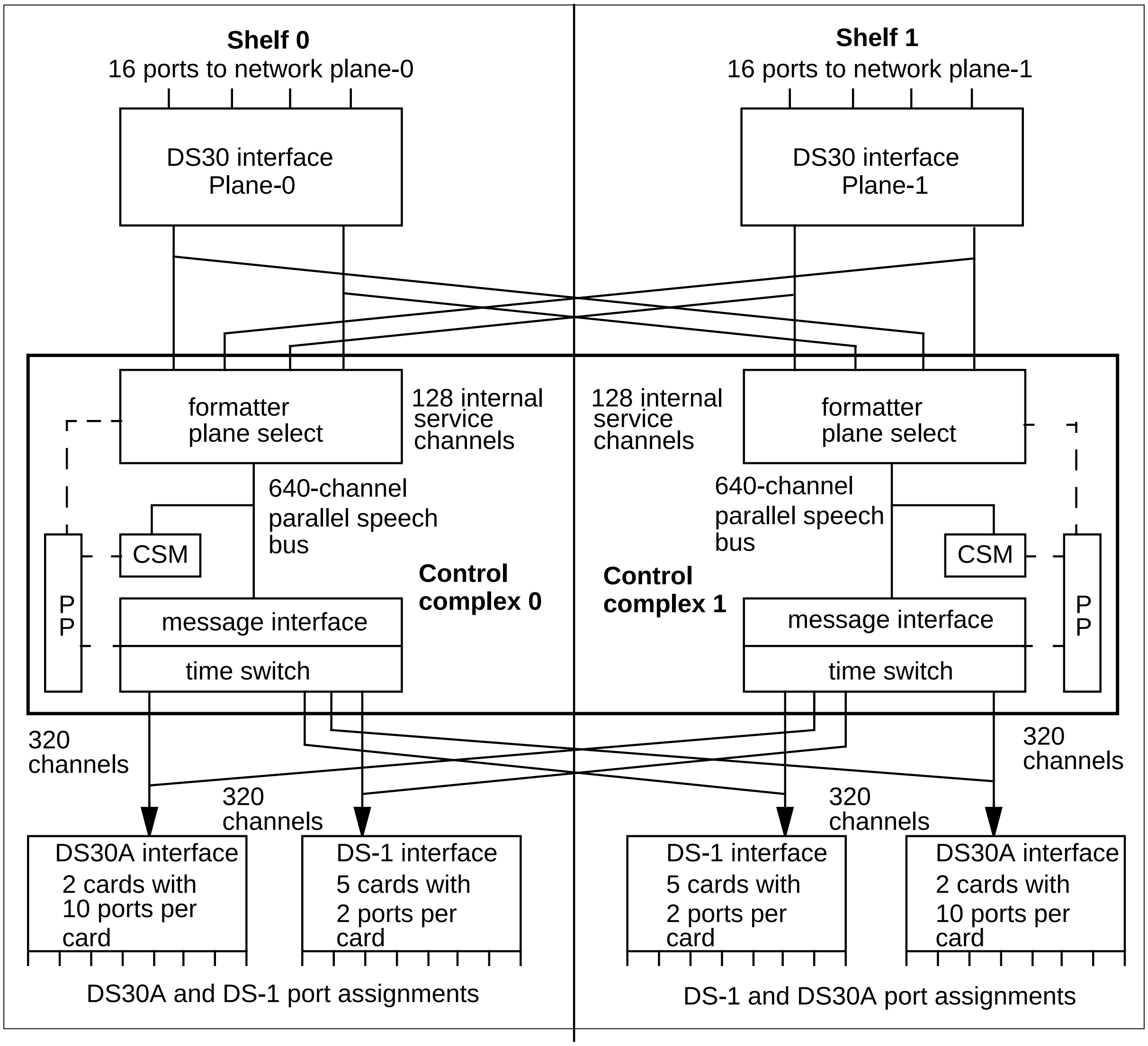
The LGC, LTC, and DTC have common configurations. In addition to the hot standby configuration of the units, the PMs provide interface between C-side and P-side links.

Other common characteristics include the following:

- a common control complex with master processor
- message and signaling processor
- associated memory
- a standard shelf and panel arrangement

Figure 13-1 illustrates the configuration of the two-shelf PMs.

Figure 13-1 LGC, LTC, and DTC common configuration



The network uses a maximum of four pairs of DS30 links to connect to the PMs. These links connect to two DS30 interface cards, one in shelf 0 and one in shelf 1. A single card supplies four DS30 ports that provide a maximum of eight ports on a completely equipped module. Four ports are for network plane 0 and four ports are for plane 1. The network distributes port assignments between the two DS30 cards. The network assigns even-numbered links to plane 0 and odd-numbered links to plane 1. Interface with the network requires a minimum of three ports for each PM (three pairs of duplicated links).

Each DS30 card synchronizes the incoming information in the PM. The DS30 card provides 128 (4 x 32) channels for each plane to the formatter cards in units 0 and 1. The formatter card provides a duplicated path through the currently active control complex.

CSM card

The CSM card is a 40-bit message card that contains 24 synchronization bits, eight integrity bits, and eight data bits. The complete message transfers over a minimum of 40 frames. The integrity bits must match between the PM that sends the CSM and the PM that receives the CSM. The CM informs the PM that receives the CSM of the expected integrity value. The integrity check makes sure that a correct path between the PMs is present. The 8-bit data byte contains data about call setup, maintenance, and other PM data.

Time switch card

The time switch card receives pulse-coded modulation (PCM) speech data. The time switch card switches the speech data to the correct P-side ports and channels. The P-side ports and channels function under the instruction of the signaling processor card.

The time switch adds the following from the message and tone card to the appropriate channels on the DS-1 links:

- A- and B-signaling bits
- tones
- system control messages

DS-1 interface cards

The DS-1 interface cards convert the PCM speech data from parallel to serial data and transmit the data to the far end. The DS30A cards also transmit data to an auxiliary LCM.

NTSX05AA processor

The NTSX05AA processor is a next generation processor for the XPM and CPM platforms. The NTSX05AA processor

- provides improved real time call processing and memory resources
- handles more simultaneous call attempts than earlier processors
- supports fast recovery from failures and short outage times during software upgrades with peripheral remote loader (PRL) memory
- contains 64 Mbytes of random access memory (RAM)
- uses plug-in Personal Computer Memory Card International Association (PCMCIA) interface cards referred to as "packlets”
- has a front panel access door for installation and removal of packlets

  The front-panel access door enables "hot" installation and removal of the cards, under power, without the need to remove the NTSX05AA processor card. However, the XPM or CPM must be in the ManB state before removing or inserting PRL cards. When pressed, the ejector buttons release the packlet that requires replacement.

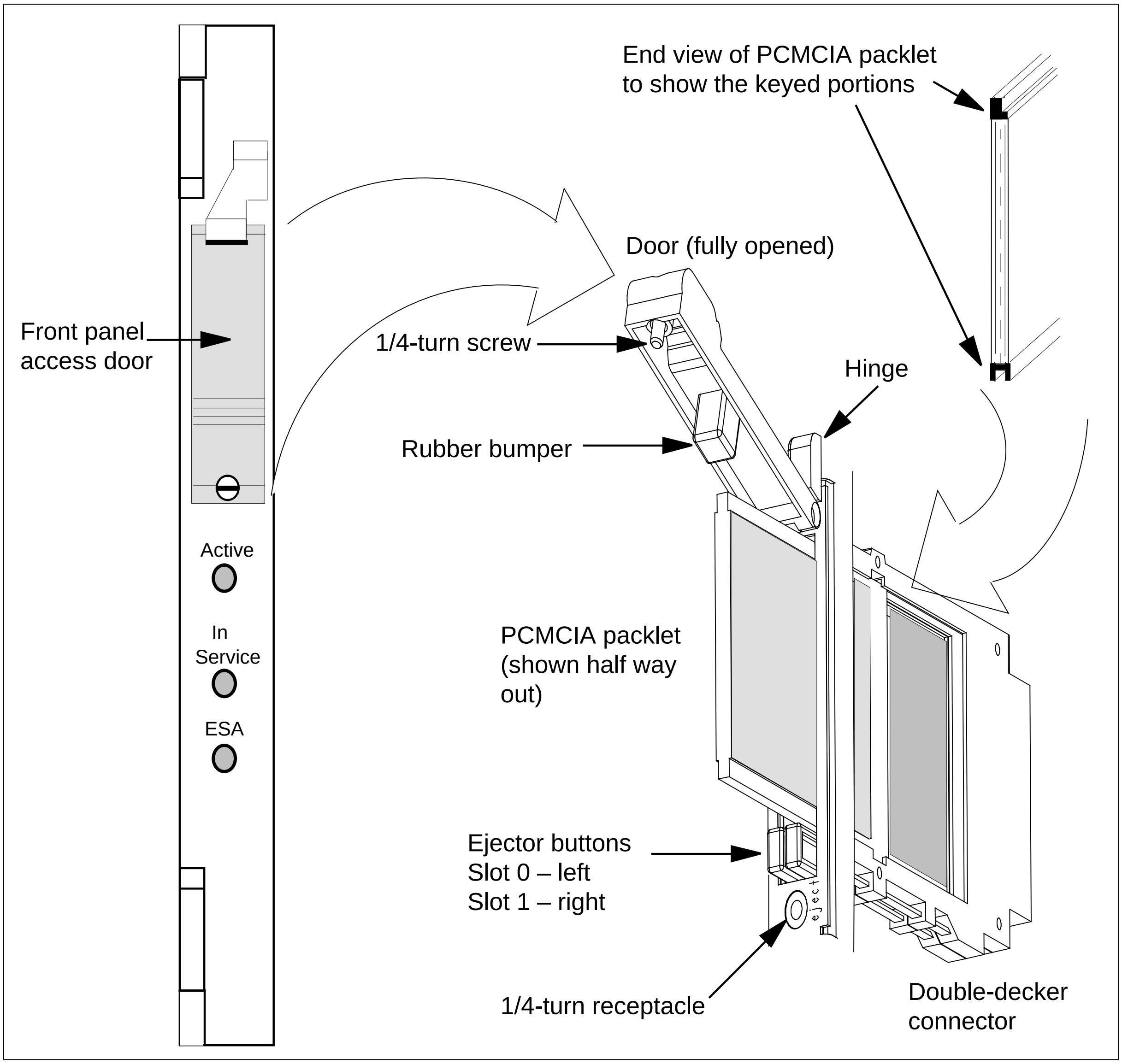
- contains three light emitting diodes (LED) on the faceplate that identify the state of the unit where the NTSX05 is located. The LEDs identify if the unit is
  - — active
  - — in service
  - — in emergency stand-alone (ESA) mode

Like other processor cards, you must enter the NTSX05 in the appropriate peripheral module (PM) inventory table, such as table LTCINV. The PROCPEC field in the inventory table identifies the processor card and additional packlet resources for the PM.

> ***Note:*** The existing NT7X05 PRL card is not compatible with the NTSX05 processor, because the NTSX05 has an on-board PRL capability using packlets.

The following figure shows the NTSX05 processor card front panel, front panel access door, and PCMCIA packlets.

Figure 13-2 NTSX05AA processor card



NTSX06 PRL packlet

The NTSX06 PRL packlets conform to the PCMCIA standards.

The NTSX06 packlets are installed in the two front-access receptacle slotlets in the faceplate of the NTSX05 processor card. Each slotlet can contain one of the following three packlets:

- NTSX06AA filler packlet
- NTSX06BA 60Mbyte flash ROM packlet
- NTSX06CA 120Mbyte flash ROM packlet

> ***Note:*** If an NTSX05AA processor does not have a PRL card in a slotlet, install an NTSX06AA filler packlet. The NTSX06AA filler packlet maintains interconnect reliability in the NTSX05AA processor card.

When you install the first NTSX06BA or CA packlet in the NTSX05, update table LTCINV, field PROCPEC. This update to table LTCINV identifies that a PRL card is in the NTSX05 card for the PM. If the PM requires only one PRL card, Nortel recommends putting the PRL in slotlet 0. After entering PRL in table LTCINV for the PM, no other updates are required to upgrade from a BA to a CA or change from a CA to a BA packlet. To remove PRL capability from the PM, you must install the NTSX06AA filler packlet in both slotlets. In addition, update table LTCINV, field PROCPEC to remove PRL. For additional information on updates to table LTCINV, refer to the *Translations Guide*.

The following example shows an LTC with an SX05AA processor and a PRL memory packlet entered in field PROCPEC.

Figure 13-3 MAP display example for table LTCINV

```
LTCNAME
   ADNUM   FRTYPE   FRNO   SHPOS   FLOOR   ROW   FRPOS   EQPEC LOAD
EXECTAB
CSLNKTAB
OPTCARD
      TONESET      PROCPEC      EXTLINKS
                        E2LOAD
OPTATTR
   PEC6X40                        EXTINFO
___________________________________________________________________
   LTC  0
   1      LTE      0      32      2     A   18 6X02NA QLI10BQ
(POTS POTSEX) (KEYSET KSETEX) (ABTRK DTCEX) (RMM_TERM RSMEX)$
(1 48) (1  49) (1 50) (1 51) (1 52) (1 53) (1 54) (1 55) (1 56) (1 57)
(1 58) (1 59)$
(UTR17 ) (MSGMX76  HOST) (  ISP 16) $

NORTHAM SX05AA PRL $ SX05AA PRL $   0
                      SPPCSA01                                $
6X40AC                           N
```

When you install an NTSX06 packlet in the NTSX05, the switch records the location of the packlet. The switch also displays the location of the packlet along side the slot number in a card list. In the example that follows, the NTSX05 is in slot 12 and the NTSX06 packlet is in slotlet 0 of the SX05.

```
Site Flr RPos  Bay_id  Shf  Description   Slot  EqPEC
HOST  01  N28  LTE  01  65   LTC :  000   12:0  SX06BA
```

When a problem occurs in an NTSX06 PRL packlet, the unit with the faulty NTSX06 goes ISTb. The system responds with the following message at the MAP terminal.

```
Flash fault detected.
```

Getting information about the NTSX05 and packlets

The system stores information about the NTSX05 processor card and the installed packlets. Enter the QUERYPM command at the PM MAP level, such as LTC or DTC level, where the NTSX05 is located. The responses give useful information to operating company personnel.

The QUERYPM command provides the following information when entered at the MAP terminal for a PM having an NTSX05 installed:

- QUERYPM - lists the name of the EEPRom Load is in the SPPCxxnn format, where xxnn is the version code, starting at SA01.

  Example of a MAP response

```
 QUERYPM
 PM Type: LTC  PM No.: 2  PM Int. No.: 0  Node_No.: 11
 PMs Equipped: 18  Loadname: QCL03AQ1  EEPRom Load: SPPCSA01
 WARM SWACT is supported but not possible: node redundancy
lost.
 LTC 2 is included in the REX schedule.
 REX on LTC 2 has not been performed.
 Node Status: {MAN_BUSY, FALSE}
 Unit 0 Inact, Status: {MAN_BUSY, FALSE}
 Unit 1   Act, Status: {MAN_BUSY, FALSE}
 Site Flr RPos  Bay_id   Shf  Description    Slot     EqPEC
 HOST  02  B02  LTE   02  18  LTC : 002              6X02AD
```

- QUERYPM CNTRS - lists the version code of the EEPRom load name. Both the executable and loadable EEPRom load version codes are displayed when the unit is at the ROM level.

Example of a MAP response

```
QueryPM  cntrs
Unsolicited MSG limit = 250, Unit 0 = 0, Unit 1 = 0
Unit 0:
QueryPM CNTRS command may take up to 2 minutes
Unit at ROM level
EEPRom Load: Loadable: SA01, Executable: SA01
UP:SX05AA
IP:BX01
Unit 1:
Ram Load: QLI07BG
EPRom Version: AC01
EEPRom Load: Loadable: SA01, Executable: SA01
UP:SX05AA
IP:BX01
```

- QUERYPM FLT - identifies non-critical faults that refer to the flash memory in the NTSX05 card when a PM is queryied for faults and an NTSX05 is installed.
- QUERYPM FILES - displays the load, image, and custom local area signaling service (CLASS) modem resource (CMR) files for up to two packlets on each unit. In addition, if the load file on the flash memory is bad or missing, the system response is `Unusble load file or file not found. Reload flash.`

  Example of a MAP response

```
QueryPM files
Unit 0:
 Slotlet 0:
   Flash Load  File: ECL07BI
   Flash Image File: ECL07BI
   Flash CMR File: CMR07A
 Slotlet 1:
   Flash Load  File: ECL07BG ** Mismatch **
   Flash Image File: ECL07BG ** Mismatch **
   Flash CMR File: CMR07A
Unit 1:
 Slotlet 0:
   Flash Load  File: ECL07BI
   Flash Image File: ECL07BI
   Flash CMR File: CMR07A
```

- QUERYPM CONFIG - this command provides operating company personnel information about the hardware configuration of an XPM. This command lists the PECs of the NTSX05 processor and the PCMCIA packlets located in either slotlet of the NTSX05. For PMs that do not have the NTSX05 installed, the response to entering this command is as follows.

Example of a MAP response

```
QueryPM config
UNIT 0   Request invalid. Unit does not have SX05 processor
UNIT 1   Request invalid. Unit does not have SX05 processor
```

When slotlets have PRLs installed the MAP response is as follows.

Example of a MAP response

```
QueryPM config
UNIT 0    Slot 12: SX05AA
  PCMCIA Slotlet 0: SX06CA
  PCMCIA Slotlet 1: No packlet
UNIT 1    Slot 12: SX05AA
  PCMCIA Slotlet 0: SX06CA
  PCMCIA Slotlet 1: No packlet
```

When there is a mismatch between the data in table LTCINV and what PRL packlet is installed in the NTSX05 slotlet, the response is as follows.

Example of a MAP response

```
QueryPM config
UNIT 0    Slot 12: SX05AA
  PCMCIA Slotlet 0: SX06CA
  PCMCIA Slotlet 1: No packlet
  PRL present in XPM but not datafilled
UNIT 1    Slot 12: SX05AA
  PCMCIA Slotlet 0: SX06CA
  PCMCIA Slotlet 1: No packlet
  PRL present in XPM but not datafilled
```

Daily audit of PRL file integrity

To ensure reliable PRL recovery for the SX06 packlets, the DMS-100 switch performs an audit every 24 hours. This audit reads each load and image file stored on flash to calculate the 32 cyclic redundancy check (CRC) and compare it with the CRC stored on flash for that file. If an error is detected, the switch will

- rename the file with the same name with a .BAD extension to prevent the recovery using a bad load or image file
- erase corrupt and out of date files
- output a PM777 log
- put the XPM in the ISTb state because of a PRL file that cannot be used

When you enter the QUERYPM FILES command, the system finds files with the .BAD extension and flags the files as corrupt on the MAP display

When a PM777 log is output, enter the XPMSTOR command. The XPMSTOR command downloads a new copy of the load file to the PRL.

XPM-Plus

The XMS-based peripheral module product life upgrade method (XPM-Plus) integrates the NTMX77 unified processor (UP) circuit pack card into the current XPM design. This upgrade method applies for domestic LGCs, LTCs, and DTCs and for the DTC7. The XPM-Plus also applies for the international PDTC, DTC, and line group controller offshore (LGCO) PMs.

The UP card replaces the NT6X45, NT6X46, and NT6X47 processor complex cards. The UP card provides increased memory, increased real time capacity, expandable memory, and decreased power use. This card contains flash memory chips. To upgrade these flash memory chips, download a firmware load. Two flash EEPROMs or banks are present on the card. The banks are 256K byte programmable chips. One bank is in the execute mode and the other is in the load mode. The EEPROM in execute mode executes random access memory (RAM). The EEPROM in load mode is a backup. The EEPROM in load mode becomes the EEPROM in execute mode if the EEPROM has faults in execute mode. You implement this process manually.

The BCS35 feature *Unified Processor Integration in the PDTC* integrates the UP card into the PDTC. This feature provides international CM and XPM software that supports the UP card in the PDTC. The Offshore DTCO (ODT) is the new software load.

DS-1 links

The DS-1 links connect the LGC and LTC to the remote PMs. The DTC interfaces with digital DS-1 trunks. The PMs provide a maximum of 20 DS-1 links.

The DS-1 links connect to the LGC, LTC, and DTC P-side through the DS-1 NT6X50 interface card.

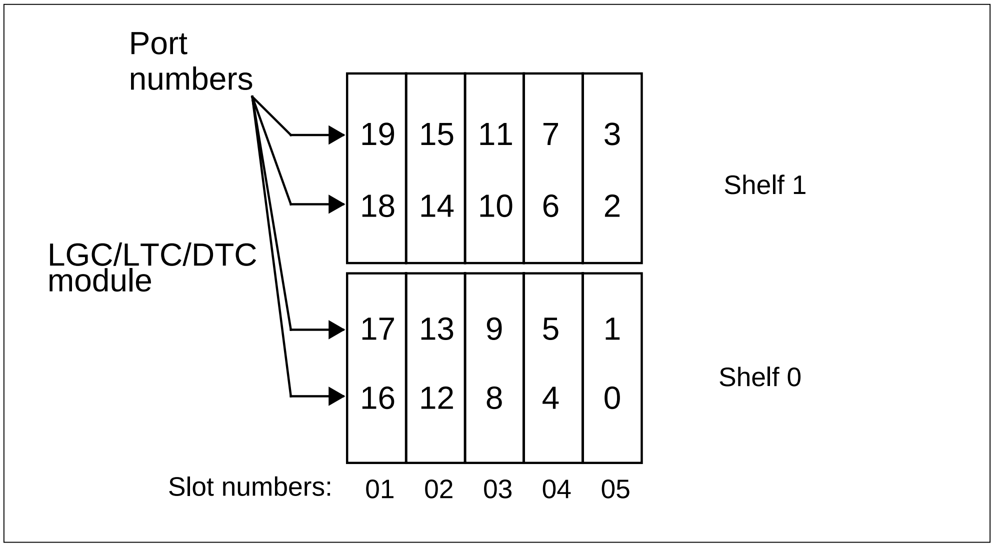
A different number of DS-1 interface cards equip each LGC, LTC, and DTC shelf. Each DS-1 card connects to the control coupler of both shelves. A maximum of five DS-1 interface cards are present on each shelf. Each interface card provides two DS-1 ports.

The following are the port assignments for each shelf:

- shelf 0: ports 0, 1, 4, 5, 8, 9, 12, 13, 16, and 17
- shelf 1: ports 2, 3, 6, 7, 10, 11, 14, 15, 18, and 19

Figure 13-4 shows the port assignments for each shelf.

Figure 13-4 DS-1 port assignments for LGC/LTC/DTC



The active unit controls all the DS-1 ports (0 to 19). A DS-1 link carries 24 channels. Each channel contains eight bits of PCM data.

PCM30 links

The PCM30 links connect the PDTC and IDTC to digital devices. The PMs provide a maximum of 16 PCM30 links.

The PCM30 links connect to PDTC and IDTC P-side through the NT6X27JA or NT6X27AA, AB, AC, BB PCM30 interface card.

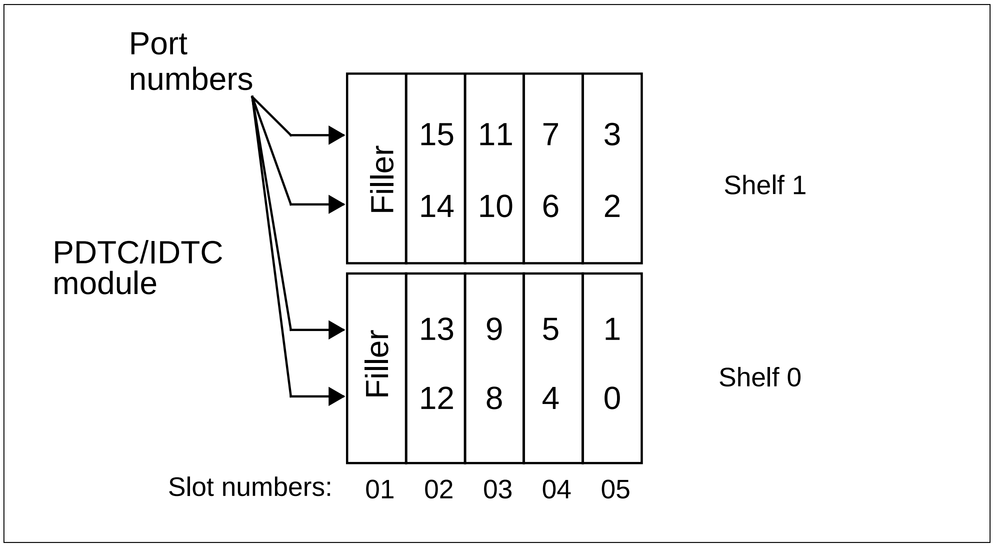
A different number of PCM30 interface cards equip each PDTC and IDTC shelf. Each PCM30 card connects to the control coupler of both shelves. A maximum of four PCM30 interface cards are present on each shelf. Each interface card provides two PCM30 ports.

The following are the port assignments for each shelf:

- shelf 0: ports 0, 1, 4, 5, 8, 9, 12 and 13
- shelf 1: ports 2, 3, 6, 7, 10, 11, 14 and 15

Figure 13-5 shows the port assignments for each shelf.

Figure 13-5 PCM30 port assignments for PDTC/IDTC



The active unit controls all the PCM30 ports (0-15). A PCM30 link carries 30 channels. Each channel contains eight bits of PCM data.

MSB6 and MSB7 configurations

The MSBs have a two-shelf configuration with an active and a standby unit. The MSBs interface between the ST and the network. The following are the three areas of MSB functions:

- signaling terminals (ST or STC) and interfaces (STI)
- MSB control complex
- DS30 interfaces to the network (MSB6 and MSB7) or DS30A interfaces to the ST

Figure 13-6 shows an MSB6 signaling terminal array (6STA) shelf configuration. The figure highlights the three MSB areas.

Figure 13-6 MSB6 6STA shelf

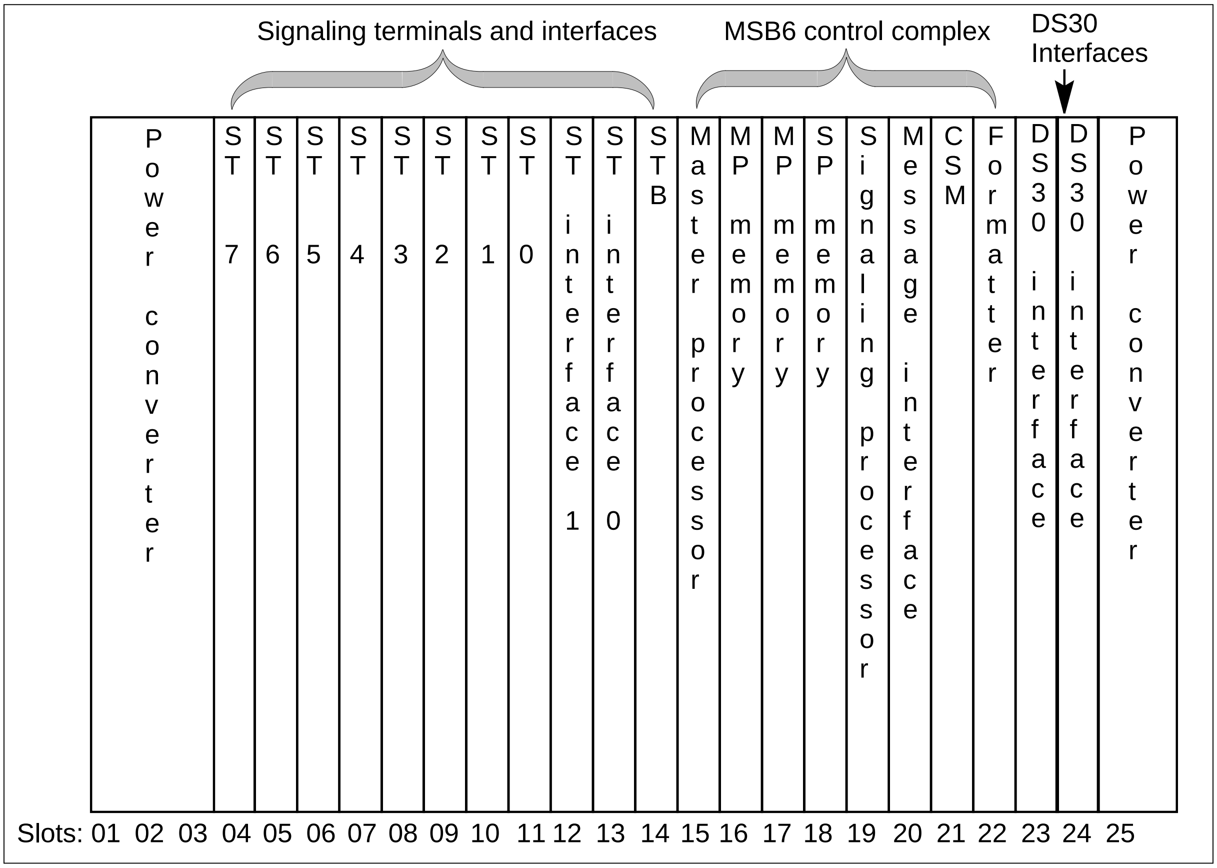
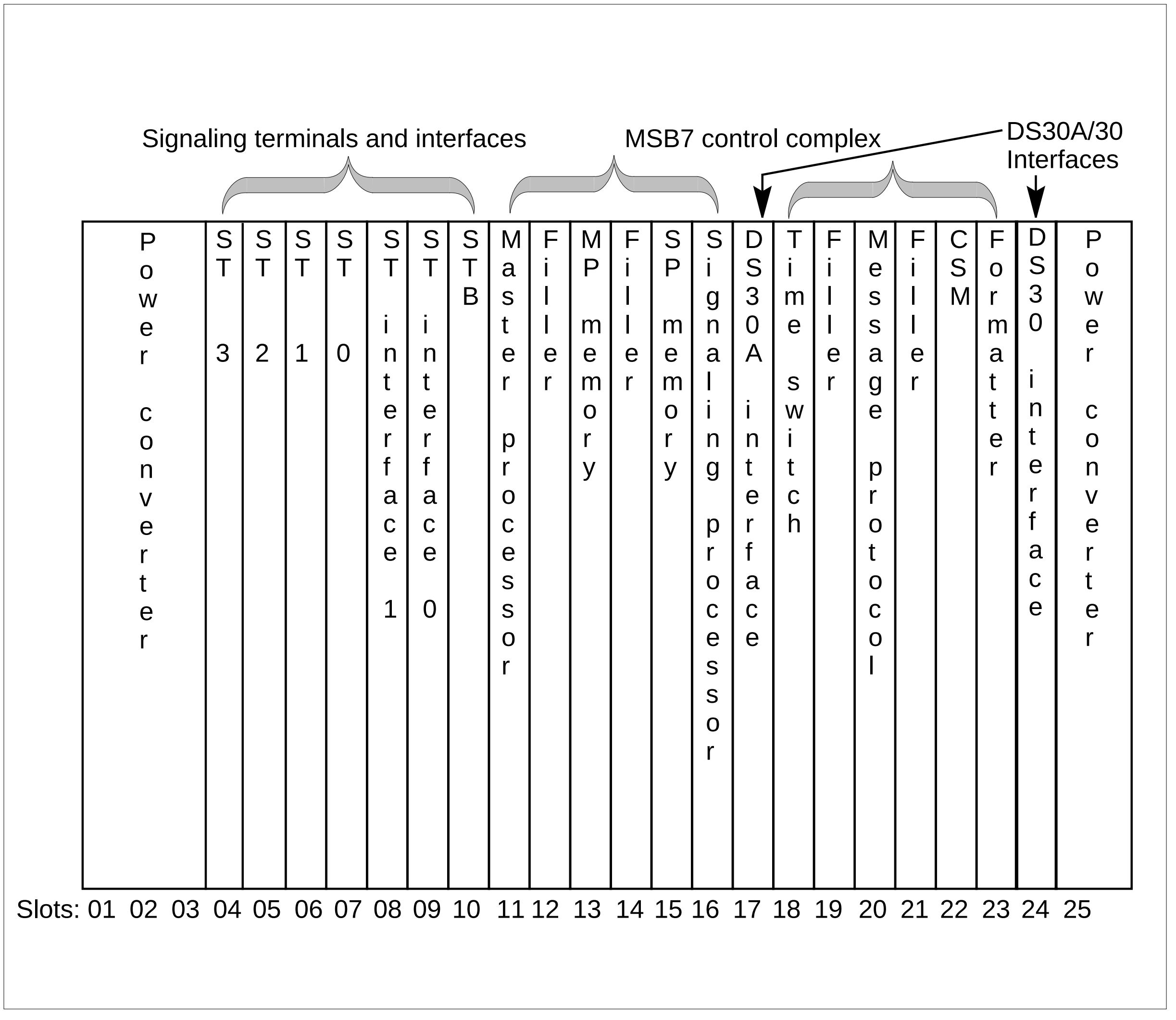


Figure 13-7 shows an MSB7 signaling terminal array (STA7) shelf. The figure highlights the three MSB areas. The DS30A divides the MSB7 control complex in the figure.

Figure 13-7 MSB7 STA7 shelf



Maintenance states

Each two-shelf PM has an assigned maintenance state. Commands entered automatically at the MAP terminal by the system or commands entered manually assign a maintenance state. Table 13-1 lists and describes possible two-shelf PM maintenance states.

Table 13-1 PM maintenance states

PM state	Code	Description
Central side busy	CBsy	The PM cannot communicate with the CM because the DS30 link or links are not available. The DS30 links carry messages between the PM and the DMS-100 switch.
In service	InSv	The PM does not contain faults that affect service and can support any intended process like call processing.
In-service trouble	ISTb	The PM is in service (InSv) but has a minor fault.
Manual busy	ManB	The PM is busy because the switch operator issued the Busy (BSY) command from the MAP terminal.
Offline	OffL	The switch operator removes the PM from service to allow commission testing. The switch operator holds the PM out of service (OOS) for a limited period of time.
System busy	SysB	System maintenance removes the PM from service because of faults.

The maintenance states and codes appear in this guide.

Internal messaging

A two-shelf PM uses intermodule communication (IMC) links to exchange information between the active and inactive units. The two IMC links are the NT6X69 message protocol (MP) card and the NT6X45 signaling processor (SP) card. The message protocol card is the primary IMC link in the PM. You can use the MP card for all types of IMC messaging between PM units.

Note: Use the SP IMC for maintenance and diagnostics.

The MP card is an IMC link that connects each unit. The IMC link exchanges the following:

- link status and connection information between the active and the inactive unit. This data allows the inactive unit to maintain calls that have stability if a switch of activity occurs.
- software loads and related data from the active to the inactive unit. The system uses software loads and related data when the C-side links on the inactive unit are down.
- maintenance and diagnostic messages from the CC to the inactive unit when message links to the inactive unit do not function.
- results of diagnostic tests performed on the inactive unit transmit to the CC through the active unit

The SP IMC link is a universal asynchronous receiver and transmitter (UART) link that connects the SPs in both units. You can use the link to load small diagnostic programs from the InSv active unit to the OOS inactive unit. The SP IMC link also provides information to diagnose faults in the mate unit. The SP IMC provides information when the message protocol card IMC link does not function.

LGC, LTC, and DTC

The SP card links cards through the A-bus. The SP polls each card and sends or receives messages by direct memory access (DMA). Each card has a specified memory access protocol.

The MP translates the PM message for the CC. The SP directs and sends the messages through the DS30 cards from the message and tone card. The system places CC messages on channel 0 of DS30 links 0 and 2. The message and tone card receive CC messages from the DS30 interface card in the same way. The SP scans the message and tone card, accesses the messages, and sends the messages to the MP for interpretation.

The message and tone card exchange C-side messages with the DS30 card over a wired link. The C-side messages to the network use DS30 protocol. The message and tone card also allow message exchange between the active and inactive units. These messages transmit over a wired link and use IMC protocol.

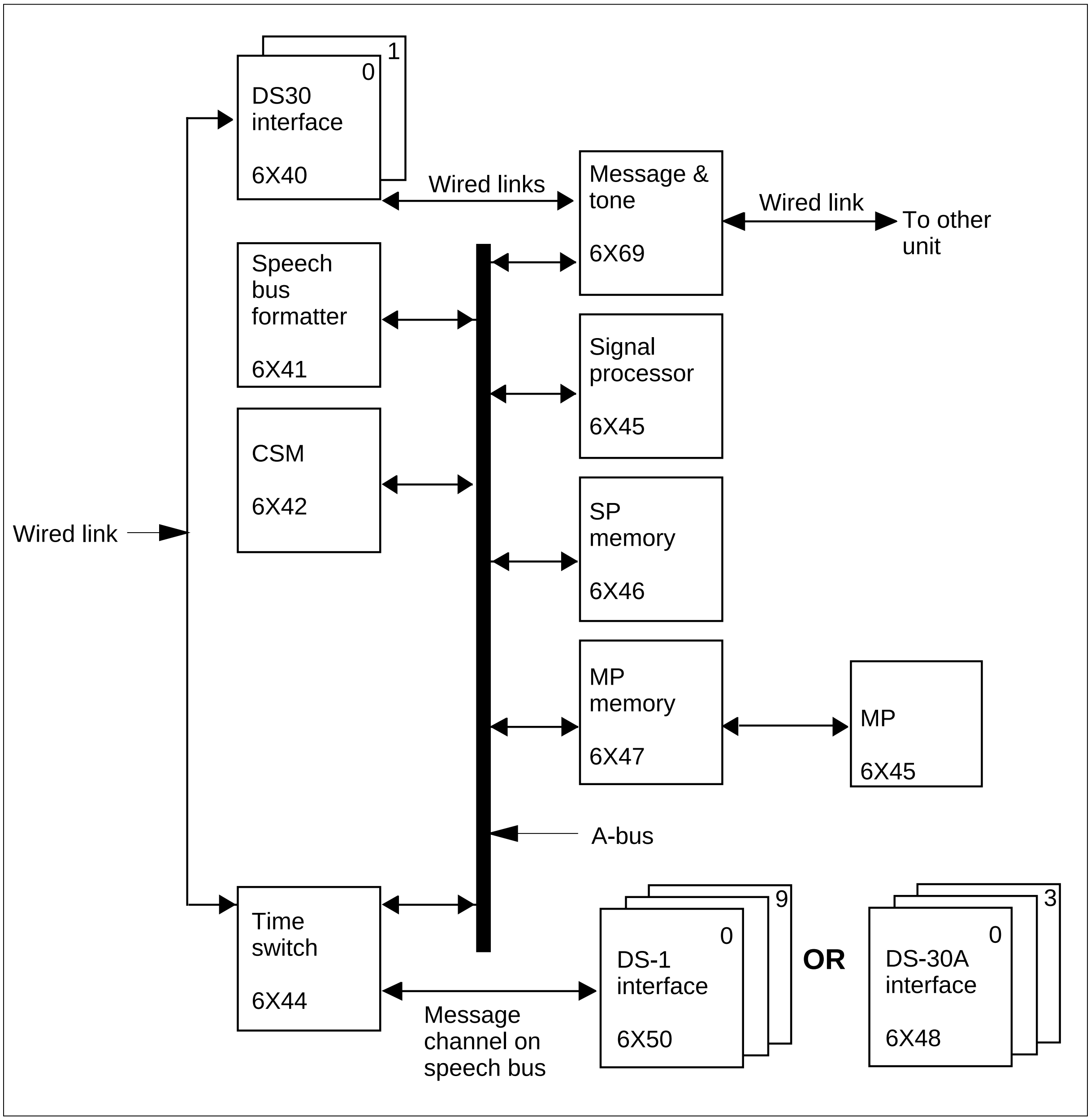
The DS30 cards and the time switch exchange control send messages over a wired link.

The system sends control and status messages to and from DS-1 cards by a message channel through the time switch. The time switch exchanges one message channel for each DS-1 link on each DS-1 card. Each DS-1 card handles two links and has two message channels.

The SP and the MP cards communicate by direct memory access (DMA) of MP memory. The SP can access SP memory and the memory of the MP. The MP can not access SP memory.

Figure 13-8 shows the message paths in an LGC, LTC, and DTC.

Figure 13-8 Message paths in LGC, LTC, and DTC



MSB6 and MSB7

The following are messaging functions of the MSB in the active unit:

- scans the ST for incoming messages from CCS transmission links. The MSB7 active unit scans DS30A link channels for incoming messages from the ST.
- determines if incoming messages on an ST are for a DTC, LTC, DCM, TM or CCC
- transmits messages through the formatter card and DS30 interfaces to the correct point
- scans DS30 link channels for incoming messages from the DTC, LTC, DCM or TM that routes to ST. The MSB active unit also scans for CCC messages for internal use.
- transmits messages through the signaling terminal buffers (STB) and ST1 to the correct ST and CCS link
- verifies transmission and reception of messages
- monitors the ST and changes the routes of CCS messages if an ST fails
- monitors MSB performance, and transfers activity through the activity circuit to the standby unit, if required.

Interperipheral message link

The interperipheral message link (IPML) provides channels for direct messages between MSBs and DTCs. The IPML uses assigned connections through the NMs of the switching network to provide the channels. The IPMLs are speech channels with messaging ability.

An XPM can use IPMLs to send messages to the following:

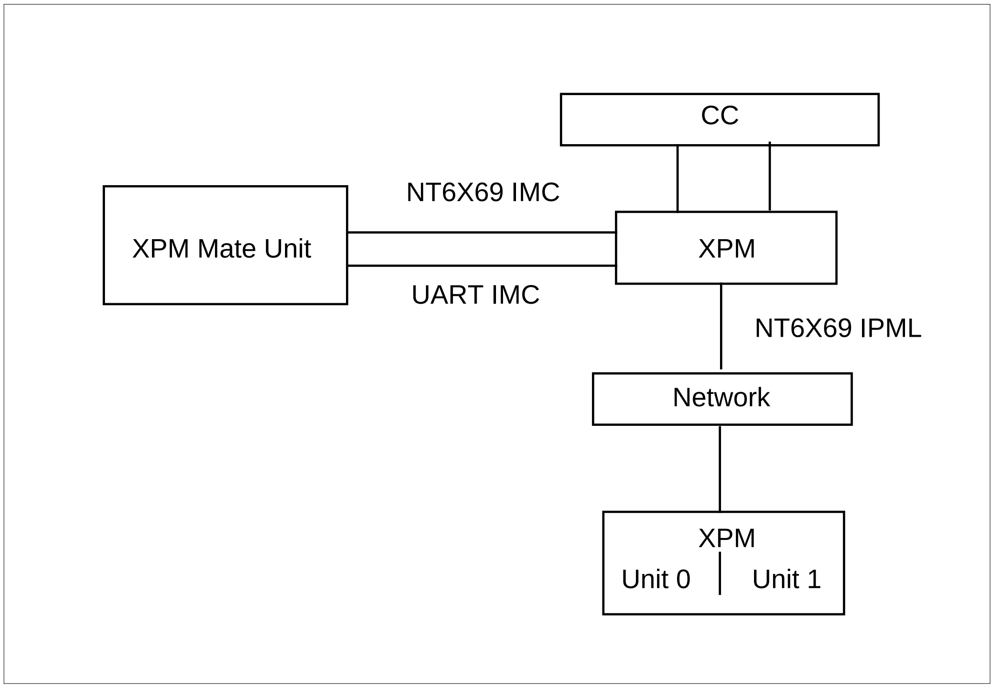
- XPM host
- XPM mate unit
- XPM P-side nodes
- XPM subtending nodes

> ***Note:*** Do not use the IPMLs with PMs that contain NT6X43 or NT6X75 cards.

The IPMLs are also used to broadcast load many XPMs at the same time. The system establishes temporary IPMLs. The broadcast load can slow or stop if a minimum of one link is down.

The IMC links between the units of an XPM or IPMLs provide ROM level messaging with the NT6X69 message protocol cards. The mate unit loads or tests an XPM unit at the ROM level of messaging. The NT6X69 IMC link allows this procedure. A unit can drop from the task level to the ROM level. When this condition occurs, the system ignores all the incoming messages that the system does not recognize.Figure 13-9 shows an overview of the IMC and IPML links supported by ROM.

Figure 13-9 IPML and IMC links supported by ROM



Configuration

Each IPML consists of a pair of two-way IPCs. The two IPCs share the message-handling load. Each IPC can carry the full message load if the other IPC fails. IPC-0 and IPC-1 are the names of the IPCs in an IPML. Each IPC has a copied path through planes 0 and 1 of the network. This copied path gives the IPML double reliability. The assignment of IPCs to different NMs in the network reduces the possibility of a failure of all connections.

The FROM end is the XPM host end of the IPML. Each network plane assigns a port and channel number to each end of the IPCs on the DS30 links. The DS30 links are between the XPMs. The IPML has a discrimination number of 0 to 127. The data appears on the display of IPML maintenance states.

Data table IPMLINV assigns ports and channels for IPC identification on the tandem originating (TO) end or subtending XPM end.

The system can assign a maximum of four message links to any P-side or subtending XPM. Only one message link can appear in the associated data table for each subtending node. For example, a remote cluster controller (RCC) that has two message links cannot have two IPMLs from the same host. This RCC can contain two IPMLs from another XPM. This XPM cannot be the host or in the node table of the RCC. The node table refers to the XPM node table that receives data from the CC when static data downloads.

IPML Maintenance

An IPML assigned to a subtending node at the ROM level of a return to service does not require maintenance. When the XPM initializes and appears at the task level of a return to service, the link drops. The IPML loses data if a system power-up or a ROM reset occurs.

The CC establishes the IPML again at the end of the subtending node when the node is at the task level of maintenance. As a result, the CC is able to continue messaging from the CC to a subtending node through an IPML. The CC does not need to reestablish the IPML if the IPML is at the task level for a host XPM.

Switch of activity

A switch of activity (SWACT) occurs when the two units of a two-shelf PM switch activity. The active unit becomes the inactive unit and the inactive unit becomes the active unit that controls call processing.

The PM initiates the SWACT if the active unit discovers a fault that the PM cannot recover. The CC can also initiate a SWACT. Maintenance personnel can initiate a manual SWACT through the MAP terminal.

The following is a list of the five types of SWACTs. The list also contains a description of the type of SWACT.

- A warm SWACT occurs by default after a system reload or restart. The system maintains established calls and drops calls in a transient state. Transient states include dialing and ringing.
- A controlled warm SWACT occurs when maintenance personnel issue the SWACT command from the PM level of the MAP terminal. A controlled warm SWACT can also occur as a result of a scheduled diagnostic like the REx test. The system maintains established calls and drops calls in a transient state.
- An uncontrolled warm SWACT results from a hardware failure or a trap in the active unit. The CC and the PM exchange a series of messages to communicate about the SWACT. The SWACT completes when the CC receives the gain message from the new active unit.
- The CM initiates a controlled cold SWACT by manual or system request. A cold SWACT initiates when conditions do not permit a controlled warm SWACT. The system removes the two units from service and reinitializes XPM data during the activity switch. The system drops all calls. A manual

cold SWACT occurs in service on DTCs. When a manual cold SWACT occurs in service, the system drops all calls. The system removes the units from service one at a time to minimize the length of the XPM outage.

- The XPM initiates an uncontrolled cold SWACT when conditions do not permit an uncontrolled warm SWACT. The system removes the two units from service and XPM data reinitializes during the activity switch. The system drops all calls.

Warm SWACT

A warm SWACT occurs by default after a system reload or restart. The system maintains established calls and drops calls in a transient state. For a warm SWACT, the units of the PM must be in-service and have warm SWACT enabled. Information transfers from the active to the inactive unit of a PM during a warm SWACT. Continuing data updates and bulk data updates are the two types of updates that result from this process.

The following limitations apply to the warm SWACT feature:

- The warm SWACT feature maintains calls. The test fails if a subscriber line test is active when a warm SWACT occurs.
- Synchronization of call data between the mates occurs when call processing is not in progress. Limited SP real time and bandwidth limitations on the IMC link between the two PM units cause this condition. Call data in the inactive unit is not always current under heavy traffic. The system can drop some established calls when the SWACT occurs.
- An established call loses the hook-flash ability to initiate flash-activated subscriber features for the rest of the call. This condition occurs when an established call continues over an uncontrolled warm SWACT. The subscriber features include call transfer, three-way calling, conference calls, call park, and executive busy override. The system ignores the hook flash.
- If a call originates from a coin phone and does not continue, the coin phone neither returns or collects the coin. A call does not continue during a warm SWACT because of heavy traffic or no answer at the terminating end. The coin remains in the hopper. The calling party receives a dial tone and can redial the call. If the calling party presses the hookswitch, the coin returns .
- A billing call retains timing when a warm SWACT occurs.

A warm SWACT can occur during a subscriber line test. When a SWACT occurs, the test fails. Operating company personnel can release the connection to the metal test pair, access the test network, and try the test again.

Enhanced warm SWACT

An enhanced warm SWACT allows active line calls that survived a controlled warm SWACT to activate any subscriber feature. Table 13-2 lists residential features that are compatible with enhanced warm SWACT.

Table 13-2 Residential features compatible with enhanced warm SWACT

Automatic call back	CND blocking
Automatic recall	Customer originated trace
Call screening	Call pickup
Calling number delivery (CND)	Make set busy
Automatic call distribution (ACD)	Essential line service
ACD name and number	Expensive route

Table 13-3 lists and describes Meridian Digital Centrex terminal features compatible with enhanced warm SWACT.

Table 13-3 Meridian Digital Centrex terminal features compatible with enhanced warm SWACT (Sheet 1 of 2)

ACD make set busy	Hunt groups
ACD make and number	Last number redial
ACD emergency key	Line screening
Automatic dial	Multiple appearance directory number (MADN) hold (POTS)
Automatic line	Make set busy
Bellcore line study	Network dial plan display (Refer to Note)
Business set display (Refer to Note)	Network electronic business set (EBS) display (Refer to Note)
Call forwarding	Network speed calling
Calling line identification	No receiver off-hook tone
Calling name inspect (Refer to Note)	Off-hook queuing
Call pickup	Originating line select option
Carrier toll denied	Permanent hold
Closed user group	Private business line

Table 13-3 Meridian Digital Centrex terminal features compatible with enhanced warm SWACT (Sheet 2 of 2)

Code calling	Private network
Code restriction	Private virtual network
Comfort tone	Query time display (Refer to Note)
Customer data change	Random make busy
Cut through dialing	Requested suspension
Data loop around	Security code
Datapath data unit (DU) profile	Sleeve leads for public file reporting system
Datapath modem pooling	Special billing number
Denied call forwarding	Special calling long
Denied incoming	Special calling short
Denied originating service	Special calling user
Denied terminating service	Star equivalent
Directed call pickup no barge in	Station message waiting
Direct inward system access	Stop hunt
Directory number (DN) network attributes	Subscriber line usage
Direct outward dialing	Terminating line select option
Electronic switching network	Toll essential service
Equal access primary inter-LATA carrier (PIC)	Uniform call distribution
Equal access toll denied	Voice message exchange

The enhanced warm SWACT feature improves the XPM code in the PM that handles the warm SWACT operation. This feature allows flash-activated subscriber features to retain hookflash ability over a controlled warm SWACT under exact conditions. These conditions associate with the line service options assigned to the line that survived the SWACT. Some active line service options can disable the enhanced warm SWACT feature.

> ***Note:*** Any active line service option not listed in these tables can disable the enhanced warm SWACT feature.

The enhanced warm SWACT feature deactivates when a subscriber feature that is not supported is active over the warm SWACT. Handling of the call defaults to the non-enhanced warm SWACT handling when subscriber features that are not supported are present. The system ignores hook flashes and takes down far-end changes with the call. The system ignores conference key messages, transfer key messages, call park key messages, and busy override key messages from a business.

SWACT back

The feature *XPM Before-SWACT/After-SWACT Audit* is available as AF5007 in BCS35 and up. This feature improves the warm SWACT operation. This feature denies the SWACT if the inactive unit cannot maintain activity or communicate with the CC. Under these conditions, this feature provides the ability to SWACT back to the original active unit. The software that drives this feature is the SWACT controller in the CC. Figure 13-10 shows the SWACT back process.

> ***Note:*** Feature AF5007 applies to the LGC, LTC, and DTC peripheral modules. This feature does not apply to units that come from the three PMs described in this guide. This feature is not supported during XPM or CC overload.

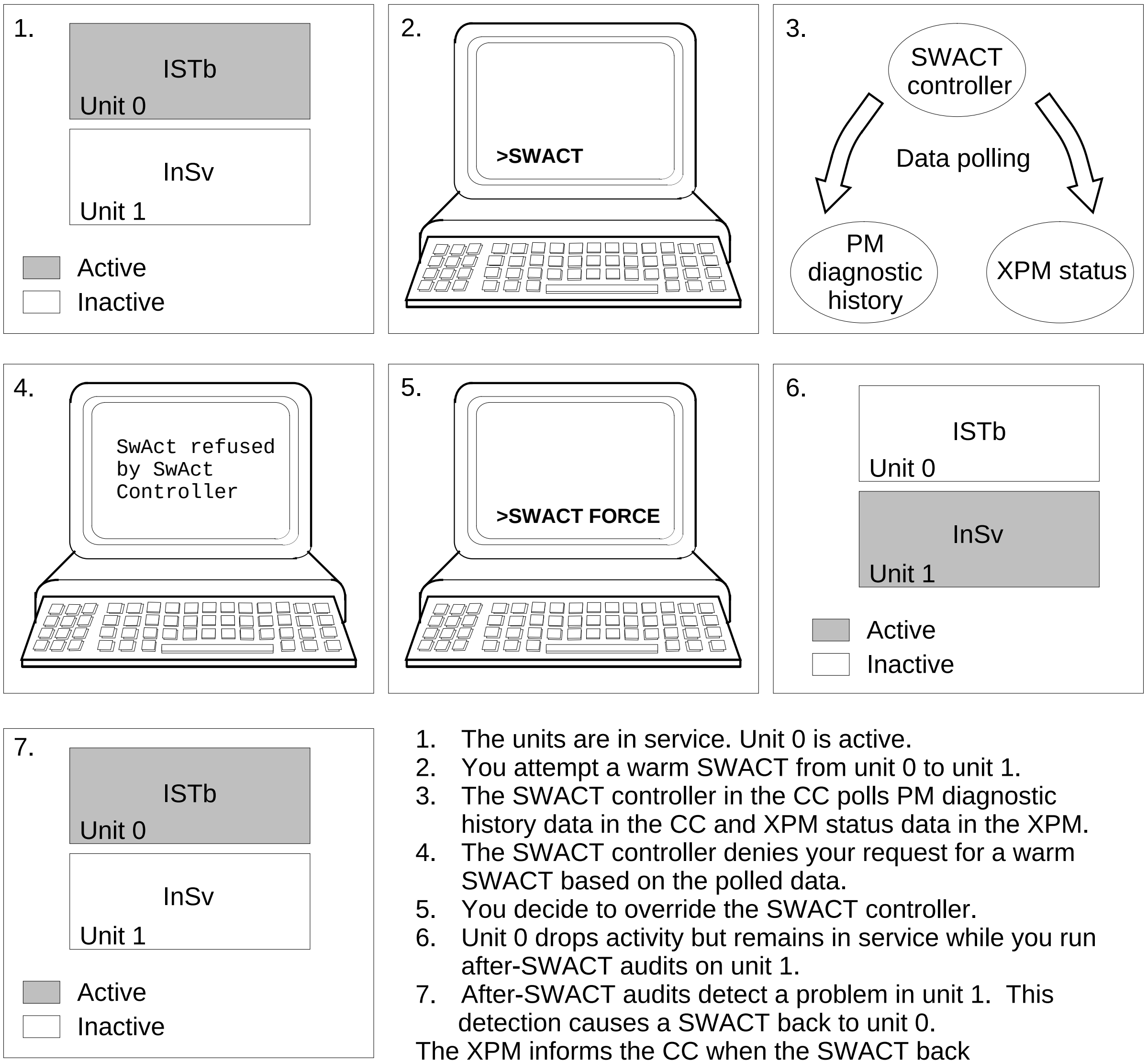
The original active unit attempts to return to service during a SWACT back. If the attempt is successful, the system busies and returns to service the inactive unit. The active unit remains in service. The system continues stable calls from the original active unit over the SWACT back. The system drops all new calls made after the SWACT and before the SWACT back. The system busies and return to service the units of the XPM if the SWACT back fails. The system does not reinitialize operational measurements and peg counts after a SWACT back.

The following commands support SWACT back:

- SWACT (with the parameters TEST, NOW, and ALL, and with the parameter FORCE for the parameters TEST, NOW, and ALL)
- TST REX NOW
- BSY UNIT nn

> ***Note:*** The SWACT back ability provides for a routine exercise (REx) test initiated by the REX scheduler.

Figure 13-10 SWACT back example



1. The units are in service. Unit 0 is active.
2. You attempt a warm SWACT from unit 0 to unit 1.
3. The SWACT controller in the CC polls PM diagnostic history data in the CC and XPM status data in the XPM.
4. The SWACT controller denies your request for a warm SWACT based on the polled data.
5. You decide to override the SWACT controller.
6. Unit 0 drops activity but remains in service while you run after-SWACT audits on unit 1.
7. After-SWACT audits detect a problem in unit 1. This detection causes a SWACT back to unit 0.

The XPM informs the CC when the SWACT back completes. The system busies returns to the service the XPM node if the SWACT back fails.

Out-of-service diagnostics

Implementation of the SWACT command automatically initiates the out-of-service (OOS) diagnostic test set on the newly inactive unit before BCS31. This command helps to resume call processing if required and eliminates faults in the new inactive unit.

If a failure occurs during the warm SWACT, you must return to service the new inactive unit quickly. The sequence to return to the original active-inactive configuration slows when diagnostics run on the new active unit. To increase the speed of this sequence with BCS35, a warm SWACT does not automatically initiate OOS diagnostics.

The OOS diagnostics run under the following conditions:

- The SWACT command contains the parameter TEST. This parameter allows the SWACT to include the OOS diagnostics.
- The REx tests continue to include the OOS diagnostics because the tests are important to the REx sequence. The system schedules the REX tests during low-traffic periods to minimize impact on call processing.

Messaging improvements

The CC does not always receive the drop and gain messages from the PM. Suspect noise on the C-side messaging links during a SWACT can cause this condition. The feature *XPM REX/SWACT Robustness*, introduced with BCS32, allows the CC more opportunities to receive gain messages from the PM. The process repeats for 15 s before the PM terminates the process. The PM sends a maximum of 15 gain messages to the CC as a result. The CC assumes the SWACT failed if the CC does not receive the gain message in 20 s.

MSB Maintenance

MSB data tables

Table MSBINV contains entries for the MSB. Table MSBPINV contains P-side information for STCM and extension frames. Table STINV contains the ST7 information that includes C-side link information on the port and channel. Entries in table MSBINV must correspond to entries in table MSBPSINV.

Additions or deletions of a tuple in table MSBINV automatically adds or deletes the associated tuple in table MSBPSINV. The system adds or deletes links while the MSB is in-service. Table MSBINV also contains entries for C-side links on an MSB. If you delete an MSB from table MSBINV, the MSB must be offline and STC or IPML cannot have assigned links.

The C-side link that you will delete from data table MSBINV must be ManB. If the C-side link supports an IPML or ST, the system deletes the link when the IPML or ST is OOS. The SWACT command switches the activity of the links to manually busy the inactive links. The message links for several MSBs must spread evenly across the available NM pairs.

The STCM and STC numbers configure the P-side port and channels. Channel 0 on all ports is not a correct value for command entries.

Table STINV contains entries for the STs to allow ST pooling and to include transmission link connection information. The removal of all STCs on an STCM from table STINV must occur before you delete an STCM from table MSBPSINV.

MSB during restarts

The following sequence occurs during a warm restart:

- The earlier state of the MSB remains the same. The maintenance action that corresponds to that state resumes.
- If the MSB is SysB, submit the RTS
- If the MSB is ManB or OffL, the MSB remains in that state
- If the MSB is InSv:
  - — the MSB remains InSv with the message link open to the network
  - — the MSB tests the hardware so that:
    - – if the MSB passes, audits run on all P-side nodes
    - – if the MSB fails, the PM is SysB and submit the RTS

For cold restarts, submit the RTS test without sending a restart message to the MSB.

The system cancels the nailed-up connections (NUC) of the time switch. This cancelation occurs when the busied or returned-to-service MSB starts again. The system reestablishes the NUCs when the MSB reloads with static data.

When the MSB returns to service, an attempt to return the STC to service without a restart occurs. If the attempt fails, the STC uses the RTS command. The STC can lose synchronization.

For reloads, the MSB becomes SysB with a reason given for the original load. The system submits the RTS after a restart.

> ***Note:*** Always perform a warm restart after the addition of an MSB7. The restart procedure establishes a communications link between the CM and MSB7. The ST level of the MAP terminal continues in a Querying ST mode if you do not perform a warm restart.

MSB7 warm and cold SWACTs

A warm SWACT to the inactive unit switches the activity in an active unit of an MSB. The system maintains calls in progress. A cold SWACT causes the system to drop calls. The SWACT occurs automatically by the system or manually by the SWACT command at the MSB7 level.

The OM group PMTYP increases the number of warm and cold SWACTs for all MSB7s in the office by each method. The OM group PM also increases the same SWACTs for each MSB7. The XPM logs contain entries for the SWACTs. The system can lose messages in progress between the NT6X43 message interface card or the NT6X69 message interface card during the SWACT.

Overload controls

With the peripheral maintenance feature, the LTC and the LGC lines have overload controls that perform the following:

- detect the cause of overloads
- control overloads about to occur
- control overloads

The overloads implemented by this feature include:

- Acceptance and completion of call capacity occurs 9999 times out of 10,000 calls processed. The completion rate is 99.99% as a result.
- Reduction of grade of service does not occur for calls accepted under overload.
- The system displays all transitions of XPMs into overload as ISTb at the MAP terminal. The LTC level command QUERYPM FLT can query the transitions.
- The OM group PMOVLD pegs the denied originated or terminated calls.

The addition of overload and congestion control algorithms for XLIUs restrict traffic into the XLIU during heavy traffic conditions. The algorithms perform the following functions:

- The system reduces the Layer 3 flow control window to limit the traffic level on the congested XLIU during light congestion.
- The system sends the RNR (at Layer 2) to the affected DTEs to stop input data traffic during severe congestion.
- Packet dropping of new incoming packets stops excess traffic from the XLIU if the free buffer pool is depleted.
- The system reclaims packets in the queue at Layer 3 sent to the link. The system reclaims the packets if activity on the link is not present after a timeout period. This condition allows for better use of the Layer 3 buffers.

Overload conditions

An XPM overload results from the use of all of a resource needed for processing.

The resource can be one of the following:

- available processor time (real time)
- call processing blocks
- messaging buffers for communication
- P-side or C-side links

The subscriber can experience no dial tone, slow dial tone, dropped calls, or calls that are not completed. The system detects an overload when a log PM180 occurs with OVERLOAD for the LTC or the LGC. The log PM180 also occurs with DMSX MSG L for the LCM. The XPM can lose stability under a heavy load or continued overload. The loss of stability can cause the XPM to drop activity and a warm SWACT that cannot maintain all calls.

The following are some of the general conditions for overload:

- The CC transmits a large number of supervisory messages to the XPM. These messages can generate work that can change either processor to a real time limited condition.
- The traffic rate is heavy and enough real time capacity to handle all calls is not available. The work load causes a shortage of communication buffers and call processing blocks over a period of time.
- The LCM or several LCMs send many originations and on-hooks to the XPM in a short period of time. The XPM handles these calls. This process creates work. The messages create work until the processors run out of real time or the interprocessor communication buffers are exhausted for a limited time.
- During some types of failures, work created in the XPM causes the XPM to overload. For example, the loss of a network plane produces large numbers of integrity failures and plane switching.

Types of overload control

Types of overload controls are as follows:

- flow control
- overload protection
- overload indicators

All of the controls provide a stable overload transition. The following paragraphs describe the different types of overload controls.

Flow control

Flow control gives calls that originate and terminate on an XPM lower priority than calls in progress. The control flow does not stop the originations or terminations. The XPM gives priority to call processing messages and control messages passed to the SP of the XPM. To reduce the load, terminations have priority over originations. The XPM and associated hardware contain the only work produced by an origination. If the system delays terminations over originations, problems occur with integrity of the originator. Originations create more work in the XPM than terminations.

To provide flow control, the system monitors the ability of the MPs and the SPs to handle more calls. The system delays calls if the processors cannot handle more originations or terminations.

The system monitors the ability of an XPM with an NTMX77 or NTAX74 circuit pack to handle more calls. The system delays calls if this circuit pack cannot handle more originations or terminations.

Overload protection

The flow control system is automatically active. As a result, the XPM must have an algorithm to deal with an overload. The algorithm monitors the amount of available real time and available communication buffers. The system denies originations at a preset level.

A time-out occurs for messages delayed when call processing messages have priority. If the time-out expires, the system drops the messages and denies the originations and terminations.

An incoming message overload (ICMO) control is also known as a *babbler*. An ICMO control occurs when one or more line cards send messages at a high rate toward the LGC or LTC. To avoid the overload, the system detects the ICMO and terminates messaging until the system determines the cause of the fault. The CC controls the detection and disabling of messages that occurs in the LCM. The LCM disables the line separately and sends a log to the CC for information only. This process allows easy installation in offices where CC support of ICMO is not available.

Measurement of the detection of ICMO occurs one line at a time in the LCM. The first line to send a message at the end of one test is the objective for the next test. Different checks occur for plain old telephone service (POTS) than for intelligent lines. Intelligent lines include P-phone or data unit. The different checks result from differences in the characteristics of the messages. Differences in the characteristics of the messages include on-hook or off-hook for POTS and key-presses for intelligent lines.

The LCM performs the following procedures to detect overloaded lines:

- The system counts the messages from the selected line for a period of 1 s. The system compares the messages to a threshold according to the characteristics of the set.
- The LCM immediately declares the line as a major ICMO (babbler) if the ICMO exceeds the threshold.
- The test continues for two seconds for POTS if the count is less than the threshold. The test continues for six seconds for P-phone. For P-phone, the

test checks the message count every second until one of the following occurs:

  - The message count exceeds the threshold for each second. The LCM then declares the line as a major ICMO.
  - The second does not contain any messages. The LCM terminates the test immediately and selects another line.
  - The total quantity of messages exceeds a threshold. The LCM then declares the line as a major ICMO. (The test disables this check for the first second of the test. The test disables this check to make sure that the messages occurred over at least a two-second period.)
  - The test reaches the test duration.

- A line produced at least one message each second. The message did not exceed the one second or total thresholds during the short test period. If the above conditions occur, the LCM monitors the line until one of the following occurs.
  - The quantity of messages in a second exceeds the threshold. The LCM then declares the line as a major ICMO.
  - The second does not contain any messages. The LCM terminates the test and selects another line.
  - The total test duration that includes the previous tests, reaches 60 seconds. The LCM then declares the line as a minor ICMO.
- A message sent to the CC through the LGC or LTC identifies a line fault as a babbling line. This condition occurs when the LCM detects an ICMO. In response, the CC generates a log LINE204. The log indicates the overloaded directory number (DN) and the line equipment number (LEN). The log also places the line in a queue for testing. All overloaded lines are taken OOS immediately. The overloaded lines are only returned to service when they passed the line test. Only major ICMOs are taken out of service.
- The test gradually checks all lines in the LCM. The test checks active lines earlier and more often. Active lines are lines often used or overloaded. This check occurs because active lines normally generate the first message after the completion of a test for ICMO.

For intelligent lines, the test checks for a threshold of 32 messages in a second. The test also checks for a total threshold of 40 messages over a six-second test duration. The POTS lines have a threshold of 135 messages each second. The POTS lines also have a total threshold of 80 messages spread over two seconds. Both seconds must contain some messages. The following example shows why this condition must occur. One second contains 90 messages and the next second does not contain any messages. This example does not declare the line to have ICMO.

The following are types of overload controls:

- termination flow control
- terminal queuing
- guaranteed dial tone (GDT)
- trunk flow and overload control

Termination flow control and overload control do not allow an LGC to deny terminations unless the LGC overloads severely. The LGC denies terminations when the incoming flow control queue of the LGC reaches the limit. The denial occurs when there are no originations that can be denied first. The LGC sends a message to the CC and the call is dropped. The event is pegged under PTRMDENY of OM group PMOVLD.

The termination flow control limits the size of a per terminal queue to 15. If the queue increases to 16, the termination flow control sends a problem message to the CC. The termination flow also discards all messages in the queue. This condition is pegged as a termination denial.

Per terminal queuing is messages linked against one terminal in one queue. Termination flow and overload control use per terminal queuing to provide correct transmission of supervision to call processing. The termination and overload controls send the complete set of supervision messages together. The termination and overload controls place the messages into terminal queues in the order the messages arrive. If a terminal has many messages in a queue, the termination and overload controls do not transmit the messages together. With per terminal queuing, message overhead reduces and the quantity of message transfers within or between the processors decreases. This condition saves real time.

Per terminal queuing reduces original messaging when a call originates or terminates. The MP that receives the messages is streamlined to provide better handling of multiple messages for a given terminal. Messages bound for terminals that are Call Processing Busy (CPB) do not use per terminal queuing. Per terminal queuing sends a single message to the MP for each terminal. The other messages link to the first terminal. The MP is able to unlink the messages and place the messages into the queuing system for MP call processing.

Per terminal queuing reduces the effect of ICMOs on the XPM. Per terminal queing does not queue multiple messages from the LCM for a terminal. The last message is the message sent to the MP. A small amount of preprocessing is performed on the messages that are discarded.

The following occurs if per terminal queuing denies a terminal. The per terminal queuing links together and can remove all of the supervision from the queue and call processing. The per terminal queuing performs this procedure easily and quickly. Per terminal queuing also eliminates the possibility of the CC processing supervision out of sequence. Per terminal queuing does not send supervision to call processing if supervision for that terminal remains on the flow control queues.

Guaranteed dial tone (GDT) is a feature that provides dial tone gradually to all telephones that remain off-hook. The telephone does not receive dial tone quickly. The GDT only applies dial tone gradually. The GDT does not provide dial tone for terminals that lose messages between the line card and the message handler of the LGC or LTC.

The GDT protects against CC overload conditions and warm restarts. The LGC or RCC does not transmit originations again to the CC at a random rate. The LGC does not transmit an origination again until one second later. This condition occurs if the LGC does not receive a reply from the CC from an origination. Under CC overload or restart, the LGC does not flood the CC with originations.

Overload indicators

The following occurs when an XPM becomes overloaded:

- The OM group PMOVLD pegs the denied originations and terminations.
- The XPM system maintenance changes the state of the XPM from InSv to ISTb.
- Log PM128 records when the state of the XPM changes and includes the reason as OVERLOADED.
- The command QUERYPM FLT displays OVERLOAD as a reason for the ISTb.
- The overload triggers a minor alarm.

When the XPM overload completes, the status display changes from the ISTb state and the alarm is canceled.

Trunk flow control and overload control

Trunk flow control and overload control use the same system as the line flow and overload control. The trunks controlled are types that use winks after the trunks receive the off-hook from the other end. This wink is the multifrequency (MF) wink. Trunk types, like data port (DP), can not have the off-hook delayed. This type of trunk does not have overload protection.

The trunk flow and overload control reduce the trunk originations to a lower priority than the priority of call processing. The system does not handle any trunk that sends unsolicited information after the trunk is off-hook. This condition occurs because the system delays originations until new work starts.

Trunk originations use last-in-first-out (LIFO) queuing. The trunk flow and overload control can deny trunk originations. This denial occurs if the quantity of new originations begins to exceed a preset threshold. The trunk flow and overload control deny old originations and queue the next originations. The originator is on-hook because the trunk flow and overload control delay the trunk. If this condition occurs, the flow control system does not report the originations to the call processing. The flow control is able to filter the noise from overloaded trunks. To perform this procedure, the flow controls do not report very short off-hooks to call processing.

The following occurs when trunk flow and overload control deny a trunk origination. The trunk flow and overload control increment a peg against the XPM type in PORGDENY. The operational measurement (OM) group PMOVLD contains PORGDENY. Trunk flow and overload control only deny trunk originations if the queue fills.

Enhanced XPM DS-1 maintenance for NT6X50AB

The XPM maintenance of DS-1 facilities are for the DS-1 NT6X50AA and NT6X50AB interface cards. The XPM maintenance is also for combinations of DS-1 NT6X50AA and NT6X50AB interface cards. The NT6X50AB is a general replacement for the NT6X50AA card on the C-side and P-side of an XPM.

All XPM loads that now have DS-1 maintenance, with the exception of the small memory DTC load, provide the following:

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

The small-memory DTC loads only use the NT6X50AB card as a replacement for NT6X50AA carriers.

The AA and AB versions support the following functions:

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

The AB version supports the following functions:

- ESF
- B8ZS
- BER, cyclic redundancy coding (CRC)
- data links for SLC-96 and facility data link (FDL) to enable the carrier facility
- remote loops
- alarm indication signal (AIS) detection

The following combinations are invalid for the NT6X50AB card:

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

The options selected for a DS-1 link are only effective after the link returns to service. The RTS command at the MAP terminal returns the link to service.

The system maintains DS-1 data in an XPM. The maintenance is for transmission faults. The system observes the transmitted digital signal to detect transmission faults.

The system maintains the following data:

- BER
  - CRC Violations
  - BpV for either frame format
- out of frame (OOF) and slips
- emergency service (ES)
- severe error seconds (SES)
- unavailable seconds (UAS)

Bit error rate

The BER is an estimation of the fraction of bits not received correctly. Coding violations refers to the fraction of bits. The maintenance and out-of-service BER thresholds are selected at a MAP terminal for each DS-1.

The system monitors the following coding violations:

- CRC violations for ESF format. The BER thresholds are preset at one error for every 10
- bits through to one error for every 10
- bits.
- BPV for either frame format. The BER thresholds are preset at one error for every 10
- bits through to one error for every 10
- bits.

Out of frame and slips

The system continues to support out of frame (OOF) and slip counts.

Errored seconds

The XPM counts the quantity of seconds while the system increments one or more units of coding violations, slips, or OOFs. Sixteen coding violations are treated as one unit of measurement.

Severe errored seconds

The XPM counts the quantity of seconds while coding violations occur with an approximate BER of 10^{-3}. The measurement only occurs during unavailable seconds (UAS).

Unavailable seconds

The XPM counts the quantity of UAS for each digroup. After 10 consecutive SES, the system makes the service not available. All following seconds are UAS, but after 10 consecutive non-SES, the system makes the service not available.

Alarm thresholds

All the data measurements have a user-defined alarm point for each digroup. The alarm points signify that a DS-1 link exceeds one of the thresholds. Some thresholds signify a maintenance level, and other thresholds signify the OOS level.

The carrier group alarms have user-defined alarm points associated with each digroup. Carrier group alarms include local, remote, and AIS. The alarm points signify the filter period used to time the alarm. The alarm points require two filter periods. One filter period defines the entry into the alarm and the other defines the exit from the alarm.

The following are default settings for the alarm points:

- Local carrier group alarm (red)
  - entry: 2.5 seconds
  - exit: 10 seconds
- Remote carrier group alarm (yellow)
  - entry: 0.5 seconds
  - exit: 0.5 seconds
- AIS carrier group alarm
  - entry: 1.5 seconds
  - exit: 10 seconds
- BER
  - MTC level: one error per 10^3 bits or greater
  - OOS level: one error per 10^3 bits or greater
- OOF
  - MTC level: 17 in 24 hours
  - OOS level: 511 in 24 hours
  - slips
  - MTC level: 4 in 24 hours
  - OOS level: 256 in 24 hours
- ES
  - 864 seconds
- SES
  - 100 seconds

The system updates user-defined alarm points in the inactive unit of the XPM in preparation for a potential warm SWACT.

The CC monitors the slip, OOF, ES, and SES thresholds because they function on a 24-hour clock.

System handling of an XPM single change supplement

The system requires the separate use of fields in a call condense block (CCB). The system requires the CCB to handle a single change supplement (SCS) for XPM software. The parameter num_of_scs_extblks of data table OFCENG makes the SCS extension blocks available to distinguish the fields.

The SCS extension blocks allow call-related data to be saved as part of an SCS. The SCS extention blocks performs this procedure without the corruption of CCB or other data structures. If required, the system reserves and releases SCS extension blocks from the SCS block pool. The OM group EXT monitors the use of the blocks.

The system manually busies the PM unit before a software change.

Broadcast loading

The data distribution network uses the following with most XPMs to load more than one XPM at the same time:

- IPMLs
- NT6X45BA processor CP plus firmware cards
- NT6X69 message protocol circuit pack.

"Broadcast loading." is the name of this procedure. The network can load a maximum of 63 XPMs concurrently on a SuperNode switch or an NT40 switch. This procedure occurs for manual or automatic broadcast loading.

> ***Note:*** The IPMLs used for broadcast loading are not datafilled in table IPMLINV. For example, it is not a requirement to datafill table IPMLINV for the PDTC.

The following are capabilites of broadcast loading:

- broadcast loading both units of multiple ManB XPMs at the same time
- broadcast loading a specified unit of multiple ManB XPMs at the same time. The units must be ManB in order to perform the load action.
- sends load messages from the CC in bursts. The load receives one reply from the XPM for each burst of four or eight messages.
- broadcast mate loading the ManB inactive units of multiple XPMs through their in-service active units.
- automatic broadcast loading of both units of multiple SysB XPMs at the same time.
- automatic broadcast connecting of all patches that associate with a load that follows automatic broadcast loading.
- manual broadcast connecting of a patch for a defined set of XPMs.

The DMS switch checks the loads in the XPMs for damage. If the DMS switch detects load damage, a SysB fault results. The QUERYPM FLT command displays this fault.

Broadcast loading perfoms the following procedures:

- reduces the amount of work the CC does,
- reduces the time required to recover an office,
- increases the speed at which many peripherals are loaded,
- and decreases the overall quantity of messages sent through the system.

When the system completes the set-up, the data distribution network loads multiple XPMs at the same rate as a single XPM.

With broadcast mate loading, it takes a longer time to load a set of XPMs than to load a single XPM unit. The active unit services mate loading after the demands of call processing are fulfilled. The total load time is less for large sets of XPM units through broadcast mate loading. The network requires a longer time to load the units through any other XPM loading method.

Automatic broadcast loading

In automatic broadcast loading, the network sends a load to unit 0 of the original XPM. Unit 0 of the original XPM acknowledges the reception of each block. The network sends the load to unit 0 of all slave XPMs in the group through the IPML. The network also sends the load to unit 1 of each XPM through the IMC link. After the network sends all blocks, the network sends a RUN message to the original XPM. The network broadcasts this message to all units in the same way the network broadcasts load blocks. The IPMLs are torn down when each XPM executes the RUN command, and each unit replies to the RUN command.

Automatic broadcast loading and connecting includes the following steps:

- the network performs automatic broadcast loading of an XPM or XPM group
- the network sends static data if the load requires connecting
- the network performs automatic broadcast connecting if the load requires connecting
- the network submits a system RTS request without waiting for a reply
- the network performs phase delaying and phase advancing for each XPM unit that failed before the unit reached the system RTS request

With automatic broadcast loading, XPMs that fail loading or connecting remain in the same retry group. The XPMs remain in this group until the network processes the whole group. If the original XPM fails, the network includes the XPM in the retry group. The network does not use this XPM as the original XPM again. After automatic broadcast loading, the network applies all patches that associate with the loadname. This procedure continues to occur if the network did not apply a patch earlier to any units in the XPM group.

The feature *Convert Series 2 PMs to SRC Part 2*, available as AL2640 for BCS35 and up, provides the following:

- Implementation of the second phase of the conversion of series 2 XPMs to a System Recovery Controller (SRC). This implementation occurs to control XPM recovery activities.
- Reduction of recovery time for XPMs. This provision includes recovery after restarts, partial system outages, and the load damage of an XPM.
- Controls automatic broadcast connecting. The feature uses the SRC that follows automatic broadcast loading to perform this procedure.
- Utilizes phase-advance capability to retry automatic broadcast loading. The feature retries loading with a subset of the XPMs in a group that failed to load during first load attempt.
- Reduces time for RTS and loading of XPMs.
- Correctly sets the static data checksum after a CC warm swact.
- Enables a manual request for broadcast load of a single XPM.

> ***Note:*** The network must provision XPMs with the NT6X45BA (or later) processor cards. The network can utilize an NTMX77 or an NTAX74 processor card with XPMs for this feature.

The SRC receives a load coordination request and performs three actions when an XPM unit needs loading.

The three actions are as follows:

- the SRC groups XPMs of the same type. The SRC performs this procedure to ensure the XPMs are broadcast loaded together.
- The SRC calls the XPM query procedure (code from a program). The SRC performs this procedure to determine if other XPMs in the same static group also require loading.
- The SRC waits for a reply from the XPM query procedure.

The XPM query procedure checks all XPMs in the group and replies for each XPM. The reply indicates the load status of each XPM. The SRC can receive a load coordination request for another XPM. This additional XPM is in the static group the SRC coordinates. If this condition occurs, the network adds the XPM to the dynamic group built for the automatic broadcast load. The network can trigger this automatic broadcast load from the RTS logic, the BSY logic, or the periodic audit of XPMs.

When the DMS switch automatically returns an XPM to service (a system RTS), the DMS switch queries the load status of an XPM. If the XPM fails to have a load, the DMS switch submits a load coordination request to the SRC. If the XPM has a load, the DMS switch informs the SRC that the XPM does not require loading.

When the DMS switch automatically busies an XPM, it queries the load status of an XPM. If the XPM fails to have a load, the DMS switch submits a load coordination request to the SRC. If the XPM has a load, the DMS switch informs the SRC that the XPM does not require loading. In addition, the DMS switch submits a load coordination request if the SysB fault of an XPM is a parity error. The recovery action of the SysB fault must include the reloading of the XPM unit.

> ***Note:*** Automatic broadcast patching is not an option for the PDTC and PLGC.

The following are three ways that the automatic broadcast load of an XPM or XPM group can fail:

- ROM-level loading
- static data loading
- patching of the XPM is not successful.

The retry of automatic broadcast loading and automatic broadcast connecting follows the automatic broadcast loading failure. An XPM that fails to load enters a phase delay for two minutes. The phase advance code of the CC determines if the retry is an automatic broadcast load or a single load for each XPM. If a retry of automatic broadcast loading is required, a three-minute grouping interval occurs. During this interval the system assembles the appropriate XPM group for automatic broadcast loading.

The following occurs during a retry of automatic broadcast loading. The network reloads the original XPMs that failed to load before any static data loading or patching occurs. If this retry does not load the XPMs, the XPMs remain in the group. The XPMs remain in the group until the network completes processing for the other XPMs in the group.

The following is an example of this condition. An XPM group with XPM 0, 1, 2, and 3 failed the automatic broadcast load attempt. The network load of the XPM 0, the static data of the XPM, and connecting is successful. The DMS switch returned XPM 0 to service. The XPMs 1, 2, and 3 have loading problems. The XPM 1 failed to load. Also, the static data of XPM 2 did not load, and XPM 3 did not patch correctly.

When the retry begins, the system loads XPM 1 first. During the loading of XPM 1, XPMs 2 and 3 wait. If the loading of XPM 1 succeeds, the system sends static data from the CC to XPMs 1 and 2. At this point, XPM 3 waits. Automatic broadcast connecting begins for all three XPMs. This completes the procedure.

Peripheral Remote Loader

Peripheral Remote Loader (PRL) reduces the time required to perform various XPM loading actions. The main benefits of PRL are as follows:

- reduction of the time the XPM is in the simplex (nonredundant) mode while the network loads software into a unit. This reduction is required because simplex operation increases vulnerability to outages.
- minimization of down time. Down down is the time when neither unit of an XPM returns to service without loading.

The PRL consists of both hardware and software to support local storage of XPM loads and images. The hardware includes NT7X05 and software includes features AF6026, AF6030, and AF6232. The PRL requires provisioning of the NT7X05 card in both units of the XPM.

The PRL removes the requirement to send load records from the computing module (CM) to the XPM when an XPM recovery is required. The PRL also removes this requirement to perform out-of-service CM-source loading for software upgrades. The PRL only addresses recovery components that associate with the transport of code, data, or patches from the CM to the XPM. Components of recovery that PRL does not address include:

- fault detection
- broadcast setup
- ESA determination
- diagnostics

XPM software upgrade

The PRL allows the transfer of software loads to an XPM unit while the unit is in service. The PRL also allows the local storing of loads in the XPM unit. The local storage device is the NT7X05 card. The application of the software occurs when the network instructs the XPM unit to load from the NT7X05 card. This process allows the replacement of an existing RAM load context with a newer, locally stored loadfile.

Peripheral recovery

The PRL makes a copy (image) of the unified processor card (NTMX77) RAM in an in-service (active or inactive) XPM unit. The PRL copies the unified processor card to the NT7X05 card. If the network must reload the XPM, the PRL restores the image to the RAM of the NTMX77 card.

The following can occur when the network must load the XPM in the above conditions. The network can reload separate units from the local NT7X05 card faster than from the CM. The XPM unit fails to recover when the unit loads from the NT7X05 card. If this condition occurs the CM sends the load to the XPM unit. The CM also sends loads to the XPM unit for XPMs that do not contain the NT7X05 card.

Associated commands IMAGE

The IMAGE command requests the dump of an image of Unified Processor RAM in in-service XPM unit(s) to local NT7X05 cards. The command syntax is:

```
IMAGE
   [<DEVICE.            {PM,
                         ACTIVE,
                         INACTIVE
[<ALL>{ALL}]
```

LOADPM

The LOADPM is a command used to apply software and XPM firmware loads to PMs. The PRL removes the ACTIVE and XPMSTOR parameters and makes XPMSTOR a separate command. This command supports loading from the local NT7X05 card (SOURCE parameter LOCAL) when associated with PRL. The command syntax associated with PRL is:

```
LOADPM
    [<DEVICE.       {UNIT <UNIT_NO (0 to 1)
                 PM,
                 INACTIVE]
    [<SOURCE> {CC [<MODE>] {FULL,
                            DATA
                            EXEC
                            CMR
                            FIRMWARE}]
                    [<FILE> STRING]
              LOCAL [<MODE> {IMAGE,  LOADFILE}]
                                 [<FILE>  STRING]}]
[<FORCE> {FORCE}]
[<NOWAIT> {NOWAIT}]
[<ALL> {ALL {<RFILE> STRING]
```

XPMSTOR

The XPMSTOR command requests the transfer of loadfiles from CM loadfile storage to in-service NT7X05 cards. The syntax is:

```
XPMSTOR
      [<DEVICE.          {PM,
                          ACTIVE,
                          INACTIVE}
      [<FILE>STRING]
      [<NOWAIT>{NOWAIT}]
       [<ALL>{ALL}]
```

PRL limitations

The PRL is only available on NTMX77AA-based XPMs with 8-Mbytes of RAM.

PM imaging is not supported by the NTAX74 processor card.

Support of image file capability does not include ISDN-based XPMs. The ISDN-based XPMs have loadfile support only.

You must not execute the XPMSTOR command during peak traffic hours.

The SMA is the only North American NTMX77-based XPM that can not configure with NT7X05 cards.

In-service firmware downloading

In-service firmware downloading allows you to load firmware into an in-service XPM or XPM unit. This capability reduces the time an XPM or XPM unit is out of service for loading purposes. In-service firmware downloading also provides read-only memory (ROM) level firmware loading for the NTSX05 card.

In-service firmware downloading supports NTMX77 and NTAX74 processor cards.

In-service firmware downloading introduces the LOADFW command. This command loads the specified XPM or XPM unit with the specified firmware load. The LOADFW command separates the firmware loading process from the upgrade process. The LOADFW command has the parameter UPGRADE, that you use to upgrade the XPM or XPM unit to the current firmware load. For more information on the LOADFW command, refer to Chapter 18.

Load file verification

The system performs checks on the firmware for load file accuracy. A load file record length check ensures the file is a firmware file before submission to the

XPM. If the record length is not 54, the LOADFW command fails and the MAP terminal displays a failure message.

Another accuracy check is the 32-bit cyclic redundancy check (CRC) along with a 16-bit checksum. The CM sends a validation message to the XPM to verify the accuracy of the firmware load. The XPM extracts the CRC and checksum that is in the firmware load. The XPM computes the CRC value and the checksum. The XPM compares the extracted and computed values to see if the values are the same. The XPM sends the result of the comparison to the CM.

To verify the firmware load, enter the QUERYPM CNTRS command.

Firmware upgrade

After load file verification, you can upgrade the XPM to the new firmware with the LOADFW UPGRADE command. For more information, refer to Chapter 18.

Reconfiguration of in-service links or nodes

The reconfiguration of a node or link between XPMs usually causes the MAP terminal message STATIC DATA MISMATCH to appear. The appearance of this message means the involved XPMs are given the status ISTb. The XPMs that you can reconfigure while in-service must remain manually busied for the table change. To reconfigure LTCs, change C-side links in table LTCINV and change P-side links in table LTCPSINV. This reconfiguration includes LGCs and DTCs.

When the network sends data change to the XPMs, the following system restrictions occur:

- Any system audit in progress cancels.
- The update must wait for current maintenance tasks to complete. The wait for the completion of the REX test is an example. The following occurs if the XPMs remain in-service. The network attempts a maximum of five retries every 20 seconds. The network performs the retries before the request for the update aborts and the network sets the XPMs to ISTb.
- A messaging error by the DMS switch causes the XPMs to become SysB or CBsy.
- An update that is not complete or correct causes the XPMs to go ISTb.
- The interactive table changes that affect static data are not supported by this reconfiguration feature. The interactive table changes can cause the XPMs to go ISTb. The supported changes are still sent.
- When XPMs are in the ISTb state with the reason STATIC DATA MISMATCH, the XPMs remain ISTb. The XPMs remain ISTb because the original reason for the state is not always fixed by the data changes.

The changes to the configuration data in table LTCINV automatically updates the configuration data in the associated tables. Calls in progress can complete as a result of the dynamic interaction of updating inventory tables. The effect depends on the type of reconfiguration.

The changes to the C-side of subtending XPMs automatically change the host or C-side XPM. When the network adds an XPM, the network assigns all network channels immediately to the C-side links. The system audit updates all the data as the network channels become available. The changed C-side node automatically changes all of the XPMs linked to the node on that side.

The P-side link reconfiguration changes the link type in an existing tuple in a P-side inventory table (LTCPSINV or RCCPSINV). The reconfiguration only affects the static data of the LTC or the RCC.

To reconfigure ringing data, change the ringing type in data table LCMINV. The ringing type is supported as a stand-alone change to table LCMINV. This condition occurs because changing the ringing type is supported as part of an LTC node reconfiguration. The reconfiguration automatically updates the C-side XPM.

Provisioning backup D-channels for LGCI and LTCI

Provision backup D-channels, in order to make both the primary and the backup D-channels available. Each D-channel resides on the 24th channel of a separate DS-1 facility, and within a single XPM.

One D-channel conveys layer 3 call control signaling messages, and the other remains in the standby state to act as a reserve. When the D-channel that carries the layer 3 call control signaling messages fails, the standby D-channel takes over. A backup D-channel increases the reliability and guarantees continued PRI services between any nodes or networks that use ISDN PRI.

Provisioning inserts the data required to run the switch into the switch database in table format. CM stores the data, and also places a more organized copy of these tables in the XPM. The primary and backup D-channels are provided at provisioning time as D1 and D2.

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.

Before NA008, provisioning a backup D-channel placed both the primary and backup D-channels 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 during backup D-channel updates, the static data also updates at the XMS 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.

Fault conditions

Several types of faults can occur to the components of the LGC, LTC, DTC, MSB6, and MSB7 PMs. In the host office, the C-side links to the network can shut down. If the network link has faults, the network can lose messaging from the CC and subscriber service. A DS30 card that has faults in a host PM can also cause communication that has faults with the CC.

Any card in a PM, can have faults and can affect subscriber service as a result. The power converter card and PM equipment other than circuit cards can also have faults.

The P-side links carry messages that are important to a subsidiary PM and to subscriber service maintenance. A P-side link that has faults can damage subscriber service and a subtending PM. In a P-side link, a channel must be available so that the call attempt is successful. Signal or software problems can make a channel unavailable for a subscriber call or for important messaging.

The faults described above are general faults. Other faults include the XMS-based peripheral module (XPM) parity fault and data mismatch.

XPM parity faults

The CC handles parity faults when possible so that the network can perform an RTS quickly.

The following are three types of parity faults:

- hard (requires intervention by operating company personnel)
- soft (the CC can clear this type of fault)
- not continuous (the CC can clear this type of fault)

A PM181 log informs operating company personnel about the type of parity fault. Other logs, like PM128 and PM106, inform operating company personnel the action (if any) the CC performs. The logs also inform the operating company personnel if the CC cleared the fault. You can also use the QUERYPM FLT command to become informed about the type of parity fault.

Data mismatch

A data mismatch occurs when an inactive unit does not have the same data as the active unit. Updates keep the inactive unit of the two-shelf PMs provisioned with the data required to control maintenance and call processing. The following are the three types of updates:

- static data update
- bulk data update
- dynamic data update

Static data update

Static data holds configuration information. The CC sends this information to both units of a PM when the network returns the PM to service.

The following occurs when operating company personnel alter configuration information:

- the system sets the PM to ISTb
- the system provides information that a static data mismatch exists
- the system provides information for the appropriate action to take.

In some cases, the system prompts operating company personnel to busy the inactive unit, return it to service, and switch unit activity.

The system can also prompt operating company personnel to perform the following:

- busy the inactive unit,
- return it to service using the NODATASYNC option
- switch unit activity.

The NODATASYNC option allows operating company personnel to update the inactive unit with CC data. This update occurs without the transfer of data from the active unit. With all static data mismatches, the system prompts operating company personnel with the correct action to take.

> ***Note:*** The network can disable the warm SWACT feature. This process occurs when operating company personnel use the NODATASYNC option to return the inactive unit to service. The network then requires a cold SWACT to switch unit activity.

Refer to Section , "Handling a data mismatch by using the NODATASYNC option" on page 20-7 for additional information. This section describes this enhancement to XPM software in more detail.

Bulk data update

A bulk data update brings the inactive unit of a PM up-to-date with the active unit. Examples of bulk data include P-side and C-side port statuses (open or closed) and call processing data.

The following occurs when the network enables a warm SWACT and both units of a PM are InSv. The inactive unit requests a bulk transfer of critical dynamic data from the active unit. The network needs the data to maintain established calls and continue call processing if a SWACT occurs. This critical data transfer is a bulk data update.

The inactive unit requests a bulk data update after the network returns the inactive unit to service. This process occurs if the inactive unit is OOS when the network enables a warm SWACT.

Dynamic data update

A dynamic data update is a continuous process where the network updates changed data in the active unit in the inactive unit. The following are examples of dynamic data updates:

- subscriber states
- channel reassignment
- port statuses
- DS-1 link information

When the bulk transfer of critical data is complete, communication continues between the mates. This process occurs so that information can continue to flow from the active unit to the inactive unit. This continuous flow of information from the active to the inactive unit is an ongoing data update. As the data changes, the network updates the inactive unit. This update occurs so that the inactive unit maintains the capability to take over CP from its mate if a SWACT occurs.

Table 13-4 lists examples of critical dynamic data transferred to the inactive unit when the network enables a warm SWACT. The active unit sends this data to a mate. The active unit sends the data in bulk first. The active unit then sends the data in an ongoing process as data change in the active unit.

Table 13-4 Critical dynamic data transferred during a warm SWACT

Dynamic data	Condition for change
Call data	The network establishes or disconnects the call.
Terminal status	The network puts the terminal (line or trunk) into service or takes the terminal OOS.
Port status	The network requests a P-side or C-side port change in state (open or close).
DS-1 maintenance	The network enables or disables maintenance or data synchronization reporting over DS-1 links.
P-side node status	The network busies or returns the P-side node to service. The LCM is an example of a P-side node.

The inactive unit can take over call processing from a mate with this data. The inactive unit can take over call processing while the unit retains most of the established calls.

C-side links

For PMs, the network triggers a C-side link minor alarm if all of the channels on a link are OOS. For XPMs, an alarm appears under the header PM of the MTC level of the MAP terminal. The alarm appears when a percentage of the total quantity of C-side links are OOS. The severity of the alarm or alarms depends on the percentage of C-side links that are OOS. All OOS C-side links cause a minor alarm. The system can set the percentage of OOS links to trigger a major or a critical alarm.

The cslink_alarm_thresholds parameter assigns the percentage of OOS C-side links that trigger the alarm or alarms in table OFCENG.

The default thresholds are set at the following:

- 30% OOS to trigger a major alarm
- 60% OOS to trigger a critical alarm

The threshold percentage must be greater than or equal to the threshold percentage of the major alarm. This condition allows the critical alarm to operate. A value of 100% turns off the alarm. The system rounds to the nearest interger to calculates the percentage of OOS links (excluding ManB). The following is an example of this condition. Three out of nine C-side links are OOS and the major alarm threshold is the default. As a result, 33.33% becomes 34%, and the system triggers the alarm.

The system does not include C-side links that are ManB in the major or critical thresholds. The system can stop audible alarms when the system makes the correct links ManB. The status display shows a minor alarm for any OOS links. The quantity of OOS links includes ManB. The quantity of OOS links appear as an alarm under the PM header of the MTC subsystem.

A change of state for the links causes the generation of the following logs:

- PM128 when the links are OOS (and the XPM is CBsy)
- PM106 when the links are RTS (and the XPM is InSv)

DS-1 links

The DS-1 links can have several faults. The faults include frame losses, slips, and bipolar violations (BpV). Different components, including the DS-1 interface card, can cause the DS-1 link problem condition. The system can lose subscriber service when a DS-1 link is in a problem condition.

> ***Note:*** The DS-1 link problem conditions do not apply to MSB6 and MSB7 PMs. The MSB6 and MSB7 PMs do not interface with DS-1 links.

XPM maintenance

XPM Maintenance Arbitrator

The XPM maintenance arbitrator (MtcArb) provides a maintenance functionality which triggers immediate analysis of anomalies that could result in service interruptions. This analysis involves determining which unit should have activity, based on the level of service each unit can provide. MtcArb functionality also notifies other maintenance systems and applications of important maintenance events.

A load that contains MtcArb, always provides the maintenance, with no ability to disable the function.

MtcArb provides a maintenance functionality with mechanisms to

- initiate immediate analysis of problems that could result in gaps in service
- provide periodic fault reporting with the log utility
- post XPMs based on the current alarm status displayed in the alarm banner, eliminating need to POST ALL and QUERYPM FLT each XPM
- determine which unit should be active, based on the level of service each XPM unit can provide
- notify other maintenance and applications of important maintenance events
- prompt the user to verify the correction of very important faults before attempting a manual return to service

The MtcArb maintenance functionality handles several major classes of DTC, LTC, and LGC faults associated with the NT6X41 speech bus formatter card, NT6X42 CSM card, and NT6X44 time switch cards.

If you attempt a manual SWACT, a pre-SWACT audit failure results in a MAP display. The MAP display identifies the internal resource of the XPM unit with the problem, and indicates the level of degradation.

After an autonomous SWACT, the system sets the newly inactive unit SysB for service level, which results in immediate RTS without diagnostics. The unit will return to service. After a SWACT for a very important problem, the system sets the newly inactive unit SysB for a MtcArb very important problem, which results in RTS by the audit with diagnostics. If the system detects a very important degradation during testing, the unit will not return to service for diagnostic failure. If diagnostics do not detect the fault, then the unit will fail RTS. This failure occurs because the system recognizes the fault as a very important problem when the unit is active.

If MtcArb is present in the load, MtcArb makes the decision to perform a SWACT. While the CM maintains diagnostic history for XPMs, CM does not refuse SWACTs based on history. CM lets MtcArb make the decision.

Execution of the command QUERYPM FLT displays one of the three following service degradation levels:

- severe
- partialservice levels
- minor or potential service levels

The command QUERYPM FLT also displays how MtcArb detected the faults and the conditions under which MtcArb detected the faults. The following list contains the fault types and the text for how MtcArb detected the fault:

- an inferred fault type: Fault inferred by maintenance
- a hard fault type: Fault detected by diagnostics
- an operational fault type: Operational fault

The command QUERYPM FLT also provides a list of potentially faulty cards.

> ***Note:*** The PM181 log provides the same information displayed by the command QUERYPM FLT.

Basic audits

The following basic audits check two-shelf PM data to ensure hardware accuracy and agreement:

- XPM parity audit
- unsolicited report handler audit
- time switch connection audit
- IMC link audit
- data mismatch audit

> ***Note:*** The time switch connection audit does not apply for the MSB6. This audit does not apply because Nortel does not supply the MSB6 with a time switch circuit card.

XPM parity audit

This audit runs as a low priority background task in the MP and SP cards. When the audit runs, the audit tests reading memory locations of the SP and MP memory cards. If the audit finds an area that has faults, the audit will reread the location. If the reread has faults, the audit tries to write a test pattern to the memory location that has faults.

The CC acts on this audit so that the memory fault can be corrected quickly.

Unsolicited report handler audit

This audit causes a software error (PM180) message when a two-shelf PM receives an unsolicited message that is not defined.

Time switch connection audit

This audit checks and corrects the time switch connection after every warm SWACT. The network requires this operation because message transfer between the active and inactive PM units occurs at a lower priority than other tasks. The message transfer contains call connection information with other data. As a result, the newly active and formerly active PM units can contain different information after a SWACT.

IMC link audit

The system audits both IMC links in a two-shelf PM to monitor the sanity of messages between the units. One IMC link appears between the NT6X69 message protocol cards and one appears between the processor cards. The system places the node (both units of the PM) in the ISTb state. This process occurs if the IMC audit fails and the system detects the fault at the node level. The system places the fault unit in the ISTb state if the system detects the fault at the unit level.

The following events occur when the system detects an IMC link failure:

- the system reports the fault to the CC
- the link closes and PM status changes to ISTb
- the PM processors no longer use link
- the system prevents warm SWACTs

Refer to "Handling an IMC link fault in Chapter 18" of this guide for additional information. Refer to Two-shelf PM trouble isolation and correction for corrective action. When the system fixes the fault, the system audit reopens the link.

Data mismatch audit

An audit continuously checks for a data mismatch between the CC and the units of the XPM for PMs. The types of PMs that the audit checks for are LTC, LGC, and DTC. The audit compares the static data and the execs with the CC while the XPM is in-service. The CC determines if a unit requires reloading based on the data checksum of the audit.

On a following RTS the CC does not load the XPM (opposed to other XPMs). This condition occurs if the audit verifies that the static data and the execs match.

The following occurs if the audit finds a mismatch:

- In the active unit, the system causes a SWACT to make the unit SysB. The system then executes the RTS command which reloads the static data and the execs.
- In the inactive unit, the system makes the unit SysB and executes the RTS command which reloads the static data and the execs.

Pre-SWACT and post-SWACT audits

The SWACT audits provide a mechanism in the XPM that increases SWACT reliability. The prevention of a SWACT to a mate unit that can not maintain activity increases SWACT reliability. The system attempts a SWACT back to the originally active unit. This process occurs if a SWACT occurs and the newly active unit does not establish two-way communication with the CC. The new mechanism that provides additional SWACT reliability is based on the following audits:

- pre-SWACT
  - pre-drop
  - pre-gain
- post-SWACT
  - post-gain
  - post-drop

Each of the audits listed above is present in each unit. Every audit performs a different action in the states of a SWACT. For example, a SWACT drops the activity of one unit and gains the activity of the mate unit of a peripheral. The following sections describe audits that control a SWACT in the XPM in more detail.

> ***Note:*** The system can execute a pre-SWACT and post-SWACT audit on the following PMs: LGC, LTC, and DTC. This audit occurs because feature AF5007 applies to the LGC, LTC, and DTC peripheral modules. The audits can not run on the derivatives of the three PMs described in this guide.

Pre-drop audit

The pre-drop audit accepts a request to drop activity. This audit also determines if the mate unit is in a acceptable condition to accept activity. This audit only runs in the active XPM unit.

One of two possible sources can initiate a SWACT of the peripheral. The following are the two possible sources:

- the CC, in the form of a request to the active unit to drop activity
- the active XPM unit, that causes a not controlled SWACT

The pre-drop audit evaluates the following information to determine if the audit can drop activity:

- source of the request (CC or XPM)
- type of drop request
- known status and history of the currently active unit
- known status and history of the inactive mate unit

The SWACT controller queries the XPM for a CC-initiated SWACT. The pre-drop audit in the XPM responds to this query. The audit informs the CC if the active unit can comply with the request to drop.

Pre-gain audit

The pre-gain audit monitors the XPM status data in the inactive unit. The audit sends this information to the pre-drop audit in the active unit. The pre-drop audit uses this information to determine if the active unit can drop activity. The audit examines the XPM status data. The XPM status data includes the following:

- Facility audits that initiated the result of the last run for each diagnostic in the facility audit for a given peripheral. The system records the facility audits in the XPM.
- Status information that includes if the inactive unit:
  - — is in service and ready
  - — has CC links OK
  - — does not have corrupt static data
  - — is in sync
  - — is not jammed as the inactive unit

> ***Note:*** The inactive unit can not reach all diagnostic paths. As a result, the performance of a manual SWACT with the FORCE option can be required. This procedure clears a failure from the pre-gain audit record.

The pre-gain audit continues to monitor and report unit status and condition information while the unit is inactive. The pre-drop audit determines if the active unit can drop activity. The audit uses the information provided by the pre-gain audit to determine if the active unit can drop activity. After the audit performs this procedure, a warm SWACT occurs. The post-gain audit in the newly active unit also starts to run.

Post-gain audit

The post-gain audit runs in the newly active unit. The single purpose of the post-gain audit is to verify that the unit establishes two-way communication with the CC. If the audit establishes communication, the newly active unit maintains activity. If the communication check fails, the unit forces a drop of activity. The drop of activity initiates a SWACT back to the originally active unit. In this event, the pre-drop audit allows the SWACT to proceed and does not refuse the SWACT. If the SWACT back fails, the system busies the XPM node and returns the node to service.

Post-drop audit

The post-drop audit runs in the newly inactive unit. The newly inactive unit remains in service for a limited time without initializing. The post-drop audit cleans up the call processing data structures of unstable calls and non-synced stable calls. The audit determines that the system does not require a SWACT back or a SWACT back is complete. After the audit performs this procedure, the XPM informs the CC. The system busies the inactive unit and returns the unit to service.

NT6X69 cards: tests and audits

The NT6X69 message protocol card performs self-tests when you enter the TST command. The protocol card also performs self-tests when the PM unit is inactive and OOS. The protocol card is a part of the PM unit.

The NT6X69 message protocol card performs the following tests:

- the destructive test that replaces the contents of the CM
- the nondestructive test that does not test the CM

Destructive test

The destructive test fails when one of the stages of the test fails.

The destructive test performs the following tests in sequence:

- resets the message protocol card
- checks the message buffer
- checks the speech bus and CM and the message buffer access from the P-side
- checks the timeslice of messaging
- tests the speech bus interface (incoming and outgoing). To perform this test, the destructive test allows the system to transmit and copy the PCM into the buffers
- tests the ROM
- resets the message protocol card

If any stage of a test fails, you must replace the NT6X69 message protocol card. Refer to Card Replacement Procedures for additional information.

Nondestructive test

The NT6X69 message protocol cards run nondestructive tests when the protocol cards can not run destructive tests.

The tests include the following:

- P-side tests
  - — use a dedicated channel of the time switch card to run a loop-around test on the P-side links. The links must be DS-30A or DS-1. The link can not be PCM30 because it does not have dedicated channels in use and cannot be identified.
  - — allow the CM for the dedicated channel and transmitting PCM samples
  - — check the received PCM samples. If the sample fails, the system lists the suspected card or cards and generates a log.
- C-side tests
  - — use a C-side maintenance channel and CSM for a loop-around test
  - — allow the CM for the channel and transmitting CSM
  - — check the received CSM samples. If the sample fails, the system lists the suspected card or cards and generates a log.
- speech bus interface
  - — sends PCM samples through the CM to copy into the receiving buffers
    - the outgoing speech bus transfers the PCM
    - the incoming speech bus transfers the PCM
- ROM

  The message protocol card tests the ROM.

Interrupt by audit

The system automatically runs the audit and does not require manual interruption. The system does not require maintenance action as a result of the audit.

The NT6X69 card can receive messages from the network interface (C-side) or speech bus interface (P-side). The system includes messages between modules in the speech bus interface. If the interrupt line to the signaling processor (SP) of the XPM disconnects, the SP can not receive any messages. The SP can continue to send messages. This condition means the CC can not signal the XPM to drop activity.

To prevent this potential stalemate, an audit of the NT6X69 card checks if the interrupt occurred. If the interrupt did not occur, the audit checks the incoming queues. The audit checks the queues to make sure the SP did not place messages in the queues. The audit generates a software error report (SWERR) and allows message processing to occur so that the SP receives messages. (The QUERYPM command displays the total quantity of SWERRs for a unit for a given time period.) This process occurs if messages that require processing exist but the interrupt is not raised. If the audit detects this condition two consecutive times, the audit sends a request for the XPM to drop activity. The audit also runs when the XPM is ManB.

The audit also checks if the message interrupt is permanently disabled. If the message interrupt is disabled, the incoming message handler can check for messages continuously. The incoming message handler can also use the real time of the SP. To prevent this condition, the audit also checks if the interrupt is disabled and messages that require processing do not exist. If this condition occurs, the audit generates SWERRs and disables message processing. If the audit detects this condition two consecutive times, the audit then sends a request for the XPM to drop activity.

Lost message counts

The XPM can not send a message if not enough message buffers exist. If this condition occurs, the XPM places the message in an interperipheral connection (IPC) buffer and in a holding queue. The XPM loses the message if the PM can not obtain an IPC buffer or the holding queue is full. The XPM can also lose received messages if IPC buffers are not available.

The system increments two counts at the data link level:

- one for lost received messages
- one for lost transmitted messages

The counts appear at the data link level of the XPM monitor. The counts store information about lost messages that the system did not save. The counts also indicate when messaging overloads.

> ***Note:*** The NT6X69 card test does not apply for the MSB6 because Nortel does not supply the MSB6 with an NT6X69 card.

REx tests

The system performs routine exercise (REx) testing to maintain the XPM service. The system performs the following actions in a REx test:

- system busies the inactive unit
- returns to service the inactive unit, that includes
  - out-of-service tests
  - downloading of static data and execs
  - a return to service
- delays to allow the unit to achieve superframe and data synchronization
- performs a warm SWACT
- system busies the new inactive unit

- runs in-service diagnostics on the active unit
- returns to service the newly inactive unit
- delays to allow the unit to achieve superframe and data synchronization

After the successful completion of the REx test, the system makes the inactive unit of the XPM the active unit. The test ends if a fault occurs on an XPM during REx testing. The system then generates a log to indicate the failure. The state of the XPM at the time of the fault remains the same.

The REx testing occurs automatically by default. Manual or system maintenance actions can override testing.

Automatic REx testing

The REx test starts at the same time daily (START time) and tests the XPMs of the office one at a time. The tests occur until the test reaches the STOP time. If the test for the last XPM starts before the STOP time, the test continues to complete. If the system suspends the testing before the STOP time, the system continues the tests at the START time of the following day. When the system suspends testing before the STOP time, the XPMs are not tested between the START and STOP times.

The operating company can set the start and stop times in data table OFCVAR with parameter NODEREXCONTROL.

The system REx (SREx) controller coordinates the automatic REx tests. The SREx is a dedicated software facility resident in the computing module (CM). The SREx controller allows compatible REx tests to run at the same time. This condition makes sure that the system can REx test all XPMs in the office within the designated test cycle. The designated test cycle is normally one week.

The SREx controller also makes sure that incompatible REx tests are not run at the same time. For example, the system can not test host and subtending XPMs at the same time. In addition, the SREx controller makes sure that REx tests are not run at the same time with incompatible activities. Incompatible activites include AUTODUMP and AUTOPATCH.

The table REXSCHED controls scheduling for automatic REx tests. In addition to basic scheduling parameters, this table also allows the naming of parallel XPM testing as automatic. As a result, the system automatically computes and adjusts the number of host XPM REx tests that can run together.

Manual REx testing

The command TST REX NOW can run REx tests manually or interrupt the tests after posting the XPM. The display for the command QUERYPM includes the status of the tests. The display also includes the time and date that the system last tested the XPM.

Different procedures exist to run REx tests on XPMs. The use of different procedures depends on the XPM having a REx controller. The following are summaries of the procedures.

XPMs without REx controller

The following summarizes the procedure to run a REx test on an XPM without a REx controller.

1 Busy the inactive unit.

2 RTS the inactive unit (includes out-of-service diagnostics).

3 Wait for the super frame and data sync.

4 Perform a warm SWACT.

5 BSY the newly inactive unit.

6 Run InSv diagnostics on the newly active unit.

7 RTS the newly inactive unit (includes OOS diagnostics).

8 Wait for the super frame and data sync.

XPMs with REx controller

The following summarizes the procedure to run a REx test on an XPM with a REx controller.

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

2 SysB the inactive unit.

3 RTS the inactive unit (includes out-of-service tests only).

4 Wait for the superframe and data sync.

5 Perform a pre-SWACT audit.

6 Perform a warm SWACT.

7 SysB the newly inactive unit.

8 RTS the inactive unit.

9 Wait for the superframe and data sync.

10 Run in-service diagnostics (TST) on the newly active unit.

11 Run in-service diagnostics (TST) on the inactive unit.

Note: The REx tests for XPMs with the REx controller apply to PMs that support feature AF5008. The tests also apply to PMs that support XPM REX Control and Trouble Notification Improvements. In this guide, the PMs that support the above features include the LTC, LGC, DTC, PDTC, and the DTCO.

A REx test for a given XPM only occurs for the following conditions:

- The REXSCHED table must turn on REX for an XPM.
- The system sets the value for the NODEREXCONTROL parameter in table OFCVAR to on.
- The system clock is within the start and stop times set in table OFCVAR.
- The XPM is the next one the system selects.
- You did not enter the TST REX OFF command for the XPM.
- The XPM node status does not show the following ISTb conditions:
  - inact OOS
  - overload

The MAP level commands QUERYPM and TST REX QUERY display the results of the last REx test. The MAP level command QUERYPM FLT gives the reason for the status of the XPM unit.

When an XPM unit fails a REx test, the system places the unit as in-service trouble with a reason REX Failed. A successful REx test or a manual return to service can clear the in-service trouble status.

The REx test generates a log at the start time daily and when the system turns off REx testing. The REx test generates logs for each XPM during the testing. The REx test generates Log PM181 if manual interruption affects automatic testing. The log also mentions when the REx test does not test an XPM because of the interruption.

Logs generated by the REx testing have the identifier IOAU112. Logs indicate one of the following conditions:

- The REx testing does not run.
- The testing timed out while the test waited for a REx test reply.
- Table OFCVAR changes the REx testing by setting the start, stop, on, and off parameters.

Operational measurements, counts, and alarms that the system normally generates for some system actions are suppressed. For example, activity of the REx test can accidentally activate counts.

The period of the REx tests vary according to the type of XPM. According to the duration of a test, the quantity of XPMs tested between the start and stop times is measured. The period helps to estimate the time it takes to test all of the XPMs in the office. Table 13-5 notes the measured period for the XPM types.

Table 13-5 Duration of REx tests

PM	Duration
ADTC	less than 15 min (estimate)
DTC	10 min (according to lab tests)
IDTC	12 min (according to lab tests)
LGC	12 min (according to lab tests)
ILTC	12 min (according to lab tests)
LTC	10 min (according to lab tests)
MSB6	less than 12 min (estimate)
MSB7	10 min (according to lab tests)
PDTC	less than 15 min (estimate)

Interface to the pre-SWACT and post-SWACT audits

The REx state machine (or controller) permits the SWACT controller to refuse to attempt a SWACT. The REx controller performs the following:

- calls the SWACT controller during the pre-SWACT step before the SWACT controller initiates the SWACT request. The SWACT controller determines if a SWACT can be attempted based on the diagnostic history of the unit. The diagnostic history of the unit is maintained in the diagnostic history database. (Refer to the description of the PM diagnostic history database, feature AF5006, in Chapter 18 of this document.) The diagnostic history database is the result of the last SWACT attempt to the inactive unit. The database is also the result of the data returned by the XPM in the pre-SWACT query message. This condition means an XPM can fail the pre-SWACT step of REx. Also, the XPM can not show any failures in the DiagHist level of the MAP display. This condition occurs if the reasons for the pre-SWACT failure does not include diagnostic failures.
- accounts for SWACT denial and failure reasons
- terminates a REx test if a SWACT is denied
- terminates a REx test if a SWACT occurs. The active unit of the XPM does not change from the time the REx test started. If the test supports the feature AF5007, REx terminates without recovery actions. This

termination occurs because the SWACT code submits a BSY/RTS of the inactive unit.

- displays the failure reason for a SWACT denial or failure performed during a manual REx at the MAP terminal as REx failed. The command string TST REX QUERY gives the reason for the failure for the posted XPM. In addition, the REx generates a PM600 log report detailing the reason of the REx failure.

Digital phase lock loop clock failure

The system identifies when a loss of sync causes a system busy following a digital phase lock loop (DPLL) clock failure. The enhanced field failure information feature allows the system to perform this procedure. To address the problem, the CC acknowledge the reception of the sync lost message. If the PM does not receive the acknowledgment, the PM goes SysB. As a result, the next time the PM returns to InSv the PM generates a sync_was_lost log. This feature logs all large out-of-phase readings to provide information on the time the DPLL clock had problems.

Automatic XPM reload

When an XPM requires a reload, the system can reload the XPM automatically without manual intervention. An automatic reload requires datafill in tables PMLOADS and LTCINV. Automatic loading (auto-loading) only occurs when the system stores the loads on a storage device like a system load module (SLM) tape or a disk.

Auto-loading occurs when the XPM is system busy and the system failed to return the XPM to service twice. When the system attempts auto-loading, the status display of the XPM shows the name LOAD. The following is an example:

```
LGC  0   ISTb   Links_OOS: CSide  0  PSide  0
Unit 0:  Act    InSv
Unit 1:  Inact  SysB   LOAD
```

If the resources required for loading are not available when the attempt occurs, an audit attempts the auto-loading again. If the XPM fails the ROM test of the auto-loading, the attempt occurs one more time. After two consecutive failures to load the XPM, the system aborts the load and cancels the audit. The failed attempts include a 10-minute time-out for the InSv that remains. The status of the XPM remains SysB.

You must datafill Table PMLOADS before you datafill table LTCINV. To remove a load name from table PMLOADS, you must first remove the load name from table LTCINV. Table PMLOADS lists the names and the locations of the loads for the XPMs. Data is automatically datafilled in table PMLOADS during the dump and restore and first datafill. This process occurs when you datafill table LTCINV. If you already datafilled table LTCINV, the dump and restore of the office copies the data of the office. You must add a device name to the table. The device name in table LTCINV identifies the device that stores the load files.

When an audit attempts an auto-load, a minor alarm can occur. The alarm occurs if the system does not store any of the load names in table PMLOADS on a storage device. The system displays the alarm as PMLOAD. The PMLOAD appears under the header PM of the continuous status display of the MTC level. This condition assumes that a more important alarm does not occur at the same time.

Increase to manual maintenance

When automatic maintenance fails to correct a fault in the DMS switch, the DMS switch provides trouble indicators. The trouble indicators reveal that a fault condition continues to exist. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and a failure of automatic maintenance. The DMS switch requires manual intervention by maintenance personnel terminal to clear the fault.

14 Dual-shelf PM preventive maintenance methods

This chapter describes the routine procedures and schedules that maintain two-shelf peripheral modules (PM). This chapter provides general information to assist qualified maintenance personnel with troubleshooting and maintaining two-shelf PMs.

The information in this chapter complements procedure documents. The information does not replace procedure documents. Refer to Routine Maintenance Procedures for more information.

Routine maintenance procedures

Perform routine maintenance procedures according to a schedule. Some of these tasks are as follows:

- Inspection of cooling unit filters
- Tests of wrist-strap grounding cords
- Replacement of cooling unit filters
- Inspection and replacement of worn out lamps in a frame supervisory panel (FSP)
- Tests of power converter voltages
- Return of cards or assemblies for replacement or repair

Routine maintenance schedules

Operating company personnel must perform the routine maintenance procedures at normal intervals.Table 14-1 lists the performance intervals of routine maintenance tasks.

Table 14-1 Schedule of routine maintenance tasks for two-shelf PMs

Performance interval	Maintenance task
Two weeks	Inspect the cooling unit filters.
One month	Test wrist-strap grounding cords.
Three months	Replace the cooling unit filters.
Three months	Inspect and replace worn out lamps in frame supervisory panel (FSP).
Three months	Test power converter voltages.
As required	Return cards or assemblies for replacement or repair.

15 Dual-shelf PM related logs

This chapter identifies the logs associated with two-shelf peripheral modules (PM). Refer to "Log Report Reference Manual". for more information.

The DMS-100 switch software uses logs to record all the important events that occur. The logs make the events known to the operating company personnel at the MAP terminal.

The following are examples of important events:

- an equipment fault,
- a change in state of equipment,
- the failure or successful completion of a test.

The log system in the DMS-100 switch creates a report that contains the above information. This log stores the report in data store (DS) for online retrieval. The report distributes to one or more output devices. The output devices display the report.

Log reports are displayed in the order that the logs occur. The log prioritizing feature displays log reports with the highest alarm first.

The generation of PM log reports occur when:

- a PM has a fault condition,
- a PM changes state,
- a PM passes or fails a test.

The PM logs 179, 180, and 181 are the most important PM maintenance logs. The generation of the logs results from a change in the PM state.Table 15-1 describes other causes for the logs and the correct actions which operating company personnel must perform.

Important PM maintenance logs include PM logs 600 and 601.Table 15-1 also describes the logs.

Table 15-1 Single-shelf PM related logs

Log name	Causes	Response
PM179	A hardware condition affects normal PM operations.	Refer to "Log Report Reference Manual" for given problems and responses indicated by this report.
PM180	The switch encounters a PM software exception, or the wrong execution of software.	Used by qualified software personnel to troubleshoot software defects that are present. Retain log report for trend analysis.
PM181	Hard parity fault	Busy unit, replace card in list, reload, and return to service (RTS).
	Soft, not continuous parity faults.	None if units are in service (central control (CC) brings in-service trouble (ISTb) unit back to service). If units are not in service, busy unit, reload, and RTS.
	Routine exercise (REX) test failures	Retest manually. Replace cards that have faults.
	Automatic system testing initiated, completed, or aborted	None (information only)
	Switchover initiated, completed, or timeout P-side port or node status mismatch	None (information only)
PM600	A REX test failed.	The PM600 records the maintenance actions performed on the XPM during the failed REX. The actions from the start of the REX to the step that failed are recorded. This information is used to pinpoint the source of the REX failure.
PM601	Operating company personnel reset long term failure counters to zero for an XPM posted at the MAP terminal. The deletion of the XPM from the datafill can also occur.	This log is an information log that must remain in a form correct for analysis. The Technical Assistance Service (TAS) and field support organizations can analyze the log if a later outage occurs.

16 Dual-shelf PM related operational measurements

This chapter lists the operational measurements (OM) group names associated with dual-shelf peripheral modules (PM).

Refer to the following for more information on PMs:

- "Operational Measurements Reference Manual"
- *Basic Administration Procedures*, 297-1001-300,
- *Service Problem Analysis Administration Guide*, 297-1001-318

The OM records contain data of events that occur during a given time period. The following are three basic types of measurements: peg counts, use, and overflow. Use operational measurements as service-level indicators. Use OMs as input for maintenance activities, hardware and software assignment, accounting, and provisioning decisions.

Table 16-1 contains information about the OM groups that associate with given dual-shelf PMs

Table 16-1 Dual-shelf PM OM groups (Sheet 1 of 2)

PM Type	OM Groups
DTC	PM, PMTYP, and ISDD
DTCO	PM and PMTYP
ADTC	PM and PMTYP
IDTC	PM and PMTYP
PDTC	PM and PMTYP
LGC	PM, PMTYP, BCLID, and BCLIDO
LGCO	PM and PMTYP

Table 16-1 Dual-shelf PM OM groups (Sheet 2 of 2)

PM Type	OM Groups
ILGC	PM and PMTYP
PLGC	PM and PMTYP
LTC	PM, PMTYP, ISDD, BCLID, and BCLIDO
ILTC	PM and PMTYP
MSB6	PM and PMTYP
MSB7	PM, PMTYP, and C7GWSCCP

Table 16-2 describes four dual-shelf PM OM groups and associated logs.

Table 16-2 Dual-shelf PM OM groups overview

Group	Information
PM	**Description:** Counts errors, faults, and maintenance state changes for DMS switch PMs with node numbers. **Associated logs:** NET101, NET102, PM100,PM101, PM102, PM107, PM108, PM109, PM114, PM115, PM116, PM117, PM118, PM119, PM122, PM124, PM125, PM126, PM128, PM152, PM180, PM181, PM183, and PM185
PMTYP	**Description:** Counts the PM errors, faults, and state changes for a group of PMs that are the same type. **Associated logs:** NET101, NET102, PM101, PM102, PM107, PM108, PM109, PM110, PM113, PM114, PM115, PM116, PM117, PM118, PM119, PM122, PM124, PM125, PM126, PM128, PM180, PM181, PM183, PM185, PM190, and PM192
BCLID	**Description:** Provides information about bulk calling line identification calls on an office-wide condition. **Associated logs:** None
BCLIDO	**Description:** Provides information about bulk calling line identification calls on a BCLID group condition. **Associated logs:** None

17 Dual-shelf PM related data structures

Data structures do not apply to the problem-solving and maintenance of two-shelf peripheral modules (PM).

18 Dual-shelf PM related user interface commands

This chapter describes how maintenance personnel can use the MAP user interface to support two-shelf peripheral modules (PM). This chapter describes the user interface, system status displays, menu and non-menu commands.

The following is a list of the sections in this chapter. The list also contains a short description of the type of information in each section.

- The section MAP user interface describes the MAP system, system status displays, and command structure.
- The section Menu commands identifies and describes the menu commands that support two-shelf PMs.
- The section Nonmenu commands identifies and describes the nonmenu commands that support two-shelf PMs.

This chapter only provides general information on user interface commands. This chapter assists qualified maintenance personnel in problem-solving and maintaining two-shelf PMs. Refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822 for additional information on user interface commands.

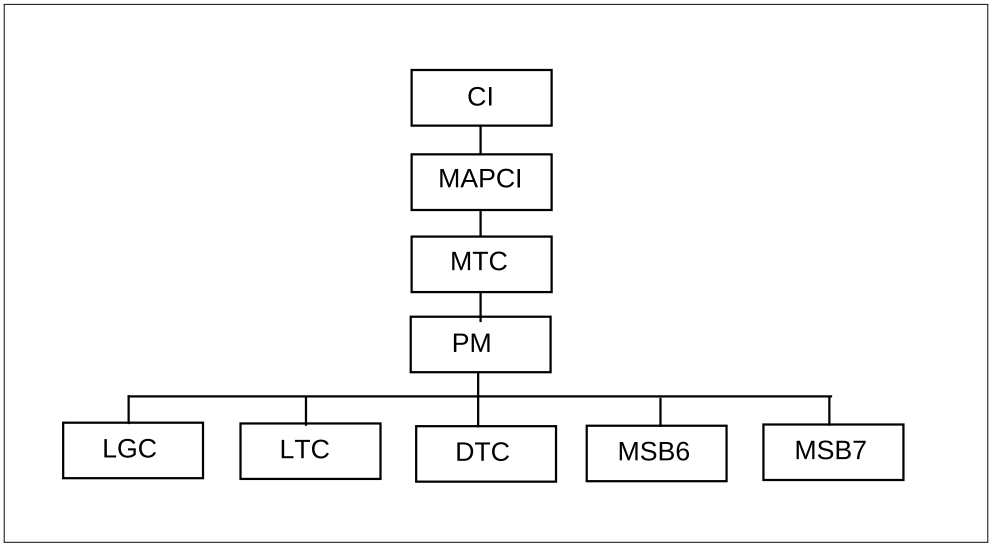
MAP user interface

A series of ordered levels organizes information at the MAP terminal. The levels start at the command interpreter (CI) level. The automatic examination of the CI level occurs when a user logs on at a MAP terminal. At the CI level, the MAPCI command accesses the next highest level. From the MAPCI level, the user can go into other levels.

Each level of the MAP system has a different set of menu commands and system status displays. A level can display and access information from a previous level. The following is an example of this condition. Some of the menu commands are used as non-menu commands at the LGC (line group controller) level. The menu commands are available at the PM level. Status information that appears at the PM level remains as the user accesses subsequent lower levels.

Figure 18-1 shows the MAP levels that support two-shelf PMs.

Figure 18-1 MAP levels for two-shelf PMs



The MAP levels for the LGC, line trunk controller (LTC), and digital trunk controller (DTC) resemble each other.

The following have MAP levels that provide features not available for other two-shelf PMs:

- the message switch and buffer for common channel signaling (CCS) 6 (MSB6).
- message switch and buffer for CCS7 (MSB7).

This chapter identifies the features not available for other PMs.

> ***Note:*** The MSB6 and MSB7 support CCS services. You will not have these PMs or the associated MAP levels if your switch does not support CCS. PM maintenance software does not support maintenance of CCS links and routing paths.

A PM identifier identifies two-shelf PMs at the MAP display. This reference a PM abbreviation and a PM number. Table 18-1 lists the PM type abbreviations and range of PM numbers for each PM type.

Table 18-1 Identifiers for two-shelf PMs

PM Type	Discrimination Number Range	PM
ADTC	0 to 255	Austrian digital trunk controller (applies to Austrian offices only)
DTC	0 to 255	digital trunk controller (supports DS-1)
DTCI	0 to 255	digital trunk controller ISDN
DTCO	0 to 255	digital trunk controller offshore (supports PCM30)
DTC7	0 to 255	digital trunk controller for No. 7 signaling
IDTC	0 to 255	international digital trunk controller (supports PCM30)
ILGC	0 to 255	international line group controller (supports PCM30)
ILTC	0 to 255	international line trunk controller
LGC	0 to 255	line group controller
LGCI	0 to 255	line group controller ISDN
LTC	0 to 255	line trunk controller (group of LGC and DTC that supports trunks and lines)
LTCI	0 to 255	line trunk controller ISDN
MSB6	0 to 9	message switch and buffer for CCIS6 and CCITT6
MSB7	0 to 9	message switch and buffer for CCIS7 and CCITT7
PDTC	0 to 255	PCM30 digital trunk controller (International)
PLGC	0 to 255	PCM30 line group controller (International)

When you enter the QUERY POST command at the MAP terminal, a list of PM types and PM numbers appears.

System status display

The first three lines of the system status display are common across all levels of the MAP system.

These lines identify the following:

- maintenance state of the subsystem that has faults
- number of PMs in each maintenance state
- alarm code for the fault

In the event of multiple faults, the system status display only identifies the most important fault.

After a two-shelf PM is posted, the system status display provides additional information on PM links and nodes.

Table 18-2 lists and describes some of the maintenance states. The state designs are used in this guide.

Table 18-2 Maintenance states for two-shelf PMs (Sheet 1 of 2)

State	Meaning
•	All PMs are in service (InSv). No alarm conditions are in effect.
nnCBsy	The indicated number of PMs are C-side busy (CBsy). The PM can not communicate with the central control (CC) because the DS30 link or links are not available. The DS30 links are used to carry messages between the PM and the DMS-100 switch.
nnDTC	Both units of one or more DTCs are not in service or have in-service trouble (ISTb). The links can also be C-side busy.
nnIPML	One or more interperipheral message link (IPML) are SysB or manual busy (ManB), P-side or C-side busy, or has ISTb.
nnISTb	The indicated number of PMs have ISTb. The error is minor in ISTb and does not prevent the PM from operating or affecting service. Logs PM128 and PM106 also indicate that a PM is ISTb and then cleared. If • log PM181 is not generated to indicate the reason for the trouble, • the log PM181 is not generated to indicate the card or cards at fault, • the PM level command QUERYPM FLT does not display the information. Manual tests at a MAP terminal indicate the causes of the following: • additional datafill (more STCMs than exist) in table MSBINV • mismatching datafill between the XMS-based peripheral module (XPM) and the data table or the CC.

Table 18-2 Maintenance states for two-shelf PMs (Sheet 2 of 2)

State	Meaning
nnLGC	Both units of one or more LGCs are not in service, or have ISTb, or the links are C-side busy.
nnLTC	Both units of one or more LTCs are not in service or have ISTb, or the links are C-side busy.
nnManB	The indicated quantity of PMs are ManB.
nnMSBx	One or more MSBs are SysB or ManB, C-side busy, or have ISTb, where *x* is 6 or 7.
nnSysB	The MTC system detects an important fault and automatically takes a PM out-of-service. The MTC system made this PM SysB. An office parameter sets the percentage of PMs that are SysB. The percentage of PMs that are SysB indicates a critical or major alarm.
Note: The value of nn ranges from 00 to 99. If nn is greater than 99, two asterisks (*) are displayed instead of numbers.	

Refer to Chapter 20, "Dual-shelf PM trouble isolation and correction," in this guide for additional information. This chapter provides information on alarm codes and given maintenance states for two-shelf PMs.

Circuit location display

System status displays that show the location of circuit cards use a standard display format. The standard display format is based on the DMS-100 Family equipment identification design. The circuit cards are listed according to the most probable cause of the fault. This ordered list becomes the recommended sequence of replacement. This condition occurs when the circuit location display is part of the response to a failed test.

The PM subsystem does not maintain the cards if the fault lies in the line or trunk interface circuits. Fault indications appear under the LNS or TRKS subsystems.

Menu commands

Enter commands and parameters at the MAP on each maintenance level. The commands and parameters are listed in the menu area of each level. The menu area appears at the left side of the MAP display. An underscore that follows a menu item indicates the requirement of a parameter as part of the entry. An underscore preceding a menu item indicates an optional parameter.

Enter either of the following to execute menu commands at any level:

- the number preceding the menu item,
- the complete command.

In response to a command prompt, a space must precede the menu item number.

If a command is difficult to enter, enter ABORT and then re-enter the original command. To obtain information about the syntax and parameters associated with a command, enter HELP followed by the name of the command. If an error occurs, the following message appears:

```
EITHER INCORRECT OPTIONAL PARAMETER(S) OR TOO MANY
PARAMETERS.
```

The reason for the message follows the message.

> ***Note:*** The MSB6 and MSB7 support CCS services and have two associated menus. The interperipheral message links (IPML) menu allows maintenance action on IPML. To access the IPML, type IPML at the PM level. The signaling terminal controllers (STC) menu provides maintenance access to STCs. To access the SPC, type STC at the MSB level when an MSB is posted. You will not have the PMs and the menus if your switch does not support CCS.

Table 18-3 lists and describes the menu commands available at the two-shelf level for the following PMs:

- LGC
- LTC
- DTC
- MSB6
- MSB7

Table 18-3 Menu commands for two-shelf PMs (Sheet 1 of 3)

Command	Action	Description of action
BSY	Busy	Busies a unit of a posted PM, a P-side link, a CLASS modem resource card (CMR), or a complete PM.
DISP	Display	Displays a group of PMs in a given state.

Table 18-3 Menu commands for two-shelf PMs (Sheet 2 of 3)

Command	Action	Description of action
IMAGE	Image dump	Copies the NTMX77 (universal processor) RAM in in-service (active or inactive) XPM units. The XPM units are then copied to the XPM peripheral remote loader (PRL, NT7X05). The PRL image is only available for non-ISDN NTMX77AA-based XPMs with 8-Mbyte of RAM.
LISTSET	Listset	Lists the PM types in the posted set.
LOADFW	Load firmware	Loads firmware into PM or PM unit.
LOADPM	Load PM	Loads software and data into a unit of a posted PM, a CMR card, or in a complete PM.
NEXT	Next	Posts the next PM in a displayed set.
OFFL	Offline	Sets a posted PM off-line.
PERFORM	Perform	Displays PM performance status at the MAP terminal and updates it every minute.
POST	Post	Posts a PM, all PMs in a given state, or PMs as a group.
QUERYPM	Query PM	Displays information about a posted PM. This information includes physical location, node number and associated peripheral load name. Associated faults are displayed at times.
QUIT	Quit	Quits the current PM level of the MAP terminal or cancels a PM selection.
RTS	Return to service	Returns a P-side link to service, a unit of a posted PM, a CLASS modem resource card, or a complete PM.
STC	Signaling terminal controller	Accesses STC maintenance menu if MSB is posted.
STCLoad	Signaling terminal controller load	Loads an STC.
SWACT	switch of activity	Switches active and inactive units for a posted PM.

Table 18-3 Menu commands for two-shelf PMs (Sheet 3 of 3)

Command	Action	Description of action
TRNSL	Translate	Displays P-side or C-side link information of a posted PM.
TST	Test	Tests a P-side link, a unit of a posted PM, a CMR card, or a complete PM.
XPMSTOR	Loadfile transfer	Transfers loadfiles from CM loadfile storage to the PRLs (NT7X05) of the in-service (active or inactive) XPM unit. The PRL is only available for NTMX77AA-based XPMs with 8-Mbyte of RAM.

Note 1: When an XPM status is displayed as manual busy (ManB), offline (OffL), or unequipped (UNEQUIP), the activity display is blank. The activity display includes Active, Act, or Inactive, Inact. The commands RTS INACTIVE, LOADPM INACTIVE, and SWACT are not correct when the activity state is not displayed.

Note 2: When an XPM status is displayed as InSv, ISTb, CBsy, or SysB, the activity (act or inact) is also displayed.

DIAGHIST option

The DIAGHIST option is the option to the DISP and QUERYPM commands that display diagnostic history. The default for this option displays supported XPMs. When used with a given PM, this option displays XPMs of the requested type.

Note: The DIAGHIST option can be used for PMs that support feature AF5006 XPM Diagnostics History. In this guide, the PMs that support feature AF5006 include the LTC, LGC, DTC, PDTC, and the DTCO.

LOADFW command

The LOADFW command has the following syntax:

```
LOADFW
   <DEVICE> (UNIT <unit_no> {0 to 1
            PM,
            INACTIVE,
            ACTIVE}
 [<file_name> string]
 [UPGRADE]
 [NOWAIT]
 [ALL]
```

In-service firmware downloading disables the FIRMWARE option of the LOADPM command. If you enter the LOADPM command with the FIRMWARE option, the MAP response indicates that the FIRMWARE option is invalid and instructs you to use the LOADFW command. The following table describes the parameters for the LOADFW command.

Table 18-4 LOADFW command parameters

Parameter	Value	Description
UNIT	N/A	Specifies loading of an XPM unit
unit_no	0 or 1	Specifies the unit number
PM	N/A	Specifies loading of the entire XPM
INACTIVE	N/A	Specifies loading of the inactive unit
ACTIVE	N/A	Specifies loading of the active unit
string		Specifies the firmware load file name. If you do not specify a file name, the system loads the firmware specified in the related inventory table.
UPGRADE	N/A	Specifies an upgrade to the new firmware load
NOWAIT	N/A	Provides the command prompt before the current command completes
ALL	N/A	Specifies a firmware loading of all posted XPMs

SWACT command

The SWACT command switches activity in a posted PM from the active unit to the inactive unit. Both units must be InSv or ManB to perform a SWACT.

Example

You enter the SWACT command without parameters for a posted PM. The following response appears at the MAP terminal:

```
A Warm SwAct will be performed after data
sync of active terminals.
Note: Please confirm ("YES", "y", "NO", or "N"):
```

You confirm the request for a SWACT. The following message appears at the MAP terminal:

```
SwAct refused by SwAct Controller
Inactive unit has a history of:
   Message link failures
   Superframe sync failures
Inactive unit is reporting:
   Unit is jammed inactive
```

If you decide to override the SWACT controller, enter the SWACT command with the FORCE option. The following response appears at the MAP terminal:

```
A Warm SwAct will be performed after data
sync of active terminals.
Overriding the SwAct Controller
Please confirm ("YES", "Y", "NO", or "N"):
```

You confirm the request to override the SWACT controller. The following response appears at the MAP terminal.

```
SwAct Failed
Reason:  XPM SwActback
```

The MAP response indicates that the SWACT failed and the original active unit regained activity.

> ***Note:*** The feature AF5007 XPM Pre-SWACT/Post-SWACT Audit supports SWACT back capability. The LGC, LTC, and DTC peripheral modules can support this audit. The derivatives of the three PMs described in this guide do not support the SWACT back capability.

Default after a system reload-restart allows a warm SWACT. Operating company personnel can disable a warm SWACT at the PM level. To disable a warm SWACT, type

>WARMSWACT OFF

and press the Enter key.

A cold SWACT occurs if a SWACT attempts for a PM while warm SWACT capabilty disables. Activity can be transferred but in-process calls are lost.

To re-enable warm SWACT, type

>WARMSWACT ON

and press the Enter key.

> ***Note:*** A warm SWACT disables when the inactive unit of the PM returns to service. The inactive unit of the PM uses the NODATASYNC option to return to service. This condition occurs because a cold SWACT is required to switch unit activity and all calls are dropped.

TRNSL command

The TRNSL command identifies C-side or P-side message links of a posted PM. This command shows the status of the DS30 C-side links to the DMS-100 network or the DS-1, P-side links.

TST command

The TST command tests one or all units of one or all posted XMS-based peripheral modules (XPMs). This command also tests a specified P-side link. The node tested must be InSv, ISTb, ManB, or SysB.

Non-menu commands

A variety of non-menu commands support the maintenance of two-shelf PMs. The nonmenu commands include CI-level commands, PM-level menu commands, and two-shelf level non-menu commands.

Table 18-5 lists and describes some of the non-menu commands that support two-shelf PMs.

Table 18-5 Nonmenu commands for two-shelf PMs (Sheet 1 of 2)

PM commands	Code	Description
ABTK	Abort task	Aborts all active maintenance action on a posted two-shelf PM. The state of the PM remains the same. This command cancels the load to unlock the keyboard.
CPSTAT	Control processor status	Displays the software processing status for a node number of a posted PM.
LDPMALL	Load PM all	Loads or reloads more than one PM at the same time. All PMs that will be loaded must be of the same node-type, posted, in the ManB or SysB state and use the same load file

Table 18-5 Nonmenu commands for two-shelf PMs (Sheet 2 of 2)

PM commands	Code	Description
NEXT	Next	Places the next PM in the set into the control (posted) position.
PMLOADER	PMloader	This CI-level command is for PM node types LTC and MSB. This command can query the cause of the alarm PMLOAD. The PMLOAD alarm can appear under header PM of the MTC level status display. This command can also be used to force the audit run that attempts the auto-load again.
PMRESET	Pmreset	Re-initializes a posted LTC, LGC, or one of the LTC or LGC units after the load. This reset verifies that the reload is correct.
WARMSWACT	Warmswact	Switches activity of the units of the posted two-shelf PM.
XBERT	XPM bit error ratio test	This CI-level command accesses XBERT monitor of commands. This command allows testing of the XPM bit error ratio of cards for in-service XPMs.
XPMLOGS	XPM logs	Allows the generation of logs from LTC or LGC and reports internal XPM software errors (SWERR). A default setting cancels this command during a reload or restart.

19 Dual-shelf PM related card requirements

This chapter provides information on card replacement procedures for two-shelf peripheral modules (PM). For additional information, refer to "Card Replacement Procedures".

Circuit card removal and replacement procedures

Special considerations for circuit card removal and replacement with two-shelf PMs do not exist.

Other equipment removal and replacement procedures

Special considerations for the removal and replacement of equipment other than circuit cards do not exist.

20 Dual-shelf PM trouble isolation and correction

This chapter provides descriptions of the procedures to correct faults in two-shelf PMs. Fault isolation and diagnostic tests are also in this chapter. You can use these tests to support two-shelf PMs.

This chapter provides general information to assist maintenance personnel with experience in troubleshooting and maintaining two-shelf PMs. For additional information, refer to one of the following documents.

- *Operational Measurements Reference Manual*
- *Log Report Reference Manual*
- *Alarm and Performance Monitoring Procedures*

Description of troubleshooting procedures

Trouble condition indicators

The system can indicate trouble conditions in many ways. These ways include the following:

- operational measurements (OM)
- log reports
- alarms

Operational measurements

OMs, which monitor and count events in the system, are a good way to detect both existing and potential system troubles. Use the OM thresholding feature to monitor and report key PM activity. Make these reports as a routine (daily or weekly). These reports should be the primary method of trouble detection.

Log reports

Logs, used as analysis tools, provide detailed information on call errors, diagnostic results, and system status. Logs are also good indicators of trouble conditions, when any of the following conditions exist:

- sudden increase in volume of logs
- message not printed reports
- large number of like logs

Alarms

Audible and visual alarms indicate that you need to correct something. Correct routine system maintenance and use of OMs and logs should minimize the occurrence of alarms.

The level of the alarm (minor, major, or critical) indicates the severity of the alarm. It also indicates how necessary it is that you fix the problem. Table 20-1 describes these alarm codes.

Table 20-1 Alarm codes

Alarm	MAP display	Description
None	•	System is functioning properly.
Minor	(blank)	Normally does not affect service.
Major	(M)	Normally indicates a service degrading, threatening condition.
Critical	(*C*)	Normally indicates a service outage.

Follow these guidelines when you respond to alarms:

- When the MAP screen displays more than one alarm of the same, clear the alarms from the left of the screen toward the right.
- If, while fixing an alarm, an alarm of greater severity occurs, respond to the new alarm. Do not continue attempts to clear the alarm which is less important.

Locating and clearing faults

This is the standard troubleshooting procedure to locate and clear faults:

1. Silence audible alarms caused by the system when alarm conditions are detected.
2. To read and isolate the fault, read status displays. Trace fault codes to the menu level you must reach in order to clear the fault.
3. Busy the hardware to remove system access to the damaged component. This process allows you to perform maintenance activity without system interference.
4. Return the hardware to service.

SysB faults

When the system (SysB) has busied a PM unit, the unit is no longer in service (InSv). It cannot process calls. If the unit is active, a warm switch of activity (SWACT) occurs and the mate unit processes all calls for the PM.

Many conditions can cause SysB faults, and the QUERYPM command can help isolate the conditions that led to the fault. Log reports provide information on how to isolate and correct faults.

Table 20-2 lists some of the possible causes for a SysB fault.

Table 20-2 Alarm codes (Sheet 1 of 2)

Message at PM level	Possible cause
All C-side Links are Down	The central control (CC) cannot talk with the PM.
Audit Detected Inconsistent PM Activity	As an example, the CC thinks that Unit 0 is active, but unit 1 is actually active. This means that the CC does not know that a SWACT occurred. The CC busies and returns to service (RTS) both units and, the units come back with the active or inactive unit configuration that the CC had.
Audit Detected Inconsistent PM State	The internal state of the active unit is not ready. The state is busy, restart, or syncing. This is normally a software error (SWERR). The CC busies and returns to service (RTS) both the PM and the C-side links. Then the CC tries to return the links to service.
Autonomous Activity Drop	A system-generated SWACT has occurred, usually because of a trap or facility audit.
Diagnostics Failed	Unit failed test or RTS.

Table 20-2 Alarm codes (Sheet 2 of 2)

Message at PM level	Possible cause
Inact Unit Lost Data Sync	Unit-to-unit communication failed, meaning that the system cannot perform a warm SWACT.
PM Audit Detect Fault	One of the background hardware audits detected a fault.
PM SWACT	A warm SWACT occurred.
Require Data Load	An error occurred on a DS-1 link to the unit, and the unit is awaiting a reset by the maintenance system.
Reset While In-Service	An error occurred on a DS-1 link to the unit, and the unit is awaiting a reset by the maintenance system.
REx Incomplete	The system terminated the REx test because of a condition that was not normal. At least one unit is ISTb, the inactive unit is BSY, or Warm SWACT is off.
REx Failed	A failure occurred during the REx test. There are several possible causes. They include inactive out of service (OOS) tests. They also include an RTS of an inactive unit, a warm SWACT, OOS tests after SWACT on the inactive unit.
Self Test Failed	One of the background hardware audits detected a fault.
Trap Message Received From PM	Unit sent an initiation complete message to the CC after an auto-restart.
Unsolicited Message Limit Exceeded	Unit sent more than 100 unsolicited messages to the CC within one minute.

Standard troubleshooting methods require that you test a specific unit of a SysB PM. If the unit passes tests and you can return it to service, you have cleared the SysB fault. A list of PM cards that are suspected to have faults can accompany test failures.

In some cases the test fails and a message that reads "No Reply from PM" accompanies the failure. To clear the fault, reset the PM using the PMRESET command. If the reset fails, a list of suspected faulty cards, like the one for test failures, sometimes accompanies the failure. The cards must be replaced one at a time. If one of the cards is defective, it is possible that you can clear the SysB problem by replacing the card that has faults.

You can reload the software to clear a fault in a SysB PM. In some cases you can not clear the SysB fault when you reset, reload, or replace the cards that you suspect have faults. In this case, there may be a problem with the PM software. Contact your maintenance support group.

CBsy faults

C-side link problems fall outside the range of PM-level maintenance.

ISTb faults

When a PM is in-service trouble (ISTb), it means that the unit has a fault but can continue to process calls. Table 20-3 lists some of the normal responses and their explanations when you give the QUERYPM FLT command. Table 20-3 also gives possible reasons for the ISTb alarm. Give the QUERYPM FLT command at the LGC, LTC, DTC, MSB6, and MSB7 level of the MAP terminal. In most cases, the log report mirrors the QUERYPM FLT response.

> ***Note:*** Never take an in-service PM out of service during high traffic periods.

Table 20-3 Possible causes of ISTb faults in two-shelf PMs (Sheet 1 of 2)

Message at PM level	Alarm	Possible problems
One or both units ISTb	Minor	One or both units are ISTb.
PM Overloaded	Minor	Traffic load is exceeding the ability of the PM to process calls.
CSLinks Out of Service	Minor	The C-side message links failed the InSv C-side links test (one each minute).
PSLinks Out of Service	Minor	A P-side link has gone SysB. This requires DS-1 link maintenance.
Warm SWACT turned off	Minor	The operating company personnel turned off the warm SWACT capability.
Warm SWACT not OK	Minor	Warm SWACT is ON, but the system cannot perform a warm SWACT.
X69 IMC link has faults	Minor	An intermodule communication (IMC) link has faults.
PM node table mismatch	Minor	The node table data in the PM and the CC do not match.
Dynamic data sync	Minor	The PM has not achieved dynamic data sync.

Table 20-3 Possible causes of ISTb faults in two-shelf PMs (Sheet 2 of 2)

Message at PM level	Alarm	Possible problems
Static data mismatch with CC	Minor	The PM static data does not match the CC static data. The PM requires a download of static data. Busy the PM and return it to service. Or, use the RTS NODATASYNC parameter to busy and return to service the inactive unit. Then execute a cold SWACT.
Data mismatch with inventory table	Minor	The load datafilled does not match the load name according to the CC. Show the PM load by issuing the command QUERYPM CNTRS.
Data out of date	Minor	The PM requires reloading.

Fault isolation tests

Handling an IMC link fault

The IMC link audit In some cases detects data loss or damage of messages over IMC links. When this happens, the status of the PM becomes ISTb and the system generates a PM128 log. If you entered the QUERYPM FLT command, the response includes the following statement:

```
NON-CRITICAL HARDWARE FAULT
```

Operating company personnel perform the following procedure during low traffic periods:

1 Test both units to confirm the audit result.

2 Busy and offline the unit that has faults and replace the damaged cards listed (NT6X69 or NT6X45 or both).

3 Return the inactive unit to service.

If the node remains ISTb for more than five minutes and the response to the QUERYPM FLT command does not change, the fault is probably in the active unit. If the RTS of the inactive unit is successful, perform the following procedure:

1 Switch the activity of the units (make sure warm SWACT is enabled).

2 Test the unit which is now inactive.

3 Busy the unit which is now inactive.

4 Replace these cards.

5 Return the inactive unit to service.

Handling a parity error fault

The PM reports to the CC that there is a parity fault. The CC will decide which action to take, depending on the type of parity error and the state of the PM units. In most cases, the fault can be corrected without a loss of service.

The primary way that the CC informs the operating company personnel that there is a parity fault is the PM181 log. This log is the primary trouble indicator. Operating company personnel can check for associated logs (such as the PM128). These logs can help operating company personnel understand what actions, if any, the CC has taken.

Handling a data mismatch by using the NODATASYNC option

The PM can have data mismatch troubles. An example of this is a static data mismatch with the CC. To solve this, busy and RTS the full PM. You can minimize the time needed to have the correct data in both PM units. Use the NODATASYNC parameter with RTS.

When you issue the RTS NODATASYNC command for the inactive unit, this is what happens:

- The node translation table transfer from the active to the inactive unit is blocked. Also, the node tables are checked to see if they match.
- The CC loads data to the inactive unit.
- Once the inactive unit is RTS, data sync between the active and inactive unit is disabled.

Note 1: The NODATASYNC option is correct only for the inactive unit.

Note 2: Operating company personnel should follow the instructions provided at the MAP terminal when using the NODATASYNC option. When you use the NODATASYNC option, the system turns warm SWACT off. The system forces a cold SWACT to update the data in the mate unit.

Note 3: On digital trunk controllers (DTCs), the NODATASYNC function is automatic as part of the in-service cold SWACT function. It is normally not required to invoke NODATASYNC manually (using the RTS NODATASYNC command). The chapter "Dual-shelf PM maintenance overview" provides additional information on the in-service cold SWACT function.

This is an example of a maintenance condition that illustrates the use of the NODATASYNC option. Assume that there is a static data mismatch for the PM. Operating company personnel should perform the following steps:

1 To busy the inactive unit, type

>BSY UNIT n

and press the Enter key.

where

n is the number of the inactive unit

2 To RTS the inactive unit use the NODATASYNC option, type

>RTS UNIT n NODATASYNC

and press the Enter key.

where

n is the number of the inactive unit

The inactive unit returns to service.

> ***Note:*** If you change static data during the RTS, the system generates a PM128 log with a message. The message indicates that the system found a mismatch in the node table between the two units. Also, the QUERYPM FLT command for the PM indicates a node table mismatch.

3 Perform a cold SWACT.

If you attempt a warm SWACT, the DMS switch responds that it will perform a cold SWACT. The system turns off the warm SWACT when you use the NODATASYNC option.

When you use the cold SWACT, the newly inactive unit can get data from the newly active unit. As the PM returns to service, it can clear all trouble indicators associated with the data mismatch.

Handling DS-1 link faults

The DMS switch executes audits of DS-1 links manually. When the system detects a fault condition on DS-1 links, you must take maintenance action. Operating company maintenance personnel use fault isolation tests to determine which component caused the fault. Maintenance personnel remove the fault condition or report it to the correct maintenance support organization. Operating company personnel perform troubleshooting procedures on DS-1 links. They post the link at the CARRIER level of the MAP terminal and enter the DETAIL command to obtain information on the link in question. Methods for handling these problems are provided in the next paragraphs.

> ***Note:*** Because the MSB6 and MSB7 do not interface with DS-1 links, the DS-1 link fault description does not include them.

Overview of carrier maintenance

Operating company personnel can execute the following operations on DS-1 carrier links at the CARRIER level of the MAP terminal:

- detail information about a specified carrier
- display carriers in a specified state
- post a carrier or group of carriers
- protection switch a carrier

> ***Note:*** Because this is a host PM document, this document does not describe how to switch protection, which applies to remote PMs.

Alarms

In some cases, frame losses, slips, bipolar violations (BpV), or other faults occur on a carrier. When this happens, the PM signals that are transmitted do not meet specifications. The DMS-100 switch monitors these signals. When they do not meet specifications, the system pegs OMs, and increments the maintenance limit (ML) and OOS limit. Steady frame loss or a number of frame losses which exceeds the normal can cause the system to put a carrier OOS. Frame slips, or BpV also cause the system to put a carrier OOS.

> ***Note:*** Operating company personnel use the SETACTION command at the MAP terminal to put a carrier OOS when it exceeds its out of service (OOS) limit. An above average amount of BpV causes the system to put a carrier OOS. The SETACTION command does not affect this process. Refer to the *DMS-100 Family Commands Reference Manual*, 297-1001-822, for more information on this command.

Isolated or intermittent faults (like frame losses, slips, or BpVs) are accumulated. When these faults reach the ML, the MAP display updates a field marked ML. This indication serves as a warning to operating company personnel that faults occurred or are occurring on the carrier.

The system places the carrier temporarily or permanently system busy. This depends on how often the system has returned the carrier to service.

The system sets the carrier temporarily system busy if it satisfies both of the following requirements:

- The carrier has raised a steady state alarm, excess BpVs have occurred, or the carrier has exceeded the OOS for frame losses or slips.
- The SETACTION command is in use with the carrier, but the carrier has not exceeded the OOS limit for RTS.

The same carrier can exceed its OOS limit for RTS. If this occurs, the system sets it permanently system busy. You must return it to service manually.

Local carrier group alarm (LCGA) and remote carrier group alarm (RCGA) are the two DS-1 carrier alarms. The DMS-100 switch places a carrier OOS when an it raises an LCGA. The DMS-100 returns the carrier to service when the system clears the alarm (frame regained). Operating company personnel can place a limit on the number of times a carrier can return to service. This limit prevents a carrier from bouncing between SysB and InSv states. The default for the consecutive number of times the system may return the carrier to service is 255.

> ***Note:*** The RCGA and remote PMs are beyond the range of this guide, which focuses on host PMs and host considerations.

A carrier remains in the temporarily system busy state until the carrier is returned to service by either of the following:

- manual action (the tests of the RTS sequence pass, indicating that no faults persist in the carrier)
- system action when the carrier audit finds no alarms persist in the carrier

You must manually return to service a carrier in the permanently system busy state.

Table 20-4 shows the ML, OS, and audit interval defaults for frame losses, BpV, slips, and RTS.

Table 20-4 Maintenance limit, out-of-service limit, and audit interval carrier defaults

Item	ML	OS	Audit interval
Frame Loss	17	511	10.0 minutes
Slip	4	255	10.0 minutes
BpV	1 in 10^6	1 in 10^3	4.8 seconds
RTS	255	255	10.0 minutes

The DMS-100 switch counts frame losses, slips, BpV, and RTS for either specified time or audit intervals. At the end of an accumulative audit interval (normally midnight to midnight), the counters are reset to zero.

The system clears the bipolar violation ML when the count falls below 1 in 10^6 bits. The system clears the OS limit when the estimated long term count falls below 1 in 10^5 bits.

The system also counts frame losses, slips, and RTS operations. The system reaches the ML and OS limits if enough occurrences accumulate.

Four types of carriers exist:

- trunk (a carrier used as a trunk to another central office)
- timing (a carrier used as a timing trunk to another central office)
- remote
- protection line

Clearing IPML faults

The system assigns maintenance states to each IPC plane, to each IPC, and to the full IPML. The relationships between the two states of the IPC that make up the IPML determine the IPML maintenance state, as table 18-5 shows. See Table 20-5 for descriptions of the conditions associated with each maintenance state. The abbreviations used to display IPML maintenance states at the MAP terminal are like those normally listed for PM states.

Table 20-5 IPC and IPML maintenance states

IPC 0 or 1	Other IPC	IIPML State
InSv	ManB, SysB, ISTb, PBsy,	ISTb
ISTb	InSv, ManB, SysB, ISTb, PBsy	ISTb
ManB	ManB	ManB
SysB	ManB, SysB, PBsy, CBsy	SysB
PBsy	ManB, SysB, PBsy	PBsy
OffL	OffL	OffL
PBsy	PBsy	PBsy

Table 20-6 IPML maintenance states (Sheet 1 of 2)

Sta.	Pln.	IPC	IPML	Remarks
PBsy	X	X	X	At least one PM is OOS in this passive state and IPC maintenance waits for the PM to RTS before the system takes additional action. Overrides SysB.
SysB				Active state. The system has detected a fault. The maintenance system is running tests and trying to RTS the following:
	X			IPC plane (1 connection on each IPC)
		X		IPC (1 connection on each plane)

Table 20-6 IPML maintenance states (Sheet 2 of 2)

Sta.	Pln.	IPC	IPML	Remarks
			X	IPML (2 connections on each plane)
Man B	X			You manually removed IPC plane from service.
		X		IPC. The system stopped call processing, message scanning, and maintenance message testing. The system retains the Nailed-up-connection (NUC).
			X	IPML. Both IPC. The system stops scanning and testing, but retains the NUC.
OffL	X	X	X	Removed from service manually for reconfiguration. Or removed from service so that it remains OOS. NUC taken down.
CBsy	X	X	X	The NM that carries the NUC, or the IPC pair is OOS.
ISTb	X			Noisy plane. Message retry rate too high.
		X		One IPC plane connection is not InSv.
			X	One IPC is InSv, and the other is OOS. One IPC is ISTb.
InSv	X			Both planes InSv.
Sta.	Pln.	IPC	IPML	Remarks
InSv		X		IPC is InSv.
			X	Both IPCs are InSv.

Diagnostic tests

Diagnostic tests are intended to be able to locate hardware faults down to a replaceable card level. The system can initiate the tests, or you can initiate one manually. The system generates system initiated diagnostics when internal counters exceed fixed levels. Use manually initiated diagnostics when log reports indicate a common equipment problem. Also use manually initiated diagnostics when the system generates system-detected alarms, or when OMs show high error counts.

A-bit and B-bit diagnostic

The A-bit and B-bit diagnostic tests the A-bit and B-bit circuits on the NT6X44 time switch card. This diagnostic tests the global loop-around of the time switch card. The test also tests the channel supervision message (CSM) loop-around of the NT6X41 formatter card. The A-bit and B-bit diagnostic performs random access memory (RAM) tests on the A B transmit and receive memories. This diagnostic also tests the function of the time switch. This test tests the generation and reception of A-bit and B-bits. It also tests the enable-disable function of the A-bit B-bit receive memory.

The diagnostic involves the following PM hardware components:

- NT6X50 DS-1 interface card
- NT6X44 time switch card
- NT6X69 message card
- NT6X41 formatter card
- speech bus

> ***Note:*** The MSB6 is not provisioned with an NT6X44 time switch card. The A-bit and B-bit diagnostic test does not apply for this PM.

CSM diagnostic

The CSM diagnostic tests the hardware involved in the transmission, reception, and use of the CSM card. Most of this hardware resides on the NT6X42 CSM card. This diagnostic tests the NT6X42 card and the NT6X41 formatter card.

The CSM also tests the following: integrity match-mismatch logic, the speech bus parity error generation (NT6X41 formatter card) and detection (NT6X42 CSM card) logic, and the channel data byte (CDB) transmission and reception logic. This diagnostic checks for actions between bits of the parity error RAM, correct interaction between the integrity match-mismatch and CDB update logic, and correct operation of the CSM loop on the NT6X41 formatter card.

This diagnostic involves the following hardware components:

- NT6X42 CSM card
- NT6X41 formatter card
- speech bus

PCM diagnostic

The feature PCM Diagnostic - Phase 2, available as AF4192 for BCS35 and up, has the following purposes:

- Enhances NETDIAG diagnostic to test the status of the network links and associated hardware in an XPM.
- Tests the complete CSM path. It establishes a PCM path from the 6X42 card to the network and back to the 6X42 card in the XPM. Tests include integrity and parity checking and plane selection check. Integrity and parity checking are done as part of the plane selection test.

The NETDIAG diagnostic involves the following hardware components:

- NT6X42 CSM card
- NT6X41 formatter card
- NT6X40 DS30 network interface card

NETDIAG diagnoses all the channels in the set that the CC allocates for NETDIAG together. The same tests run in parallel on all channels in the set. The number of channels depends on on the status of the link. If the link is in service on at least one plane, the diagnostic only uses the maintenance channel. This prevents interference with call processing. Otherwise, all the channels are allocated. NETDIAG fails if any of the tests fail. If the CC is unable to allocate any channels, NETDIAG does not run. NETDIAG passes if all the tests pass.

If NETDIAG fails, it performs a limited fault isolation test, based on the ports and tests that failed. It selects the suspected cards and reports them to the CC. The CC performs a fault isolation test and generates a log. If the test fails on an in-service link, the system changes the state of the link to SysB.

The following restrictions apply for this feature:

- NETDIAG can only run as part of the NETWORK LINK TEST on any first level XPM that supports CSM.
- It can only run on the in-service active unit of the XPM.
- It can only run as part of the test of links in ManB or OK states.
- It is invoked only as part of a manual action.

Formatter diagnostic

The formatter diagnostic tests the NT6X41 formatter card. This diagnostic tests the control RAM and the C-side loop enable-disable function. This diagnostic also checks for correct function of the network framing interrupts, C-side messaging, and P-side messaging. This diagnostic also checks the integrity of the speech bus connection and message memories, both on the NT6X69 message card.

The diagnostic involves these hardware components:

- NT6X41 formatter card
- NT6X69 message card
- NT6X44 time switch card
- speech bus

Note: The MSB6 is not provisioned with an NT6X44 time switch card, and the formatter diagnostic test does not apply for this PM.

Message diagnostic

The message diagnostic tests the hardware of the NT6X69 message card. The diagnostic checks for correct functioning of the time slice processes of the on-board processor, the speech bus interface, the IMC link, and the cyclic redundancy check (CRC) ROM. The integrity of the message buffer memory and P-side and C-side messaging are also validated.

This diagnostic involves the following hardware components:

- NT6X69 message card
- NT6X44 time switch card
- NT6X41 formatter card
- NT6X50 DS-1 interface cards
- speech bus

Note: The MSB6 is not provisioned with an NT6X44 time switch card and the message diagnostic test does not apply for this PM.

Tones diagnostic

The system cannot execute BSY, OFFL, RTS, and TST commands on lines that belong to the class remote. The tones diagnostic runs pulse code modulation (PCM) checksums on the tones of ports 16 and 17 (phantom ports). This makes sure that these checksums agree with the checksums in the tone ROM. The tone ROM is on the NT6X69 message card. The second purpose of this diagnostic is to check the speech bus connection memory for all channels (except 0 and 16) of ports 16 and 17. This makes sure that the tones are enabled on the speech bus.

The following hardware components are involved in this diagnostic:

- NT6X69 message and tone card
- speech bus

Note: The MSB6 is not provisioned with an NT6X69 card and the tones diagnostic test does not apply for this PM. This test applies for the MSB7.

Speech path diagnostic

The speech path diagnostic checks all the XPM speech channels for data integrity. This test involves checking all C-side and P-side loop-arounds and all time slots of the speech bus. This diagnostic also tests the highway multiplex and the PCM enable-disable gates.

This diagnostic involves the following hardware components:

- NT6X41 formatter card
- NT6X69 message and tones card
- NT6X44 time switch card
- NT6X50 DS-1 interface cards
- speech bus

Note: The MSB6 is not provisioned with an NT6X44 time switch card. The speech path diagnostic test does not apply for this PM.

Time switch card diagnostic

The PM time switch card switches speech, control, and supervisory signals from the C-side to the P-side of the PM. The time switch card diagnostic tests the NT6X44 time switch card. This diagnostic will only be run if the PM is OOS. The diagnostic tests if the time switch card is present. The diagnostic also tests the cards incoming and outgoing connection memories, and the function of the card that switches time. In addition, the time switch diagnostic tests the NT6X44 phase comparators in both InSv and OOS states. This diagnostic also checks the values of the office-sync phase comparators. This process detects faulty comparators that are used in office synchronization.

This diagnostic involves these hardware components:

- NT6X44
- NT6X69

Note: The MSB6 is not provisioned with an NT6X44 time switch card. The time switch diagnostic test does not apply for this PM.

DS-1 card diagnostic

The DS-1 card diagnostic verifies that DS-1 cards operate correctly. The diagnostics can verify the DS-1 link. This depends on how the system invokes the diagnostics. The DS-1 card diagnostic runs during CC link audits, and when the PM or a DS-1 link is returned to service from the MAP terminal. This diagnostic also runs when the system tests a DS-1 link from the MAP terminal.

PCM looping tests occur during the test of the DS-1 link from the MAP terminal.

Two link audits exist: the InSv audit tests all InSv DS-1 links; the OOS audit tests all SysB DS-1 links.

> ***Note:*** Because the MSB6 and MSB7 are not provisioned with DS-1 cards, the DS-1 card diagnostic does not apply for these PMs.

DTC NT6X50 DS-1 interface card diagnostic

Maintenance support personnel must test the NT6X50 cards of the digital trunk controller (DTC). All spans on the DTC should be in the OffL state, so that the full DTC is OOS. Verify that spans are not looped back into themselves (intra-span loopbacks). In this case, they fail the reset test. The system can only perform a complete test of the span when the span is OOS.

Before testing, determine the discrimination numbers and the quantity of DTCs and line trunk controllers (LTCs) in the office. Do this process from table LTCINV by listing all the DTCs and LTCs. Also, verify that the span match the intended office configuration. Choose a DTC and from the CARRIER level of the MAP terminal (described in *Menu Commands Reference Manual*, 297-1001-821) and make all its spans BSY and OffL.

The failed tests are identified by these codes:

- 0001 — DS-1 12/16 loop
- 0002 — control register
- 0003 — PCM loop-around
- 0004 — zero suppression
- 0005 — tone loop-around
- 0006 — AB bit
- 0007 — DS-1 digroup loop-around and reset

If the system identifies code 0003 or 0006, repeat the tests for resetting the span. A second failure indicates that you must replace the 6X50 card.

When the system has tested both sides of the PM, you can return to service from the carrier level the spans that are OOS.

If PM level tests indicate a DTC failure, use the RTS command and OffL on both spans of the suspected card. If the NT6X50 card fails the test, replace the card.

The test stages include these processes:

- use of the channel loop-around
- tests of the carrier alarm
- enable, disable, and use of digroup loop-around
- checks of the tone checksum through the digroup loop-around
- tests of zero suppression

The tests occur in the following sequence:

- set up control registers
- 12/16 looparound
- test digroup loop-around enable or disable
- AB signaling bits test
- ZCS test
- carrier fail alarm insertion

These conditions must be set up manually or by the system in order for the tests to occur:

- The test can occur on the peripheral when it is active and InSv or OOS.
- For a P-side, the conditions are:
  - the unit is inactive
  - the port is in range
  - a message card is present
  - a time switch card is present
  - the NT6X50 card has been datafilled
  - the port status changed.
  - a C-side maintenance channel selected.
- For a C-side, the conditions are:
  - the unit is active
  - the port is in range
  - a message card is present
  - a time switch card is present
  - the port status changed.
  - the port is datafilled
  - two non-message channels exist on the link

- a 12/16 loop is obtained
- messaging is off (if necessary)

- The complete test can run only when the DS-1 links are in the manual busy (ManB) state. Busy the links from the carrier level (see *Menu Commands Reference Manual*, 297-1001-821).
- For a peripheral that is InSv, only part of the test is done. The partial test includes:
  - a check that the NT6X50 card is present
  - a check that the NT6X50 card has been datafilled
  - a check that the Hiway MUX is set
  - a check of the 12/16 loop path for the P-side only
- With the P-side node InSv, you must also manually busy the associated unit to ManB its message or speech link.
- The following components must be operating correctly:
  - the common C-side interfaces of the NT6X50 card
  - the loop-around delay circuits for the channel loop-around
  - activity and clock signal selection
  - insertion of clock information
  - removal of clock information
  - control byte functions and communication
  - status byte functions and communication
  - bit inversion
  - digroup loop-around
  - the component that sends the outgoing carrier alarm
  - the component that detects the incoming carrier alarm
  - the PCM channels
  - zero code suppression (ZCS) on transmissions
  - elastic store
  - extracting AB signaling bits

NT6X50AB interface cards: testing

Testing the AB version of the NT6X50 card occurs under the same conditions. It runs by the same commands as other NT6X50 cards except for the checks for the additional functions of the AB version. (For other NT6X50s, the AB differences are ignored.)

The additional testing of the NT6X50AB includes:

- signaling bit freeze mechanism
- operation in standard frame format or extended frame format (EFF)
- SLC-96 data path (tested as part of the X98 chip)
- Facility Data Link (FDL) data path (tested as part of the X98 chip)
- binary eight zero substitution (B8ZS)
- 8-bit error counter (in EFF)
- access to all 8-bits of error counters
- BpV error insertion for testing
- maintenance and status latches for increased functionality

> ***Note:*** The NT6X50AA DS-1 interface card has a standard frame format of transmission. The NT6X50AB DS-1 EFF card has the extended frame format (EFF). Unless you specify the EFF, the format refers to the NT6X50AA card. For information on the cards, refer to GS6X50.

The tests occur in this sequence:

- 12/16 looparound
- test digroup loop-around enable or disable
- change enable bit
- register selection bit
- error counter test
- AB signaling bits test
- signaling bits freeze test
- SLC-96 data path
- FDL data path
- ZCS and B8ZS test
- carrier fail alarm insertion
- NT6X50 check

The X98 chip performs most of the functions of the NT6X50AB. The DS-1 interface circuits uses the two transmit lines from the X98 chip and prepares them for transmission over the DS-1 link.

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

- No data transmission over the DS-1 link.
- Only one side of the line is active. This results in a continuous BpV state at the far end.
- The outgoing signals are bad, resulting in a high error rate and bad synchronization at the far end.

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

- loss of synchronization caused by a bad signal or a signal that is not present.
- high error rate for a receive signal
- high BpV rate
- no receive clock is generated, so that the incoming serial bit stream cannot be sampled

You can recognize a fault in the receive direction if you notice these signs:

- synchronization problems
- high BpV rate
- high CRC rate in the EFF

The DS-1 tests detect these signs.

The system provides a permanent loop-around from outgoing channel 12 to incoming channel 16. These channels are not used for speech. The test verifies the operation of the loop-around. The test sends a tone on channel 12 and does a checksum on channel 16.

If the test passes, the PCM path between the peripheral and the DS-1 card functions correctly. The X98 functions well enough to synchronize to the master frame pulse. If the test fails, the PCM path between the peripheral and the DS-1 card is possibly defective. The X98 may not be able to synchronize to the shelf, or the loopback may have faults.

Most tests rely on the digroup loopback for their operation. Verify the integrity of this function early. When the least significant bit of control register 0 is high, the system puts the the DS-1 card into a digroup loopback. This loops PCM data transmitted on DS-1 channels 1 through 24 back to the peripheral on the same incoming channel. The test verifies the operation of the digroup loopback. The test sends a tone in the outgoing direction and does a checksum on the PCM data in the receive direction.

If the test passes, the PCM path up to the DS-1 interface circuits functions correctly in both directions. The card is responding to control word 0. There are three reasons the test can fail: the PCM path through the card has faults, the digroup loopback does not function, or the control register access has faults.

The most significant bit of both control words is used to qualify the newly received control word. This bit must be high for the X98 chip to respond to the control word. This rule eliminates 50% of the possible control word values but provides some noise protection from erroneous values.

The test verifies the operation of the change enable bit for control word 0. The test attempts to remove the digroup loopback with this bit set low.

If the test passes, it verifies the operation of the change enable bit for control word 0. If the test fails, the change enable function does not operate. This function does not operate because of a failure in the X98 chip or because an NT6X50AA card is present.

The second most significant bit of the outgoing control word specifies which control register you must update. This test verifies the register selection bit when it attempts to change the state of the digroup loop back bit when the system selects register 1. When you select register 1 the remote loop back should operate instead of the digroup loopback.

If the test passes, select control register 0 or 1. If the test fails, either the register selection function can not operate or an NT6X50AA card is present.

Two 8-bit error counters are provided by the X98 chip. One counter monitors BpVs bit-by-bit. The other counter monitors CRC errors on a superframe. The least important four bits of the status word that return to the peripheral contain error counter data.

The contents of the error counter data depend on the following settings or operation of these bits:

- Hi/Lo bit
  - 0 - send the upper four bits of the counter
  - 1 - send the lower four bits of the counter
- frame format bit
  - 0 - frame format (BpVs are sent)
  - 1 - EFF
- BV count bit
  - 0 - CRC errors sent
  - 1 - BpVs are sent

- Count mode bit
  - 0 - stop at maximum
  - 1 - wrap to zero
- Test bit
  - 0 - normal
  - 1 - insert errors

The test verifies that all bits of the counters are functioning and accessible. The test also verifies the operation of the other bits that select the different modes of operation.

If the test passes, it verifies the following:

- both error counters
- nibble selection
- counter mode selection
- frame format selection
- error counter selection
- test bit operation
- latch reset operation

If the test fails, it means the error monitoring circuits are not functioning. If you can only access the upper nibble of the counters in the BpV mode, an NT6X50AA card is present.

The NT6X50AB provides these data paths:

- AB and CD signaling bits path
- SLC96 data path
- FDL data path

The system transmits signaling bits once every six 125-microsecond frames. The frame format contains twelve 125 microsecond frames in a superframe. This format means that the system transmits or receives two signaling bits every superframe. These bits are the A and B signaling bits. In the EFF, there are 24 frames in a superframe. These frames provide an additional two signaling bits, the C and D bits.

In the outgoing direction, signaling bits are inserted into the PCM data by the time switch card and are not affected by the X98 chip. In the incoming direction, the X98 chip extracts the signaling bits from the DS-1 bit stream.

The X98 chip then inserts signaling bits into bit 1 of the DS-60 for the corresponding time slot.

The test does more than verify the signaling bit deletion and insertion. The test also verifies the frame format selection logic. The system tests each bit individually. It also verifies the functioning of the frame format selection logic. For an NT6X50AA card, only the A and B bits are available; while in the EFF of the NT6X50AB card, the C and D bits are also available.

The test verifies the operation of the signaling bit deletion and insertion logic. The test also verifies the frame format selection logic. The test checks each of the signaling bit values when the card is in both formats.

If the test passes, then the signaling bit insertion and extraction logic and the frame format selection logic are functioning. Also, the X98 chip is able to synchronize frames in either format. If the A and C bits are identical and the B and D bits are identical, the card is in frame format. This means that the frame format selection logic can not toggle between both modes. This can also mean that an NT6X50AA card is present.

In the event of a frame loss or carrier failure, the signaling bit freeze maintains the state of the last correct signaling bits. As long as the carrier is present and the link is in superframe format, the system updates a 3-frame buffer with the current signaling bit information. In the event of frame loss or carrier failure, the system does not update the buffer. But, the contents of the buffer provide signaling bit data to the peripheral to maintain the state of the last correct signaling bits received. You can not test this function because it requires that you lose either synchronization or the carrier. This is not possible without manual interruption.

SL20C-96 data can transmit over the DS-1 link when the X98 chip is in frame format and bit 3 of control word 1 is high. SLC-96 data consists of 6-bit values. These bits replace the frame signaling bits of the outgoing DS-1 bit stream. The bits are combined to form a 6-bit value in the receive direction. Access to SLC-96 data path is by DS-30 channel 7. The system can transmit or receive a new value every twenty four 125-microsecond frames or 3 microseconds.

The test verifies the integrity of the SLC-96 data path. The test performs the equivalent of a pattern test on the link. If the test passes, the SLC-96 data path and the superframe synchronization function. If the test fails, the SLC-96 path does not operate. This problem is either because of a faulty X98 chip or because an NT6X50AA card is present.

The NT6X50AB provides a FDL at 4 kilobytes per second. The NT68X50AB can only do this when it is configured in the EFF and bit 3 of control word 1 is high. The system uses 12 of the 24 framing bits that occur each superframe to transmit FDL data. Three 8-bit bytes are available during each 48-frame period. These bytes are updated at the end of frames 1, 17, and 33 of the master frame, or every 2 microseconds. The system only uses a pattern test to test this link. The reason for this is that it is not possible to send or receive data at the FDL rate.

The test verifies the integrity of the FDL path. If the test passes, the FDL functions. The card is able to synchronize while it does framing bit substitution and FDL data reconstruction. The test can fail for these three reasons: the mechanisms necessary for FDL communication may not be functioning, synchronization may not happen, or an NT6X50AA card is present.

Far-end clock recovery depends upon the quantity of 1s in the incoming DS-1 bit stream.

Use these methods to make sure that enough 1s exist for a test:

- ZCS
- B8ZS

Zero code suppression sets bit D7 of any outgoing channel to a 1 if the channel contains all 0s. Do not use the technique for data transmission. Data corruption may result.

B8ZS replaces any consecutive eight 0 bits in the outgoing bit stream with a special value that contains BpVs in bit positions 4 and 7. If the system detects this special pattern it ignores the BpV. The system also substitutes eight 0 bits for the received data. The technique allows data to transmit over the DS-1 link without damage by the encoding or decoding facilities.

The test verifies the operation of both the ZCS and the B8ZS. The test transmits an all 0s pattern and monitors the received data. The X98 chip inverts data in both directions. The actual data the system uses for the test is an all 1s pattern.

If the test passes, both the ZCS and B8ZS are functioning. If the ZCS section passes and the B8ZS section fails, then the card is an NT6X50AA. If the test fails, the ZCS and B8ZS bit can not operate and a defective X98 chip is the cause.

Setting bit B4 of control word 0 higher causes the system to transmit a carrier fail alarm to the far end. In frame format, this causes bit 2 of all 24 outgoing channels to be set to one. In the EFF, the system transmits the alarm by sending an all 1s byte followed by an all 0s byte over the facility data link. The system repeats this pattern until the alarm is removed. The FDL link preserves the integrity of any data channels in the transmit direction.

The test verifies the operation of the carrier fail alarm (CFA) bit in both frame formats. In the EFF, the system tests the integrity of the PCM path during a carrier fail alarm. To perform this test, the system does a pattern test during the alarm.

If the test passes, the carrier fail alarm insertion and detection circuits function normally. If the test fails, either the insertion logic or detection logic does not work. If only the frame format section of the test passes, then the card may be an NT6X50AA.

Because of the compatibility of the NT6X50AB card with the NT6X50AA, you can install NT6X50AB in place of NT6X50AA for maintenance. If the card is supposed to be an NT6X50AA and all of the tests that it supports passed, do no additional testing to determine if the card is an AB version.

Because the NT6X50AA cannot support the features of its AB version, an NT6X50AA cannot function where the system requires an NT6X50AB. In this case, only the tests of their identical functions pass, and the other tests fail. If all tests pass except those that are relevant to an NT6X50AB, the system displays a message. This message indicates that an NT6X50AA card is present instead of an NT6X50AB.

Testing an NT6X78 CLASS modem resource card

The NT6X78 CLASS modem resource (CMR) card can be mounted in an LTC, LGC, or RCC. When you use the NT6X78 card with feature package NTXA01, the system datafills the card in table LTCINV or RCCINV.

When the card is datafilled, the following normal PM maintenance for a card applies:

- load (by the command LOADPM)
- query (by the command QUERYPM)
- return to service (by the command RTS)
- test (by the command TST)
- detect faults (by responses to the commands RTS or TST)

In-service tests run when the unit is ISTb or InSv. Out-of-service tests run when the unit is ManB. If the card fails the tests of a return to service, the PM is not returned to service.

In some cases, no CMR card is in its designated slot, that is, you can not datafill. In this case, a response to the RTS or test command indicates the card in a card list.

Results of a test of the CMR card

The CC runs PM tests (by the command TST or RTS) and displays the most recent test results at the MAP terminal in the status display of the PM. When the *TESTED CMR* response appears, the system does not update the MAP screen. This is due to the positioning of the CMR card in the sequence of PM card tests.

Fault detection

Faults are detected by the XPM when

- self-tests run on all PM cards, including CMR
- a calling number delivery (CND) encounters errors
- errors are detected by the CMR card.

Responses to the commands TST, RTS, LOADPM, or QUERYPM indicate if the CMR is the cause of the fault.

Log PM181 indicates that the CMR card test failed with the *CMR DIAG FAIL* message.

When the CMR card is the cause of a noncritical fault, the peripheral reports the fault to the CC. The system flags the unit with the status ISTb, and generates log PM128. Log PM128 indicates by the *CMR_NT6X78AA OOS* message that a CMR card has gone out of service.

If the XPM has the in-service trouble (ISTb) state because of the CMR card, this response appears at the MAP terminal for the QUERYPM command:

```
CLASS MODEM RESOURCE CARD 6X78AA OUT OF SERVICE
CMR CARD TROUBLE
```

DS-1 link diagnostic

To test a DS-1 link at the carrier level, post the associated PM and issue the TST command.

In the case of an InSv link, the TST command causes the PM to execute a PCM loopback test on the link. If the PCM loopback test fails, the DMS switch generates PM181, PM183, and PM128 logs

When a system audit detects a SysB link, the DMS switch generates a PM110 log.

When a link returns to service, the PM leaves the ISTb state and enters the InSv state. The PM only does this if no other faults are present. The DMS switch generates a PM106 log if no other faults exist. If other faults exist, it generates a PM128 log. The DMS switch generates a PM184 log when a link returns to service.

When you enter the PM level test command for a link that is inactive and is OOS, the following tests occur:

- Hardware presence: checks for the presence of the NT6X43 message interface and NT6X44 time switch cards. The cards are required for the test to occur.
- P-side interface: checks that all NT6X48 cards that are datafilled are present for the remaining loop-around tests.
- Full PM selective links: checks one or all P-side links of the XPM. The link or node type has no effect. This test checks links one at a time.

You can not busy the last message link to a PM in order to busy the P-Side link of an XPM from the XPM.

> ***Note:*** Because the MSB6 and MSB7 do not have P-side links, the P-side links tests do not apply for these PMs.

CMR diagnostic for LGC and LTC

The CMR card is self-diagnosing. The card contains on-board firmware. This firmware provides the card-level diagnostic. The primary function of the diagnostic is to detect service-affecting faults as soon as possible.

Mount the CMR card in an LTC, LGC, or RCC. When you use it with feature package NTXA01, datafill the NT6X78 CMR card in tables LTCINV or RCCINV.

When datafill applies to the card, the following normal PM maintenance for a card applies:

- load (by the command LOADPM)
- query (by the command QUERYPM)
- return to service (by the command RTS)
- test (by the command TST)
- detect faults (by responses to the commands RTS or TST)

In some cases, no CMR card is in its designated slot, that is, it can not be datafilled. In this case, a response to the RTS or test command indicates the card in a card list.

The CMR diagnostic reports CMR failures. This diagnostic provides the PM with both InSv and OOS diagnostics along with a CMR audit. The CMR audit invokes the InSv diagnostic regularly.

- The InSv diagnostic controls the on-board firmware diagnostics, which continuously test different critical components of the CMR card. This diagnostic runs once a minute as requested by an InSv audit. In addition, operating company personnel may request the InSv diagnostic if they use the TST UNIT # CMR command at the MAP terminal.
- The OOS diagnostic is a more full test of the functionality of important CMR hardware. This diagnostic uses some of the same on-board firmware diagnostics as the InSv tests. It allows a more complete testing of all resources where normal InSv traffic and time restrictions do not permit it.
- Use the CMR audit to run this audit normally. The facility audit normally used for this purpose has too low a repetition time (7.5 minutes) to provide detection time for the CMR card. So, the system has created a new audit for this feature.

The system logs the results of the CMR diagnostic test as a PM181 audit exception report. The PM181 audit exception report lists the failed card list and indicates that the CMR diagnostics detected the fault.

> ***Note:*** The CMR card is not supplied in the DTC, MSB6, and MSB7. The CMR card is supplied in the LGC and LTC at the request of the customer.

Speech path diagnostic

The speech path diagnostic consists of four separate tests: the hardware presence test, P-side interface presence test, P-side loop test, and internal loop test. Each test runs only if all of the preceding tests are passed.

The hardware presence test ensures that the NT6X41, message NT6X69, and time switch (NT6X44) cards are present in the LGC and LTC. This hardware is necessary for the remainder of the tests. If any of these cards is not present, the diagnostic returns a *No Resources* error and produces a PM181 log report.

The P-side interface presence test ensures that NT6X50 DS-1 interface cards datafilled for the LGC and LTC are present. It is used to set up the next P-side loop test. The P-side interface test terminates upon detection of any removed or failed NT6X50 DS-1 interface card, at which time the diagnostic returns a *No Resources* error and produces a PM181 log report.

The P-side interface test checks for the presence of all NT6X50 DS-1 interface cards. Then the P-side loop test verifies the correct operation of these and other dedicated P-side loop-around circuits for the LGC and LTC. P-side interface cards supported in the LGC and LTC are as follows:

P-side link diagnostic

This test checks for NT6X69 message and a time switch NT6X44 card in the LGC and LTC. These cards are necessary for the other P-side link diagnostic tests to run. If any of these cards are not present, the diagnostic returns a *No Resources* error and produces a PM181 log report.

The P-side interface presence test is the same as that in the speech path diagnostic. It makes sure that all LGC and LTC P-side links that you will test are still present. This test flags missing or failed NT6X48 DS3OA peripheral interface card or NT6X50 DS-1 cards in the LGC and LTC.

The first two tests in the P-side link diagnostic makes sure that the necessary hardware is present. The full peripheral test checks one speech channel on each specified LGC and LTC P-side link to its LCM. This test runs only if the LGC and LTC are in active mode.

Testing the IMC links

System audits test and monitor IMC links in feature package NTXA67. Maintenance action results from audit failures. The IMC is available through the NT6X69 message protocol card and the NT6X45 firmware card.

> ***Note:*** Because the MSB6 is not provisioned with a NT6X69 message protocol card, the IMC links test does not apply for this PM.

Function of the IMC links

There are two IMC links for each XPM:

- one link connects the NT6X69 cards between each unit (at 64 Kilobits/sec)
- one link connects the NT6X45 cards between each unit (at 19.2 Kilobits/sec)

The NT6X69 link is for general interunit messaging. For example, the link can update information in the standby unit to enable a warm switch of activities (SWACT). The NT6X45 is for exchanging processing data.

Auditing the IMC links

The system audits both IMC links to monitor the sanity of messages, that is, carrying messages without data losses or damage. If the IMC test does not receive its auditing messages for a link, the system allows up to 10 minutes to ensure the mate unit is not re-initializing. After 10 minutes, the system assumes that a link failed.

An IMC link is a communication link between the two units of a node. If the system detects the fault at the node level, it reports the node in ISTb. If it is at the unit level, the fault is applies to the specific unit.

In some occurrences, the mate unit is at the ROM level of maintenance (no RAM load is present in the peripheral memory, or the peripheral has trapped into its ROM load). In this case, the IMC test detects that its mate unit is at the ROM level and reports it to the CC.

The IMC test runs on both the active and inactive units. But, only the active and InSv unit reports fault detections to the CC (this avoids duplicate unsolicited messages).

When the test detects a link failure the following actions occur:

- the test reports the fault to the CC
- the link is closed and the status of the XPM changes to ISTb
- the XPM processors no longer use the link; warm SWACTs are prevented.

The test results do not indicate which end of the link between the units is at fault. The system makes the fault status of the link not important (the ISTb state). The system does not assume that both units lost communication. The system allows the XPM to continue processing calls.

Recovering from an IMC fault

When the status of the XPM becomes ISTb, the PM128 log reports the fault. Use the QUERYPM FLT command to determine the cause of the fault.

For the IMC links, the response includes the *NON-CRITICAL HARDWARE FAULT* statement.

If this statement is the response to the query, do the following:

1. Test on both units with the TEST command to confirm the audit result.
2. Busy the inactive unit with the BSY command, and replace the NT6X69 or NT6X45 card or cards that have faults in that unit.
3. Return the inactive unit to service with the RTS command.

If the ISTb remains and the RTS of the inactive unit is successful, do the following:

1. Switch the activity of the units by using the SWACT command.
2. Busy the now inactive unit by using the BSY command.
3. Test the unit by using the TEST command.
4. Make the suspected card or cards in this unit OffL by using the OffL command, and replace the suspected card or cards.
5. Return the inactive unit to service by the RTS command.

If you replace the cards and the fault is still present, the problem is probably in the backplane. This assumes that all the spare cards are free from faults. To verify the backplane, use engineering tests.

Testing XPM units by the mate

There is a feature package for PMs of node type LTC and message switch and buffer (MSB). This is feature package NTXA67. This package allows the CC to request that an XPM unit test another unit that is OOS or that does not communicate. In some cases the CC can communicate one unit of an XPM but not with its mate. In this case, the CC tries to reestablish communication through the unit. If it is not successful, the CC requests the unit that continues to communicate to test its mate. When the unit completes the tests, the system lists the product engineering code (PEC) of each card that has faults at the MAP terminal. Log PM181 records the maintenance action of the system. When you use mate testing, you reduce the quantity of cards the system lists as having faults.

Note: Mate testing does not apply for LGC or DTC.

Conditions for the tests to occur

The XPM must have the NT6X69 messaging card and the BA or a later version of the NT6X45 firmware card. You must activate parameter XPM_MATE_DIAGNOSTICS_AVAILABLE of table OFCOPT for each PM.

The conditions for the tests to occur depend on the following:

- the state of each unit (InSv or OOS)
- the activity of each unit (active or inactive)
- the state of the IMC link for each unit IMC link (InSv or OOS)

In some cases, the IMC link is InSv, and the CC that communicates with the active and InSv XPM unit. In this case, the unit tests the mate which is does not communicate. If a communications failure occurs between the CC and the active and in service XPM unit, the XPM switches the activity to the other unit. The SWACT is warm or cold. This depends on if the inactive XPM unit was in-service before the communication between the CC and the active unit failed. After the SWACT, the newly active unit then tests its mate.

If the IMC link between the units is OOS, the system displays automatically a default list of cards when it attempts the test by the mate.

Testing by the mate

When the mate tests begin, the system determines the software level of operation for the mate unit. At the read-only memory (ROM) level of operation, the unit uses only the ROM of the firmware card. The unit is not aware of the software load in the active unit. At the task level of operation, the unit uses the software in its own load to operate. It is therefore able to do maintenance actions.

If the mate is running at the task level, the system runs all tests. If the mate is running at the ROM level, the system only runs ROM tests.

If the ROM tests pass and the mate unit fails to start, the NT6X69 link loads the mate unit through the active and InSv unit.

If the mate needs to be loaded, the CC initiates loading automatically. Mate loading only occurs if the required load resides on a disk and if any subtending PMs are not in an overload state. While loading occurs, the MAP terminal displays its progress if the system posts the XPM of the tested unit. After the system completes loading, the task level tests are initiated.

Cancellation of the tests

The system stops or prevents the tests if the following happens:

- the system detects a fault
- maintenance is already in progress in the active and InSv unit
- one or more key software modules is missing in the XPM loads
- the state or activity of the inactive and InSv unit changes while the mate testing is in progress

Display of mate testing actions

When the mate tests run, and the MAP terminal posts the correct XPM, the following maintenance flag appears. The flag appears in the status display of the active unit:

```
DIAGNOSING MATE
```

In the status display of the inactive unit, a group of the following maintenance flags display the progress of tests and communication:

- /Reset — The IMC links reset the inactive unit for additional maintenance action.
- /NonDestr ROMtst — The ROM tests that are not destructive are running.
- Testing — The task level tests are begun.
- Tested SPCH DG — The speech test of the task level tests passes.
- /Status — The inactive unit is receiving a status message from its mate.
- /Loading: nnnK — The inactive unit loads from the CC through the active unit, where nnn increments the quantity of kilobits.
- /Run — The system instructs the inactive unit to run.

- Initializing — The load starts.
- Mate Syncing — The inactive unit is attempting to synchronize with its mate.
- /Clear Data — The CC clears the unit&';s static data in preparation for resending.
- /Static Data — The static data is being resent.

Before a warm SWACT occurs, the superframe and the dynamic data between both units must match.

An XPM automatically synchronizes to its C-side links by default during a communication failure with the CC. The state of the links could be the cause of the failure. The unit you will test depends on its mate for the synchronization data. While synchronization occurs, the */MATE SYNCING* maintenance flag appears at a MAP beside the status display of the inactive unit.

If the synchronization fails, the warm SWACT cannot occur. Entering the QUERYPM command for the posted XPM of the units lists the reason or reasons for the failure.

XPM ROM tests

The ROM diagnostic detects faults in the processor and memory cards. It starts when the PM unit is in the who-am-I (WAI) state. The ROM tests check the following XPM processing cards by the tests:

- CPU cards (NT6X45)
  - clock timer test
  - sanity timer test
  - USART (host and terminal) test
  - memory management unit (MMU) test
  - direct memory access (DMA) test (not for ESA)
- RAM cards (NT6X46 and NT6X47)
  - RAM test
  - parity test
  - status register test.

The ROM tests test the following memory card circuits:

- memory circuits
- parity circuits

- DMA circuits (on NT6X46 only)
- activity circuits (on NT6X46 only)
- holding registers

Note: Reload the the unit after this diagnostic.

The system displays a card list if any of the ROM tests fail. This list appears in Table 20-7 and includes the following:

Table 20-7 XPM ROM test failure

Test Response	Fault	Card (hexadecimal)
1 - 1F	memory test	6X47, 6X46, or 6X45
20 - 2F	parity test	6X47, 6X46, or 6X45
31	sanity test	6X45
41	timer test	6X45
51 - 55	MMU test	6X45
61 - 63	status test	6X47, 6X46, or 6X45
71 - 74	USART test	6X47
81 - 82	DMA test	6X47, 6X46, or 6X45

The ROM test is a destructive test (can lose RAM) and can only run on ManB XPM units. You must reload the XPM after the ROM test, then manually return the unit to service. If you attempt an RTS before you reload the XPM unit, the system displays a warning message. To specify the ROM test during maintenance testing, the TST command has the ROM parameter. To load an XPM, but not run the ROM tests, the LOADPM command has the force parameter. For more information on the use of these commands, refer to the correct XPM level command descriptions.

Performing XPM bit error ratio tests

In feature package NTX885, the XPM bit error ratio test (XBERT) does the following:

- detects and measures PCM bit errors that occur in XPM and LCM cards.
- commissions DS-1 and PCM30 links and trunks that you have looped back at the remote end without the use of a remote node.

XBERT detects bit errors in the transmission of high speed data in XPM and LCM cards in the following XPMs:

- DTC
- LGC and ILGC
- LTC

> ***Note:*** To use XBERT, each of the PMs must be equipped with one of these: an NT6X69AB message protocol card or an NT6X69AA message protocol card with an NT6X79 tone card.

XBERT performs six tests that handle different hardware components in the PM speech and data paths. The test names and their corresponding cards appear in Table 20-8.

Table 20-8 XBERT test types

Test name	Related card
XBERTBIC	NT6X44, NT6X48, NT6X69, NT6X52/BX35, NT6X54/BX36
XBERTDCC	NT6X44, NT6X48, NT6X69, NT6X52/BX35
XBERTHLP	NT6X44, NT6X69, NT6X50, NT6X27 and associated carrier
XBERTINT	NT6X41, NT6X42, NT6X44, NT6X48, NT6X69
XBERTPSL	NT6X44, NT6X48, NT6X69

The ISOLATE parameter, if specified, automatically runs tests to isolate a fault to a set of cards. The number of cards in its card list varies from one to three, depending on the test results.

You can test P-side ports or LCM bus interface cards (BIC) sequentially with one manual request.

For each XBERT test, if you test a DS-1 port on the XPM P-side port, the system tests the NT6X50 card. If you test the DS-30A port, then the system tests the NT6X48 card. For tests XBERTDCC and XBERTBIC, if the node on the P-side of the XPM is an RCLM, then the system tests the following control cards:

- the NT6X73 link control card
- NT6X50 cards on the RLCM host interface shelf

For accurate test results, run each of the XBERT tests on an active InSv XPM unit. The XBERT tests can run on an out-of-service (OOS) unit. For tests XBERTDCC and XBERTBIC, at least one unit of the LCM or RLCM must be InSv.

> ***Note:*** Do not use XBERT as a tool for providing accurate bit error ratio evaluations. It does not use the Consultative Committee for International Telephone and Telegraph (CCITT) standard test patterns in its test procedure. It uses XPM tone PCM to provide the 64 kilobits per second test bit stream.

All of the tests function in the same way. Each of the tests checks the following:

- if the hardware is present
- channel and data connections
- concurrency of tests

All of the tests first check if the NT6X44 time switch card and the NT6X69 message protocol cards are present. If these cards are not accessible, XBERT displays a response, and aborts the remainder of the test. If the cards are accessible, XBERT checks if the XPM P-side interface card (NT6X48 or NT6X50) is present. This card controls the port that you test manually.

If all of the hardware presence tests pass, invoke each test. These tests set up the channel connections for the test paths for each of the tests. When the test path is ready, XBERT sends data through the looped test path and verifies it as it returns. Verification continues for up to nine hours or up to the manual testing.

XBERT can run at the same time as all of the valid XPM types in an office. XBERT cannot test more than one test path at a time in any single XPM unit. Although you can manually request the P-side ports for testing, the system can not test a specific channel on that port unless you run test XBERTHLP. In test XBERTHLP, you must specify a channel.

While XBERT tests run on Insv or OOS units, there is no degradation of call processing. There is also no interference from other XPM tests.

At the end of a test, XBERT releases the test path connections and displays the bit error statistics based on the completed test run. The system can also display these statistics at any time during the test run.

Test XPMINT

For internal testing, the XBERTINT test path travels through the following cards:

- 6X41 formatter
- 6X42 CSM
- 6X69 message
- 6X44 time switch
- 6X48/6X50 DS-30A interface or DS-1 interface

> ***Note:*** Because the MSB6 is not provisioned with an NT6X69 card, the XBERTINT test does not apply for this PM.

Test path establishment

XBERTINT sets up the test path. The XBERTINT attempts to allocate two loop-arounds at the XPM P-side interface cards on the two ports that you specified manually. If the system does not complete the attempt, it displays a response and aborts the test. If the P-side loop-around allocations are successful, then the test attempts to allocate a C-side loop-around. The C-side loop-around loops data back toward the P-side at the NT6X41 formatter card. If the system can not allocate this C-side loop-around, the system displays a response and aborts the test. If all of the loop-arounds are established, the system cross-connects the two P-side channels with the C-side channel.

XBERTINT requires that you manually specify two P-side ports (P1 and P2) for testing. The ports can be both DS-30A, both DS-1, or one of each.

Test XBERTPSL

When you test the P-side loop, the XBERTPSL test path travels through the following cards:

- NT6X69 message protocol
- NT6X44 time switch
- NT6X48/NT6X50 DS-30A interface or DS-1 interface

> ***Note:*** Because the MSB6 is not provisioned with a NT6X69, NT6X44, or NT6X48 card, the XBERTPSL test does not apply for this PM.

The XBERTPSL sets up the test path. It attempts to allocate a loop-around at the XPM P-side interface card on a manually specified port. If the system does not allocate the loop, it displays a response and aborts the test. If the system completes the loop-around allocation, then the test proceeds.

The XBERTPSL requires that you specify only one P-side port (P1) for testing. The port can be either DS-30A or DS-1.

NT6X45BA processor cards for an LTC or MSB

With feature packages NTXA66 and NTXA67, NT6X45BA processor CP plus firmware card enhances the maintenance for an LTC or MSB. The NT6X45BA processor CP plus firmware card enhances the maintenance with the addition of the following capabilities:

- it checks if the card has the correct software load
- it flags if the XPM is doing ROM tests at the same time as the task level (RAM) tests of maintenance
- it performs tests that do not destroy ROM on InSv or OOS units, including inactive units

.

The system gives the status of the NT6X45BA card only if NT6X69 message protocol card is present.

Messages are displayed at the MAP terminal to indicate the activity of the tests provided for the NT6X45BA processor card. The displayed message depends on the entered command.

- Before the system performs tests by the TEST command, the maintenance flag ROM and RAM QUERY appears. This flag appears while the system automatically queries the loads of the NT6X45 cards.
- The system performs the tests that do not destroy ROM that you initiated with the TST command. While the system performs these tests, the system displays the NONDESTR ROMTST maintenance flag.
- Before the system loads by the LOADPM or RTS commands, the system automatically queries the loads of the NT6X45 card. The maintenance flag ROM/RAM QUERY appears.

The PECs of the NT6X45 card replaces the firmare release field of the inventory data table. The PECs do this in order to indicate to the CC which NT6X45 firmware capabilities are available. The PECs for the NT6X45 cards of units of the same LGC or MSB can have different PECs during a batch change supplement (BCS) application. You can perform wrong maintenance if you entered the wrong PECs into the tables LGCINV and MSBINV.

The system audits the NT6X45 cards by an audit to ensure the IMC links do not have faults. The results of the audit determine maintenance actions.

XPM diagnostic history

Extended Peripheral Modules Diagnostics History, feature number AF5006 provides a resident database to record selected diagnostic results of XPMs. This feature captures diagnostic results that indicate the sanity of the XPM. This database provides operating company personnel with MAP command access to data on the accumulated results of diagnostics. The system retains data in the history database over warm, cold, and reload restarts. This feature is part of software package New Peripheral Maintenance (NTX270AA).

> ***Note:*** Use the DIAGHIST option for PMs that support feature AF5006. In this guide, the PMs that support feature AF5006 include the LTC, LGC, DTC, PDTC, and the DTCO.

This feature is one of a group of three related features. The two other features are: XPM PreSWACT/Post SWACT Audit, feature number AF5007, and XPM REX Control and Trouble Notification Improvements, feature number AF5008. Feature AF5007 determines if the system must perform a SWACT. To make this decision, this feature uses a subset of diagnostic results, along with past REX tests and SWACT results. This test refers to the functionality introduced by feature AF5007 as the SWACT controller. Feature AF5008 modifies the XPM REX test to use the SWACT controller and enhance the log.

An XPM may execute diagnostics to test the functionality of its hardware. Diagnostics may run as a result of CC or XPM requests. Diagnostics that the XPM performs are normally part of XPM audits. System analysis makes use of the diagnostic results provided by feature AF5006. The feature provides the diagnostic results for system analysis by the SWACT controller and operating company personnel.

This feature provides short-term diagnostic performance data to the SWACT controller. The system provides a set of query procedures for applications that need information. The SWACT controller determines if a SWACT is authorized. Short-term data includes diagnostic and audit failure counts since the last time a unit gained activity.

Feature AF5006 provides data on the failure history of diagnostics. This data is in the form of the number of failures that occur and which cards are at fault. The system supplies MAP commands to display data for a given XPM or for all XPMs supported by this feature. The use of MAP commands makes two sets of data are available: short-term failure counts and long-term failure counts.

Short-term failure counts accumulate from the last time a unit gained activity. This data helps operating company personnel guide their maintenance activities and support organizations for outage analysis. If an outage occurs, include the XPM Diagnostic History data for that peripheral.

Long-term failure counts accumulate from the time when long-term failure counts last reset. The counts may reset because of BCS application or manual action. Long-term failure counts are intended to last for the life of the BCS. This data returns to the design groups to provide data for diagnostic system improvements.

Description of diagnostics

Because different PMs contain different hardware, different diagnostics run on every type of PM. There are approximately 75 diagnostics for XPMs. Only a part of the 75 diagnostics run on any given PM. This feature captures failures for the following types of diagnostics:

- in service
- out of service
- single diagnostic
- facility audit
- other audits

Each diagnostic indicates zero or more cards as determined by the XPM. In some instances, the CC generates card lists for the MAP display terminal or in logs. The list of card failures report includes any card that an XPM diagnostic or audit indicates, or that the system reports to the CC.

> ***Note:*** Feature AF5006 records only cards indicated by an XPM and not cards generated by the CC.

Diagnostics may group together and run as a set of diagnostics or run as a single test. Normally defined sets are

- in-service tests
- out of service tests
- facility audit tests
- mate diagnostics
- ROM diagnostics

In-service and out-of-service tests

In-service and out-of-service tests are solicited tests; they run as a result of the CC requests. The CC requests to test an XPM unit by using the manual TST command, manual or system RTS, SWACT, BSY or REX commands. When the CC requests the test, the XPM runs a set of diagnostics. The diagnostics that the set includes vary according to three items. The PM type of the XPM, the state of the XPM unit, and the activity of the XPM unit. If the unit is in service, the XPM runs a set of in-service diagnostics. If the unit is out of service, the XPM runs a set of out-of-service diagnostics.

The results of each diagnostic are returned to the CC along with a final result for the full set. If any cards have faults the system generates a card list. The system transfers the list to the CC at the termination of the set of tests.

Facility audit

The facility audit is a set of diagnostics the XPM runs to test itself. If the XPM encounters problems, it sends a message to CC that indicates the problem along with a list of cards that have faults.

Mate diagnostics

If the system loses communication with one unit, the mate unit of the unit which is not communicating may diagnose that unit. The mate unit then sends the results to the CC.

ROM diagnostics

If the XPM is at ROM level, the system can implement a set of ROM diagnostics.

This feature does not capture failures, nor does it capture the cards that mate and ROM diagnostics indicate. For each diagnostic, the system generates a card list or log at the MAP terminal. The diagnostic history does not record any card list or diagnostic failure.

Table 20-9 lists and describes diagnostics that this feature supports. The diagnostics are classified as solicited, audit, or as both. In addition, diagnostics are identified that the SWACT controller requires.

Table 20-9 Diagnostics supported by XPM diagnostic history test (Sheet 1 of 2)

Diagnostic name	Description	Type	Required by SWACT controller
AB DIAG	A/B Bits	solicited	no
AMUDIAG	6X50 External Loop	solicited	no
CSD1 DG	C-Side DS-1	solicited	no
CMRDIAG	CMR card	both	no
CONT DG	Continuity Diag	solicited	no
CSMDIAG	CSM Diag	solicited	no
CS SPCH	Network Links	solicited	no
DS1DIAG	P-Side DS-1	solicited	no
FORMATR	Local Formatter	solicited	no
MSGDIAG	6X69 Messaging Card	solicited	yes

Table 20-9 Diagnostics supported by XPM diagnostic history test (Sheet 2 of 2)

Diagnostic name	Description	Type	Required by SWACT controller
MSG IMC	IMC Link	both	yes
PADRING	6X80 Pad/Ring	solicited	no
PARITY	Parity Audit	audit	yes
PS LOOP	P-Side Loops	solicited	no
PS SPCH	P-Side Speech Links	solicited	no
SPCH DG	Speech Path	solicited	no
SYNC DG	Sync Diag	both	yes
TONES DG	Tone Diag	both	no
TS DIAG	Time Switch Diag	solicited	no
UTRDIAG	UTR Card	solicited	no

Table 20-10 lists the cards supported by the XPM diagnostic history test.

Table 20-10 Cards supported by XPM diagnostic history test (Sheet 1 of 2)

Card name	Description
NT6X40	Net Interface Link
NT6X41	Speech Bus Formatter and Clock
NT6X42	CSM
NT6X44	Time switch and A/B Bit Logic
NT6X45	Master/Signalling/File Processor
NT6X46	SP Memory
NT6X47	MP Memory
NT6X50	DS-1 Interface
NT6X69	Messaging Card
NT6X70	Continuity Card

Table 20-10 Cards supported by XPM diagnostic history test (Sheet 2 of 2)

Card name	Description
NT6X78	CLASS Modem Resource (CMR)
NT6X79	Tone Generator
NT6X92	Universal Tone Receiver (UTR)
NTMX77	68020 Processor (UP)

System stores diagnostics

This feature stores diagnostic results in the form of counters. Each unit of each peripheral that this feature supports has its own set of counters. The system keeps counters for diagnostic failures and for cards that have faults. Three types of counters are kept:

- diag (the number of times a diagnostic fails)
- card (the number of times a diagnostic reports a damaged card)
- diag and card combination (the number of times a diagnostic and card combination occurs)

The system keeps two sub-counters for each of the three counters: a short-term failure counter, and a long-term failure counter. Feature AF5007 uses the short-term failure counters to determine if you can perform a SWACT. The system resets short-term failure counters during the BCS cycle. Long-term failure counters record the diagnostic history of a peripheral or office over a extended period of time. The QUERYPM DIAGHIST RESET command or the BCS application resets long-term failure counters.

A single test failure can report one or more diagnostic failures and zero or more cards that have faults . It is possible for a diagnostic that runs in one unit to report cards in that unit and also its mate unit. When a diagnostic fails, each diagnostic routine sends the failure information to the history database.

Resets and time stamps

The history database stores five time stamps for every peripheral:

- for the node
  - — the time when long-term failure counters are last reset
- for unit 0
  - — the time when short-term failure counters for unit 0 are last reset
  - — the time when the last diagnostic failure occurred on unit 0
- for unit 1
  - — the time when short-term failure counters for unit 1 are last reset
  - — the time when the last diagnostic failure occurred on unit 1

The system resets short-term counters (set to zero) internally by the unit when a unit gains activity. This gain of activity can be the result of an RTS or SWACT command. The system resets long-term counters by the node from an XPM posted at the MAP terminal. When the system resets long-term counters, it generates a log. This log contains a summary of the data collected for that node before the reset.

A BCS application resets all diagnostic history data, including short-term and long-term failure counts. In this case, the system does not generate a log with long-term failure counts.

Product specific test tools

You can use many tools to test components from PMs. Use the PERFORM tool to test the LGC, LTC, and DTC. Use XPM single-change supplement commands to test all XPMs, including the MSB6 and MSB7 PMs.

PERFORM tool for LGC, LTC, and DTC

The PERFORM tool is available in feature package NTX827 (F6168), or NTX750 for an integrated services digital network (ISDN). PERFORM displays information about the processors of a posted PM of node type LGC, LTC, DTC, or RCC. This list includes node type LGC or LTC equipped with ISDN signaling processor (ISP) and D-channel handler (DCH) cards for ISDN basic rate interface (BRI) service. The PERFORM tool runs a maximum of 24 hours. The default is 15 minutes. To access the PERFORM level from the PM level, post a PM and enter the command PERFORM. The PM types that use the PERFORM feature have the command PERFORM at menu item 17.

Status display

When you access the PERFORM level, the system adds the performance status of the posted PM to the status display of the PM. The MAP display is updated every minute. The system updates timers every 15 seconds. Some of the data that the system collects and displays is the result of averages over the 15 second interval. The following display appears at all of the PERFORM levels:

```
LOAD NAME: load_name
STATUS: status  REASON  LOGOS: o/o  TIME: hh.mm.ss.
```

A description of each of these fields follows:

- The field LOAD NAME identifies the name of the load in the active unit of the posted XPM.
- The field STATUS is one of the following states:
  - RUNNING indicates that the process is active.
  - START_PEND indicates that the measurements begin when the next CC minute starts.
  - STOP_PEND indicates that the measurements begin when the CC minute ends.
  - STOPPED indicates that the process is inactive.
- The field REASON is one of the following:
  - COMMAND indicates the command STRT started the performance process.
  - DCH_DROP indicates that the process stopped because the DCH is not InSv or is IsTb.
  - DCH_SPARE indicates that the process stopped because DCH sparing occurred.
  - NOT_STARTED indicates that the process has not started.
  - NO_STORE indicates that the PM has no temporary store available.
  - TIMEOUT indicates that a PM process timed out. This causes one of the states described above.
  - UNKNOWN indicates that a not known or unrecognized condition makes sure the PERFORM tool does not continue.
  - XPM_DROP indicates that the process stopped because of a warm or cold SWACT in the PM.
- The field LOGS is one of the following:
- ON indicates where the system generates logs when one of the following occurs: 15 minutes (or duration) expires, when you enter the command STOP, a warm or cold SWACT has occurred, or the time for the run expires.

- OFF indicates where the system generates logs only when a warm or cold SWACT occurs.
- The field TIME denotes the hours, minutes, and seconds that remain for the decreasing time of the performance process. When the time expires, the process stops.

XPM single change supplement commands

The XPM single change supplement (SCS) commands provide the application, removal, or checks of alterations to software that apply to XPM units. The commands also display the names of the software loads in XPMs.

You can apply a large set of SCSs to many XPMs in an office. The number of XPMs in an office that you can change is 150. The quantity of SCSs that the system can store for that office is up to 300.

A group of one or more SCSs that is associated with one XPM load name is called a loadname SCS set. The SCS set name is the same as the XPM load name. You may add, delete, or display the SCSs of an SCS set. Use the commands INFORM, UPDATE, REMOVE, and SET.

To display the status of a change, use the INFORM command. The status is listed and described in Table 20-11.

Table 20-11 SCS status codes

Code	Status	Description
FA	failed	The last action on the software change of a unit failed.
NE	needed	The unit requires the software change, and the change is part of an SCS set. If you reload the unit, the change applies.
RE	removed	The software change was in the unit but was removed. This implies that the unit does not need the change.
UN	updated, not needed	The software change is in the unit but is not a part of the loadname SCS set associated with the unit. A reload of the unit does not include the change in the update.
UP	updated	The system updates the software change in the unit. The system includes the change in the reloading if the system updated the unit.

The correct way to handle an SCS for XPM software requires the use of exclusive fields in a call condense block (CCB). In order to distinguish the fields, SCS extension blocks are available through parameter num_of_scs_extblks of data table OFCENG.

The SCS extension blocks allow you to save call related data as part of an SCS, but does not damage a CCB or other data structures.

The system reserves and releases the SCS extension blocks from the SCS block pool as required. The OM group EXT monitors the use of the blocks.

21 Dual-shelf PM problem solving chart

This chart summarizes dual-shelf alarms, causes for dual-shelf alarms and the procedures for clearing the alarms. This chart is an overview for problem solving and how to maintain a dual-shelf peripheral module (PM) for qualified maintenance personnel. For more information, refer to "Alarm and Performance Monitoring Procedures".

LGC, LTC, and DTC

The following problem solving chart provides operating company personnel with problem solving procedures. These procedures are for a line group controller (LGC), line trunk controller (LTC), and digital trunk controller (DTC) alarms.

Table 21-1 Clearing LGC, LTC and DtC alarms (Sheet 1 of 2)

Alarm condition	Cause	Procedure
Critical	Power problems caused both units to be out of service (OOS).	1. Make sure that you powered up the PM. Check for EXT alarm and end aisle alarm lights. 2. Identify PM in critical state. 3. Post and busy the PM that has faults. 4. Return to service (RTS) the PM that has faults. 5. Replace cards in displayed card list. Use correct card replacement procedures. 6. If no reply from the PM, reset the PM that has faults. 7. If reset fails, reload the PM that has faults. 8. Return PM to service.

Table 21-1 Clearing LGC, LTC and DtC alarms (Sheet 2 of 2)

Alarm condition	Cause	Procedure
Major	Processor card or cards that have faults caused one unit to be out of service.	1. Identify the system busy (SysB) PM unit. 2. Post, and busy the PM unit that has faults. 3. Perform OOS test. 4. Replace cards in the card list. Use correct card replacement procedures. 5. Reload if you need to, and RTS PM unit.
Minor	Non-processor card or cards have faults and caused some degradation of service.	1. Identify the in-service trouble (ISTb) PM unit. 2. Post, and busy the PM unit that has faults. 3. Perform OOS test. 4. Replace cards in the card list. Use correct card replacement procedures. 5. Return to service the PM unit.
	P-side links OOS caused some degradation of service.	1. Display P-side links at the MAP (maintenance and administration position) terminal. 2. Busy and test SysB links. 3. If test fails, replace cards in card list, and retest. 4. If test passes, return links to service.
Minor continued	C-side links OOS caused some degradation of service.	1. Display C-side links at the MAP terminal. 2. At NET LINKS level, busy and test SysB links. 3. If test fails, replace cards in card list and retest the test. 4. If test passes, return links to service.
	PM load mismatch with inventory table caused some degradation of service.	1. Determine the load the PM must use. 2. Enter correct load name in table LTCINV. 3. Busy, load, and return the PM unit to service.
	Data is out of date and caused some degradation of service. Static data mismatch with CC caused some degradation of service.	1. Busy the PM unit that has faults. 2. Load the PM unit with central control (CC) data. 3. Return the PM unit to service.

MSB6 and MSB7

Table 21-2 provides operating company personnel easy access to problem solving procedures for MSB6 and MSB7 alarms. The procedure *Alarm and Performance Monitoring Procedures* provide more complete problem solving methods for the MSB6 and MSB7.

Table 21-2 Clearing MSB6 and MSB7 alarms (Sheet 1 of 2)

Alarm condition	Cause	Procedure
Critical	Power problems caused both units to be OOS.	1. Make sure that you powered up the PM. Check for EXT alarm and end aisle alarm lights. 2. Identify the SysB MSB6 or MSB7. 3. Post and busy MSB6 or MSB7 that have faults. 4. Perform OOS test. 5. If test passes, RTS MSB6 or MSB7. 6. If test fails, replace cards in the card list. Use correct card replacement procedures. 7. Load the MSB6 or MSB7. 8. If load passes, RTS MSB6 or MSB7. 9. If load fails, reload and RTS the MSB6 or MSB7.
Major	Processor card or cards have faults and caused one unit to be OOS.	1. Identify the ISTb MSB6 or MSB7. 2. Post and busy MSB6 or MSB7 that have faults. 3. Perform OOS test. 4. If test passes, RTS MSB6 or MSB7. 5. If test fails, replace cards in the card list. Use correct card replacement procedures. 6. Load the MSB6 or MSB7. 7. If load passes, RTS MSB6 or MSB7. 8. If load fails, reload and RTS the MSB6 or MSB7.

Table 21-2 Clearing MSB6 and MSB7 alarms (Sheet 2 of 2)

Alarm condition	Cause	Procedure
Minor	Non-processor card or cards have faults and caused some degradation of service.	1. Identify the ISTb MSB6 or MSB7. 2. Post and busy MSB6 or MSB7 that have faults. 3. Perform OOS test. 4. If test passes, RTS the MSB6 or MSB7. 5. If test fails, replace cards in the card list. Use correct card replacement procedures. 6. RTS the MSB6 or MSB7.
	C-side links OOS caused some degradation of service.	1. Display C-side links at the MAP terminal. 2. Busy and test SysB links. 3. If test fails, replace cards in card list and retest the test. 4. If test passes, return links to service.
	PM load mismatch with inventory table caused some degradation of service.	1. Determine the load the PM must use. 2. Enter correct load name in table MSBINV. 3. Busy, load, and return the PM unit to service.
	Data is out of date and caused some degradation of service. Static data mismatch with CC caused some degradation of service.	1. Busy the PM unit that has faults. 2. Load the PM unit with CC data. 3. Return the PM unit to service.

22 Dual-shelf PM advanced problem solving procedures

This chapter details advanced problem solving procedures to use to maintain a dual-shelf peripheral module (PM).

Advanced problem solving procedures

Under normal conditions, you can busy and test a unit that has faults. As a result of this testing, the MAP terminal displays a list of cards. The card at the top of the list is often the cause of the problem with the unit. Replace the problem card, and test the original unit that has faults again. If the unit passes this test, the unit returns to service and the problem solving procedure is complete.

If normal problem solving procedures do not restore a unit to service, the unit can require advanced problem solving procedures. The operating company personnel with experience can use MAP terminal responses from failed problem solving attempts to formulate a maintenance plan. The unit can require more advanced step action procedures to repair a fault.

Powering up dual-shelf PMs

Use the following procedure to power up dual-shelf PMs:

1 Post the dual-shelf PM.

2 Set the switch on the power converter to the ON position.

3 While you hold in the reset button on the power converter, flip the correct circuit breaker up. Do not hold the circuit breaker up. If the PM unit receives power, the circuit breaker will stay in the ON position. If a problem with the power occurs, the circuit breaker will trip back down to the OFF position.

- **a** Repeat Step 2 and 3 for the other PM unit.
- **b** Busy both PM units.

4 To check table PM Loads for correct load file, type

>LOADPM PM

Powering down dual-shelf PMs

Dual-shelf PMs are part of the host office. Use the general host office powering down procedure to power down PMs. Use the following procedure to power down a dual-shelf PM.

1 Enter the PM level at the MAP terminal.

2 Post the dual-shelf PM.

3 **>BSY PM no**

where

no is the number of the PM

4 **>TRNSL C**

5 Make the unit that you power down inactive. The system will busy one or more C-side links before you busy the PM unit posted in Step 2.

6 Enter the network level and busy the port assigned to the link or links noted in Step 4.

- **a** **>NET**
- **b** **>LINKS pair**

  where

  pair is the network number
- **c** **>BSY plane link**

  where

  plane is the number of the network plane

  link is the number of the link that interfaces with the network plane

7 Enter the PM level again, and POST the PM noted in Step 2.

>TRNSL C

(Note the status of the busied link.)

8 Remove the power from the busied PM unit. Set the switch on the power converter to OFF. The PM unit powers down. Repeat this procedure for all correct PM units.

Bigfoot utility

The Bigfoot utility stores information on passed and failed diagnostics. The implementation of feature AF5008, XPM REX Control and Trouble Message Improvements with the Bigfoot utility only maintains information on failed diagnostics. Failed diagnostics are error log information that enhance debugging procedures. The diagnostics code maintains a results graph for each set of diagnostics that run. The results graph contains data on each diagnostic test in a diagnostics run. The results graph identifies a diagnostic as passed, failed, not run, or test not defined.

Diagnostics results graph output

An example of the diagnostics results graph display output follows:

```
<001>     CLASS      EVENT   CC TIME OF EVENT
    DIAG GRAPH (#0F)  #0000:00:06:34:58

Diag_id =did_cmr_diag(#7) - CMR Card Diagnostics.
res_num=FF(P=Pass,F=Fail,N=Not Run|Test Undefined,O=Other)
Diag Results Graph: P F N N N N N N N N N N N N N N N N N N
```

> ***Note:*** In this guide, the PMs support the new emphasis on failed diagnostics of feature AF5008. These PMs include the LTC, LGC, DTC, PDTC, and the DTCO.

23 LCM and UEN

The *Peripheral Modules Maintenance Guide*, 297-1001-592, provides maintenance information on peripheral modules (PM) in the DMS-100 Group that reside in the host office. The *Peripheral Modules Maintenance Guide*, 297-1001-592 is for maintenance employees with experience and offers background information to assist in troubleshooting and maintaining these PMs.

This guide provides information on four types of PMs: single-shelf PMs, two-shelf PMs, the line concentrating module (LCM) and Universal Edge 9000 (UEN) DMS, and the link peripheral processor (LPP). Chapters 24 through 33 of this guide describe maintenance activities for the LCM and UEN, and these chapters provide information on the activities that follow:

- Chapter 24, "LCM and UEN maintenance overview," describes the basic maintenance strategy for the LCM and UEN. It describes the functions of the LCM and UEN, potential fault conditions, and system actions that attempt to correct these fault conditions. It also explains when activities should be escalated to manual maintenance.
- Chapter 25, "LCM and UEN preventive maintenance methods," describes the routine maintenance procedures and schedules for the LCM and UEN.
- Chapter 26, "LCM and UEN related logs," identifies the logs that may be generated for the LCM and UEN.
- Chapter 27, "LCM and UEN related operational measurements," identifies the operational measurement group names associated with the LCM and UEN.
- Chapter 28, "LCM and UEN related data structures," identifies the data structures associated with the LCM and UEN.
- Chapter 29, "LCM and UEN related user interface commands," describes how maintenance personnel might use the MAP to support the LCM and UEN. It describes appropriate MAP levels, system status displays, and menu commands.
- Chapter 30, "LCM and UEN related card requirements," provides background information on card replacement procedures for the LCM and UEN.

- Chapter 31, "LCM and UEN trouble isolation and correction," provides general descriptions of the procedures to correct faults in the LCM or UEN. It also describes fault isolation tests and diagnostic tests that may be used to support the LCM and UEN.
- Chapter 32, "LCM and UEN troubleshooting charts," is a high-level table that lists symptoms of LCM and UEN faults, possible causes of these faults, and the actions that can be taken to correct them.
- Chapter 33, "LCM and UEN advanced troubleshooting procedures," describes in detail the procedures to resolve more complex faults in the LCM and UEN.

24 LCM and UEN maintenance overview

This chapter provides the basic maintenance plan for the line concentrating module (LCM) and Universal Edge 9000 (UEN) DMS. The chapter provides maintenance personnel with experience with background information to use when troubleshooting the LCM and UEN.

The following list describes the topics that are addressed for the LCM and UEN in this chapter.

- The section "Functional description" describes the functions, configuration, and features of the LCM or UEN. This section describes how LCM or UEN components interact with themselves and with other DMS-100 Family components.
- The section "Fault conditions" describes hardware and software faults possible with LCM or UEN and related components.
- The section "Automatic maintenance" describes the actions the system takes to diagnose and repair these faults.
- The section "Escalation to manual maintenance" describes the rationale for handling maintenance on a manual basis.

LCM overview

Functional description

PMs are shelf-mounted or frame-mounted units that provide an interface between the network modules (NM) and analog or digital transmission facilities, service circuits, or secondary PMs. Several types of PMs are required to adapt the characteristics of these different transmission facilities to the NM. These PMs act separately or in tandem to provide services or offer selected characteristics.

The LCM is a secondary PM. The LCM connects a line group controller (LGC) or a line trunk controller (LTC) with up to 640 analog lines. The LCM uses two to six DS30A links in its connections. It is a two-unit PM that normally operates in load-sharing mode. Its main functions include the following:

- associates a DS30A channel with a subscriber line to allow an outgoing call to be made or an incoming call to be received
- supports up to 640 analog lines
- provides from two to six DS30A links to an LGC or LTC
- supports Meridian Digital Centrex (MDC) services
- supports many line card types, including plain-old telephone service (POTS) and Meridian business set (MBS).
- performs low-level call processing functions, which include the following:
  - — scans lines for state changes
  - — dial pulse digit collection
  - — monitoring of power and ring generation functions
  - — detection of mate processor failures
  - — message handling to and from an LGC or LTC for 640 lines

LCM call processing functions are controlled by software resident in the host DMS-100 Group office. LCM call processing functions include class of service, code understanding, screening, and routing.

Call processing

Scans for state changes The LCM continuously scans all of the lines in one drawer for state changes. The state changes will be from on-hook to off-hook or from off-hook to on-hook. The direction of the state changes depends on the status of the lines it scans.

Detection of start When a subscriber lifts the receiver, the LCM detects an off-hook. The LCM sends a message through a signaling channel to notify the central processing unit (CPU) of this state change. The LCM notifies the CPU through the LGC or LTC and the network.

Dial tone connection and digit reception The CPU receives the off-hook message from the LCM. The CPU assigns a voice channel on the speech link between the LCM and network. The CPU assigns an integrity message (continuity check message) to the calling line.

Integrity messages are assigned to each network connection and are sent by the originating and terminating line or trunk. If the start or termination ends detect a discontinuity in the integrity message transmission, the connection switches to the other network.

The CPU assigns a voice channel and integrity message to the calling line. Next, the CPU orders the LCM to execute the following commands:

- associate the assigned voice channel with the calling line
- send the integrity message
- give dial tone to the calling line
- receive the called digits
- report to the CPU after the digit is dialed

Digit analysis and network connection The CPU receives all digits from the originating LCM and determines the location of the called line. The CPU assigns a voice channel to the called line. Next the CPU tells the network to set up a connection between the calling and called lines. Last, the CPU tells the LCM to stop receiving digits and look for the integrity message from the terminating LCM.

Ring connection The CPU sends a message to the originating LCM to both ring and scan for on-hook on the calling line. It tells the terminating LCM to ring the called line and send a channel supervision message (CSM) to the originating LCM.

Talk connection and call disconnect When the called line goes off-hook, the CSM signal notifies the originating LCM of the off-hook event. The LCM tells the CPU of the off-hook status on the called line. The CPU orders the originating LCM to stop ring on the calling lines. The two parties are now in the talking state. The originating and terminating LCMs scan both lines for state changes.

For example, if the calling party terminates the call, the originating LCM sends an on-hook message to the CPU. The CPU commands the network monitor to release the network connection.

At the same time, the CPU orders the originating LCM to stop sending and checking integrity, to disassociate the assigned voice channel, to idle the calling line, and scan for an off-hook on the calling line.

Configuration

The LCM is a two-unit PM that resides on two shelves in a line concentrating equipment (LCE) frame. Each LCM unit resides on a line concentrating array (LCA) shelf. A 0 or 1 identifies each LCM. Each LCA consists of up to five line drawers (LD), and each LD consists of two subgroups. Each LSG consists of 32 line cards.

The following formula shows how each of these components supports the 640 analog lines of the LCM.

1 LSG = 32 line cards

2 LSGs = 1 LD = 64 line cards

10 LSGs = 5 LDs = 1 LCA = 320 line cards

20 LSGs = 10 LDs = 2 LCAs = 1 LCM = 640 line cards

The LCM C-side connects to an LGC or LTC. The LCM uses as many as six DS30A links in its connections. The LGC and LTC must be within 50 feet of the LCM. The LGC and LTC have a maximum of 20 ports available for DS30A links from the LCMs. From one to ten LCMs can connect to each LGC or LTC, depending on the volume of traffic.

Figure 24-1 illustrates a normal LCE frame and shelf design. The baffle and fuse panels above each LCA permit air circulation for cooling and carry sets of five +5-V, +15-V, and -48-V fuses for the LD, as well as a pair of fuses for the ringing voltage outputs.

Figure 24-1 LCE frame and shelf design

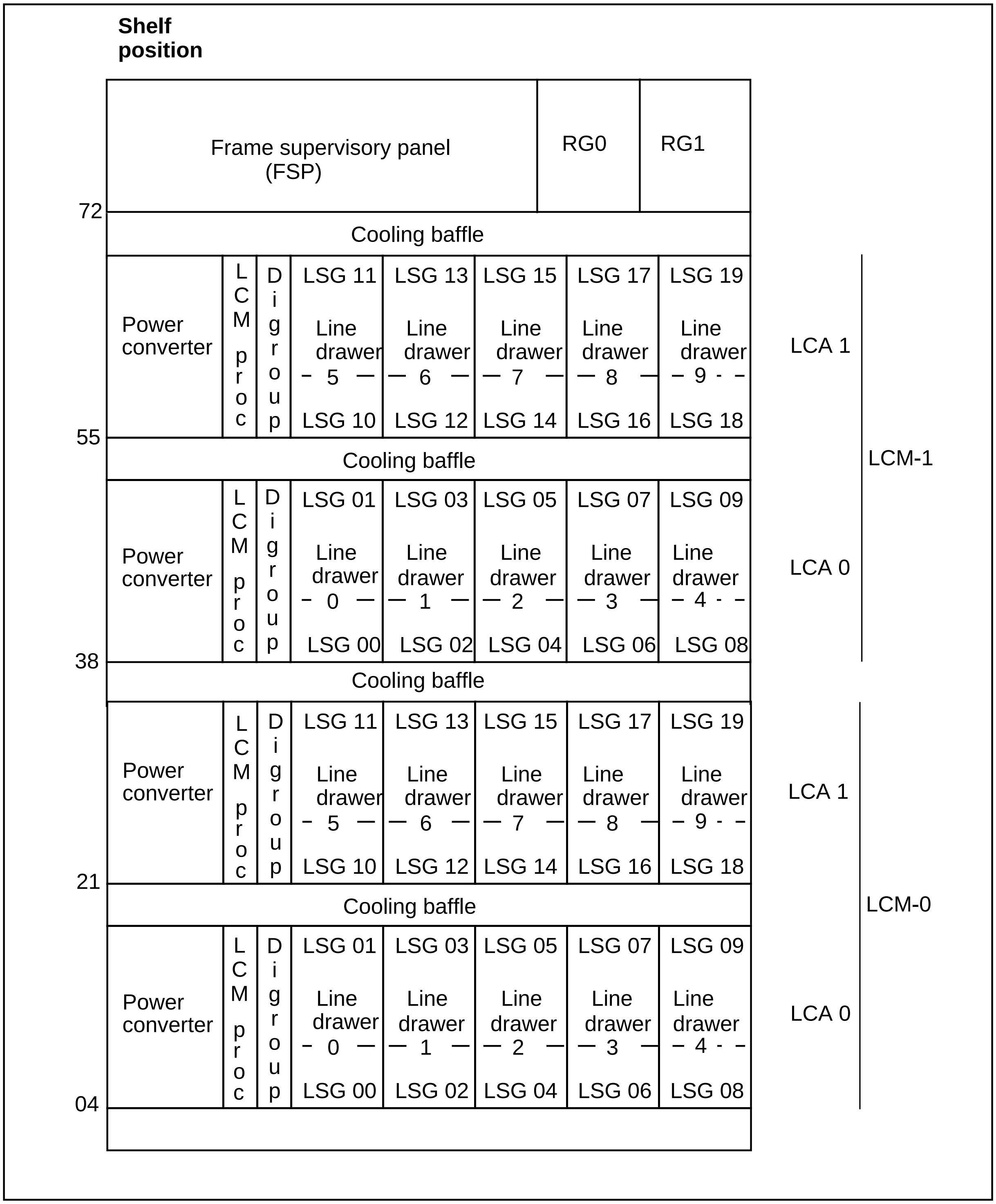


Figure 24-1 also illustrates the numbering standards of LCM components. LCMs are numbered in a sequence from 0 to n within a switch. LCAs are numbered 0 or 1 within an LCM. LDs are numbered in a sequence from 0 to 9 within an LCM. LSGs are numbered in a sequence from 00 to 19 within an LCM.

Table 24-1 lists the identification numbers by LCA shelf for LDs and LSGs.

Table 24-1 Identification of LD and LSG in LCA shelves

LCA shelf	LD	LSG
LCA-0	LD-0 to LD-4	LSG-0 to LSG-9
LCA-1	LD-5 to LD-9	LSG-10 to LSG-19

Each LCA shelf has the following cards:

- power converter card
- control complex cards, which include the following:
  - LCM or XLCM processor card
  - digroup controller card
- line drawer cards, which include the following:
  - bus interface cards
  - line circuit cards

Power converter card

The NT6X53 power converter card, located in slots 01-03 of the LCA, contains circuits for converting -48-V office battery to regulated +5-V and +15-V outputs in order to supply power to the circuit cards on a shelf. The power converter also contains relay circuits that control the application of ringing and ANI/coin voltages from the ring generator to the LCM line circuits.

Power connections to the two shelves of an LCM are arranged so that one converter can supply both shelves if the mate converter fails.

LCM processor card

The NT6X51AA LCM processor card has the following functions and features:

- controls LCA activity and sanity audit
- collects dial pulse digits
- handles DMS-X message protocol on DS30A links to the LGC or LTC
- monitors power supply and ringing generator

- monitors ANI/coin functions
- interfaces to digroup control card
- contains 64 kbytes of random access memory (RAM)

XLCM processor card

The NT6X51AB expanded memory LCM (XLCM) processor card has the following functions and features:

- ability to perform all functions of LCM processor card
- ability to use LCM or XLCM software loads
- ability to function as replacement card for LCM processor card
- contains 256 kbytes of RAM in four memory banks

Digroup control card

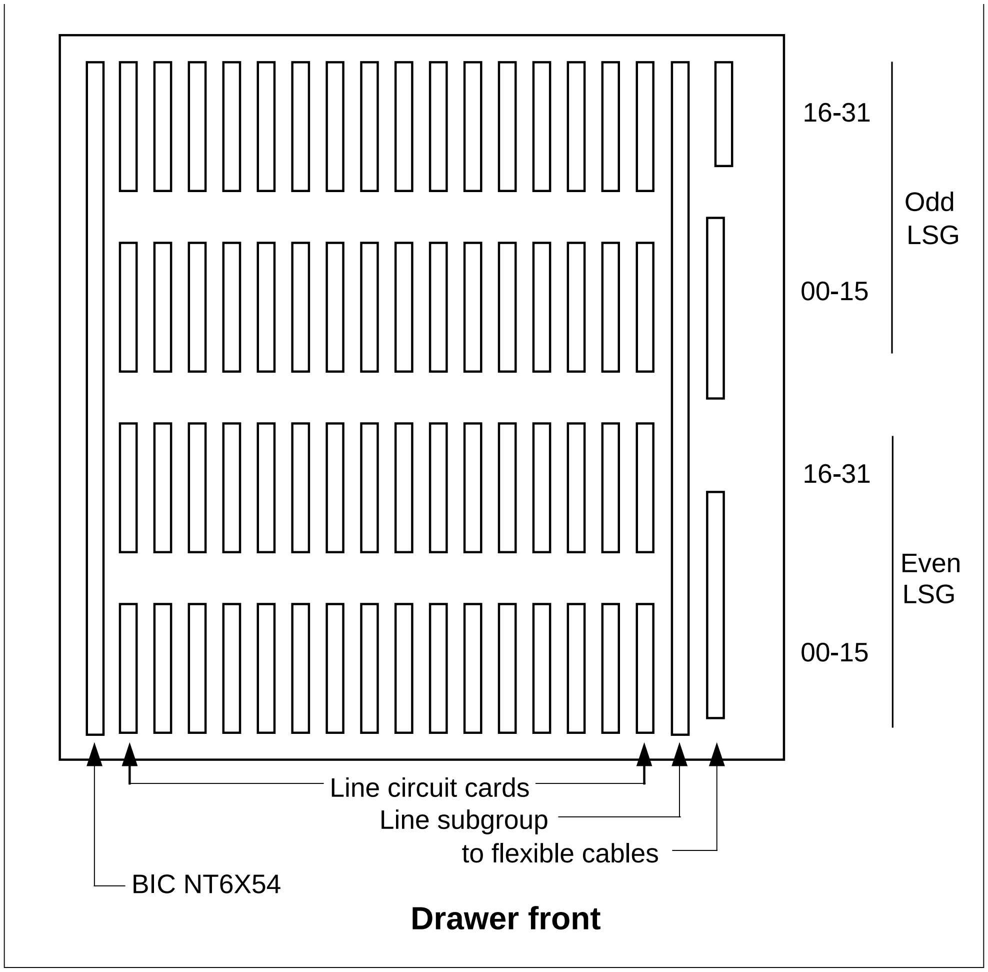
The NT6X52 digroup control card has the following functions and features:

- provides time-switch capability for associating a line card to a given channel on a DS30A link
- terminates one connection cable containing three DS30A links that interface to an LGC or LTC
  - LCA-0 = DS30A links 0, 2, and 4 to LGA/LTA-0
  - LCA-1 = DS30A links 1, 3, and 5 to LGA/LTA-1
- provides the LCM processor with access to all six DS30A links
- provides the LCM processor with one 32-channel digroup interface to each of the ten line drawers
- provides digital loop around paths for fault isolation

Line drawer cards

Each line drawer (LD - NT6X05) in the LCA shelf has one bus interface card (BIC) (NT6X54). Each line drawer also has up to 64 line cards of different types. Figure 24-2 illustrates a normal LCA line drawer and the position of the BIC. The LD can withdraw from the frame to access line circuit cards and remain working. Flexible cables connected to the rear receptacles allow the LD to remain working.

Figure 24-2 BIC in LCA line drawer



The BIC is at the front of the LD, behind the front faceplate. The BIC connects to the two LSGs (64 line cards) in its drawer. In addition to connecting its two 32-channel LSGs to both LCAs, the BIC performs the following other functions:

- scans line circuits for hookswitch changes or message present (understanding of dialed digits)
- sends signals through a ring multiplexer to control the relays in the power converter to select ring and ANI/coin voltages
- monitors LD activity circuit for maintenance
- performs digital loop-around on command from the maintenance system

Communication between LCA-0 and LCA-1 or between two LSGs travels through the single BIC in each drawer.

The line circuit (LC) cards are located behind the BIC in four rows of up to 16 LCs. The top two rows of LCs form the odd-numbered LSG, and the bottom two rows form the even-numbered LSG. Normally, the LCA-1 control complex controls the odd LSG of both LCA. The LCA-1 uses the ten digroups (ten 32-channel P-side ports) available on the LCA-1 digroup control card.

The 32 line cards (0-31) located in the top two rows of each drawer form the odd LSG of a line drawer. The 32 line cards (0-31) located in the bottom two rows of every drawer form the even LSG. See Figure 24-2.

LC cards are available in several types so that the LCM can support different types of analog or digital telephone equipment. The LC cards now supported are as follows:

Standard line card type A (NT6X17AA, AB, AC) or POTS card

Supports single-party, two-party, and private branch exchange (PBX) analog telephone sets (type 500 or 2500). Loop start, superimposed ringing, and frequency selective ringing with bridged ringers. Includes cutover control circuit. See Line Card Type B (coin).

> ***Note:*** The position for LC-00 is assigned to a type A line circuit and used for analog ring test purposes. Circuit LC-00 is not available for assignment to a subscriber line.

Line card type B (coin) (NT6X18AA, AB, AC)

Provides all features of type A, plus multiparty lines. Supports coded ringing, PBX ground start, hotel and motel, and analog pay per use telephone sets that require coin control.

Line card type C MDC (NT6X21AA, AB, AC, AD)

Supports MDC-related electronic multiple line telephone sets and operator consoles.

Line card type D, data line card (DLC) (NT6X71AA, AB, AC)

Provides data transmission interfaces for operation with computer terminals.

Line card type E, message-waiting line circuit (NT6X19AA)

Provides all the features of the type A line circuit plus a message-waiting lamp driver circuit. This circuit causes the message waiting lamp on the associated telephone set to flash. The lamp flashes at 1 hertz to inform the subscriber that the telephone is holding a message.

Message-waiting converter (NT6X20AA)

Provides -150-V synchronization pulse for the message-waiting lamp circuit.

Integrated bit error tester (IBERT) card (NT6X99AA)

Provides a bit error-rate test (BERT) pattern to test the transmission quality of data lines in a DMS switch office.

Power converter card (NT6X23AA)

Provides voltage (+48-V) that is applied across a reversed tip and ring in order to disable the pad on a coin subset.

The LCM uses DMS-X protocol to communicate over its DS-30A links with the LGC or LTC and host office. DMS-X, a half-duplex byte-oriented protocol like DS30, is responsible for the transmission and reception of message data. DMS-X is a state-driven code. DMS-X requires handshake protocol messaging between the LCM, LGC, or LTC, and host at each stage of data transfer. The LCM or expanded memory LCM (XLCM) processor card handles the DMS-X message protocol for the LCM.

The host LGC or LTC provides all correct-cadence subscriber tones, which the LCM applies as needed to subscriber lines. The tones supported by the host LGC or LTC and applied by the LCM are as follows:

- dial tone
- audible ring
- warble tones [Integrated Business Network (IBN) electronic business set ringing]
- busy tone
- reorder tone
- receiver off-hook (ROH) tone

Maintenance states

Each LCM is assigned a maintenance state either by the system or manual commands entered at the MAP display. Table 24-2 lists and describes possible single-shelf PM maintenance states.

Table 24-2 PM maintenance states

PM state	Code	Description
Central side busy	CBsy	PM can not communicate with the central control (CC) because the DS30 link or links, used to carry messages between the PM and the DMS-100 switch, are not available.
In service	InSv	PM is free of service-affecting faults and is able to support any intended process, like call processing.

Table 24-2 PM maintenance states

PM state	Code	Description
In-service trouble	ISTb	PM is in service (InSv) but has a minor fault.
Manual busy	ManB	PM is busy because the switch operator issued the Busy (BSY) command from the MAP position.
Offline	OffL	Removal of PM from service by switch operator for commissioning testing or to hold PM out of service (OOS) during a limited time.
System busy	SysB	Removal of PM from service by system maintenance because of faults.

These maintenance states and codes will be referenced throughout this guide.

Data tables

Entries in the data table SITE control the assignment of LCM site names. HOST, or any name selected by the operating company to designate the central office, is the first entry in data table SITE.

A discrimination number in the range of 0 to 99 identifies each LCE frame. This number, plus the module number are the parameters used with the command POST. The module number (0 or 1) indicates the lower or upper LCM in the order given. The LEN that associates with each LCM (site name, frame, and bay) is assigned in table LCMINV.

Data table LNINV records the relationship between the location of the LC in the LD and shelves of an LCM. Data table LNINV also records the circuit and LSG numbers.

Takeover of mate unit

The LCM two-shelf configuration has duplicate processor capability. The duplicated processors, one in each shelf, normally operate in a load-sharing mode where each processor shares the process load. Each processor is in full control of one-half (320) of the subscriber line cards within an LCM. In the event of a failure in one of the processors, a switchover occurs. The mate processor takes control over the complete LCM. The remaining control complex can support all six DS-1 links and all 20 LSG. This switchover occurs without interruption to existing calls in the talk or ring state.

In the normal load sharing mode of the LCM, CPU 0 controls even numbered drawers through DCC 0, while CPU 1 controls odd numbered drawers through

DCC 1. During takeover, the active unit can access all drawers through its DCC. The inactive unit of the DCC cannot access any drawers for call processing. However, the inactive unit of the DCC can access any drawer for testing.

A switchover can occur because a serial data link between LCA shelves sends data from each call in progress from one LCA shelf to the other LCA shelf. When a processor from one LCA shelf fails, the mate processor has the current conversations of the first shelf stored in random access memory (RAM). The mate processor can takeover call processing from the malfunctioning processor on the other LCA shelf.

The same switchover capability applies to LCM power converters. If one power converter fails, the remaining power converter can perform the following tasks:

- supply power to all 20 LSGs
- distribute ring and automatic number identification (ANI) and coin control voltages to all 20 LSGs. One of the two RGs located in the host interface equipment (HIE) supplies the coin control voltage.

LCM self-tests that detect that a BIC (NT6X54) drawer has a fault can prevent LCM takeover. Takeover occurs if the digroup control card (DCC) (NT6X52 cards) drawer has a fault. Tests that detect drawer faults require the DCC to send test messages for loop around to the BIC. DCC tests do not check all circuits used in DCC/BIC communication. Therefore, damaged circuits on the DCC may cause the BIC faults.

Overload controls

When the amount of traffic on an LCM exceeds the process capacity, the LCM automatically processes at a slower rate. The LCM processes at a slower rate until the overload clears. As the system demands LCM to process, the work queues and receives priority in the data store (DS).

Control for large numbers of P-phone hits

When a large number of function keys are hit on a P-phone, the LCM recognizes a P-phone with ICMO. This normally occurs when the LCM recognizes the key sequence as invalid. The LCM ignores the key sequence or informs the CC to operate the cutoff relay on the P-phone. The cutoff relay removes the P-phone from service.

To allow continuous service on the P-phone, the LCM uses an algorithm as follows.

- A threshold allows four function key hits in a 2 second span, including the keys for the following:
  - automatic line
  - call forward
  - date
  - DN
  - intercom
  - query time
- When the number of key hits passes this threshold, all following function key hits are ignored. All other key hits continue to process (for example, digits, off-hooks, and on-hooks).
- The selected function key hits process when a 2-second period passes without any function key hits.

Overload controls for an LCM with an expanded memory

An LCM with an NT6X51AB extended LCM processor card has an expanded memory capacity. Feature AF4194, "XLCM Overload Controls", has the following purposes:

- Prevents LCM from going system busy because of traffic rates many times beyond its considered capacity. The LCM will not go system busy because of a reserved supply of short memory blocks.
- Prevents LCM outages.

When the LCM with expanded memory is running far above its considered capacity, it may not have enough short memory blocks. The LCM may not have enough short memory blocks when a high rate of messages comes in from the host XPM. When the LCM does not have enough short memory blocks, it may suspend many internal processes. The LCM also cannot continue to accept external messages. The result is call degradation, and the LCM immediately reports an overload.

If the LCM runs for extended periods without short memory blocks, the potential exists for problems with operating system resource handling controls. When problems occur with the resource-handling controls, the operating system generates complete software error reports (PM180). At the same time, the CC busies the unit.

When the LCM reaches its reserve supply of short memory blocks, it sheds all messages (except maintenance and debug) from the C-side. When a message must be shed, the LCM will report an overload. The number of reserve short memory blocks will be sufficient to ensure operation of all LCM tasks in any traffic environment.

Overload control by LGC

The LGC handles overload control for the LCM. The LCM does not know the call processing state of a terminal. Without this knowledge, it cannot distinguish between originations, terminations, and calls in progress. Overload controls in the LCM apply to all three types of work.

The overload controls in the LCM act to keep the LCM in-service. The controls do not maintain a constant throughput for all levels of overload. Calls in progress are affected in the same way as originations and terminations. Throughput decreases as overload increases.

The LGCs know the call processing state of a terminal. When an LCM is in overload, the LGC can control the flow of work to and from the LCM.

The LGC decides which LCMs are in overload and applies flow controls to origination messages for those LCMs. Flow controls in the LGCs (but not the LCMs) provide the following:

- control of the flow of originations
- guaranteed dial tone
- per terminal queuing
- last in, first out (LIFO) queuing of originations

When the LGC has a large number of messages for the LCM, LGC flow controls cannot receive messages until C-side messages transmit. When the LCM goes into overload, the LCM overload controls take effect. The controls remain in effect until the LGC overflow controls receive a message.

When the LCM resumes normal operation (the overload passes), it may not send any messages to the LGC flow controls. An audit ensures cancellation of the overload status. Every three seconds the audit checks the load state of each unit. The audit cancels overload state if the unit does not have any queuing terminations and sends no messages for three seconds.

Control of originations by LGC

After recognizing the overload state from a message from an LCM, the LGC flow control decides when to queue the message. The LGC puts the new message on the LIFO queue when the terminal is idle or there are messages in queue.

After 20 milliseconds or more, the flow control takes a message from the queue. If the LCM is in overload, flow control puts the message on the guaranteed dial tone (GDT) queue. The GDT audit removes a message from the queue. If the message is from an LCM in overload, the audit places the message back into the queue.

If the LCM is not in overload, the GDT audit checks how old the message is. When messages are less than three seconds old, flow control sends it to the master processor (MP). For older messages, the LGC queries the LCM for the current terminal state. LGC control of originations in the LCM acts as a THROTTLE for the rate that MPs and CCs process originations for LCMs in overload.

Unless the LGC receives the LCM overload control message as the DS in the LCM fills, the LCM overload controls react. The LCM overload controls react by slowing the rate of accepted work or by halting the process until store is available.

The three stages of action occur for the following:

- C-side communication
- interunit communication
- line scans

The first work completed or sent from the LCM receives priority.

C-side communication

The LCM processor decreases the rate at which it scans for a message from the C-side. When the incoming work load slows, requests for DS decreases. MAP commands about LCM status and C-side responses to terminals slow.

Interunit communication

Under normal traffic conditions, each LCM processor queues update messages about the development of call processing. When the interunit communication link is available, the processor of the active unit sends its mate the update. The processor updates the mate so that the mate unit can take over call processing without canceling calls. During traffic overload the processor does not store update messages for the mate processor. Calls in progress are given priority over update messages. If an uncontrolled takeover occurs, calls are canceled.

Line scans

During overload, the processor stops scans of the BIC until enough DS is available. Incoming work does not reach the P-side. The work queues in the output buffer of the BIC. When the buffer is full, it will not accept more work. The effect is to cause dials that are not completed or ignored keys on business sets.

Incoming message overload control by the LCM

One or more line cards form the incoming message overload (ICMO) control (alias babbler). The ICMO sends messages at a high rate toward the LGC or LTC. To avoid an overload, ICMO detects and messaging stops until the system determines the cause of the fault. The detection and disabling of incoming messages are done in the LCM with control by the CC.

The LCM measures detection of ICMO one line at a time. The first line to send a message at the end of one test is the objective for the next test. Different checks are done for POTS and programmed lines (for example, P-phone or data unit). Different checks are done because of differences in the characteristics of messages. For example, on-hook or off-hook for POTS compared to key-presses for programmed lines.

The LCM does the following to detect overload on lines:

- The messages from the selected line for one second are counted. The messages are compared to a threshold based on the characteristics of the set.
- If the messages exceed the threshold, the line is a major ICMO (babbler).
- If the count is less than the threshold, the test continues. The test continues for two seconds for POTS or six seconds for P-phone. The LCM checks the message count once each second until one of the following occurs:
  - — The quantitiy of messages exceeds the threshold for the second, in which case the line is a major ICMO.
  - — There are no messages in the second, in which case the test terminates and selects another line.
  - — The total quantity of messages exceeds a threshold, at which time the line is a major ICMO. This check disables for the first second of a test. A disabled check ensure that the messages occurred over at least a 2-second period.
  - — The test duration is complete.
- The LCM monitors the line when it produces one message each second and does not exceed the 1 second or total thresholds. These thresholds are in place during during the short test period. The LCM monitors the line until one of the following occurs:
  - — The quantity of messages in a second exceeds the threshold, in which event it is a major ICMO.
  - — There are no messages in a second, in which case the test terminates and selects another line.
  - — The total test duration (including the previous tests) reaches 60 seconds. At this time the line is a minor ICMO.

- When the LCM detects an ICMO, it sends a message to the CC to identify a line fault as a noise line. The message travels through the LGC or LTC. In response, the CC generates a log LINE204 to indicate the overload directory number (DN) and the line equipment number (LEN). The CC puts the line in a queue for testing. Major ICMOs are immediately taken out-of-service (OOS) and only return to service when the ICMOs pass the line test.
- The LCM checks all lines, but active lines (those used often or in overload) are checked earlier and more often. These lines generate the first message after the completion of a test for ICMO.

Display of overload state

When an LCM overloads, the LCM status display changes to ISTb while the units are InSv. By entering the QUERYPM FLT command at the LCM level, the response includes the following phrase:

```
PM OVERLOADED
```

Logs PM128 and PM181 indicate the overload condition. The system generates log PM128 with the following phrase included when normal call processing resumes:

```
PM OUT OF OVERLOAD
```

Ringing generator

The LCE frame is usually equipped with two ringing generators (RG), RG0 and RG1. At the start, RG0 supplies ringing voltage to both units of the even-numbered (lower) LCM in a LCE frame. RG1 supplies ringing voltage to both units of the odd-numbered (upper) LCM units in the same frame. RG0 supplies ANI/Coin voltages to both units 0 of the two LCM. RG1 supplies ANI/Coin voltages to both units 1 of the two LCM. This condition is the primary RG condition. If the ANI/Coin voltages in an RG fail, the associated LCM units become SysB. Both LCM units go into the takeover state.

Ringing is not affected by a unit takeover. If an RG fails, all four units in the two LCMs switch over to use the InSv (secondary) RG. When an RG fails, the LCM that has that RG as its primary switches to the secondary RG. Use the command SWRG to manually switchover RGs. Identify the primary RG as preferred, and the secondary RG as standby on the MAP display. RG states are displayed as OK if in operation, or ISTb if not in operation or busy.

In some configurations, RGs are not required in every LCM. In this event, it is necessary to control the application of RG software to avoid processes which are not necessary. Entries in data table LCMINV field RGEQUIP impose control. LCM units which are equipped with RG have entry Y in this field, and unequipped LCM units have entry N. N is the default entry. If RGs are not equipped, the responses and displays associated with the SWRG and POST commands are changed.

Overload conditions

For LCM shelves with the NT6X51AB expanded memory board, additional diagnostics are available to assist in detecting RG overload conditions. Results are displayed by the QUERYPM command.

Line drawer and ringing generator faults cause RG overload. If tests indicate an RG that has faults, the damaged RG is set to ISTb and all drawers use the stand-by generator.

Broadcast load of LCMs

Broadcast loads of LCMs that use the XPM data distributor are available with feature package NTXA66AA. The following are the requirements for a set of LCMs posted at the MAP terminal for broadcast loads.

- Use the LOADPM command with the parameter ALL.
- The posted set of LCMs must have at least two LCM units of the same PM type. The LCM units must have the same load file and the same C-side node type.
- The Table OFCOPT must have the parameter office_recovery_available set to true.
- The C-side XPM load must support fault isolation and office recovery.

When the active unit of C-side XPM (LTC or LGC) loads a set of LCMs, it displays *Loading LCMs* next to its maintenance flag. The LCM loads block other manual maintenance on the XPM unit. Any system action on the XPM, like switch of activity (SWACT) or SysB, aborts the broadcast load operation on the LCMs.

The set up for a broadcast load is done by parameter office_recovery_available of table OFCOPT.

The set up for a load by the mate unit is done by parameter mate_loader_available of table OFCOPT.

Distributed data management

The capabilities of broadcast loads and distributed data management (DDM) are used by the LCM through the following maintenance commands. The capabilities are used when the parameter specified is ALL:

- BUSY
- LOADPM
- OFFL

- RTS
- SWACT
- TST

In feature package NTX041, data tables for DTCs and message switch and buffer (MSB7s) can have DDM.

Reconfiguring nodes or links

Reconfiguring a node or link between XPMs normally causes the MAP message STATIC DATA MISMATCH, which means the involved XPMs are given the status ISTb.

Change C-side links, C-side nodes, ring data (all for PM type LCM only) in table LCMINV to reconfigure LCMs. Addition or deletion of tuples will also reconfigure LCMs. (Remove convertible LCMs from service for these changes.)

Restrictions for implementing reconfiguration data

XPMs that can be reconfigured while InSv must be manually busied for the table changes.

When the XPMs receive the data changes, the following system restrictions occur:

- The system cancels any system audit in progress.
- The update must wait for current maintenance tasks to complete. Assuming the XPM remains InSv, up to five retries are attempted every 20 seconds until the request for the update is aborted and the XPMs are made ISTb.
- A messaging error by the system causes the XPMs to become SysB or CBsy.
- An update that is not complete or wrong causes the XPMs to go ISTb.
- Interactive table changes that affect static data but are not supported by the reconfiguring feature can cause the XPM to go ISTb. The supported changes continue to be sent.
- When an XPM is in the ISTb state with the reason STATIC DATA MISMATCH, the XPM remains ISTb. The XPM remains ISTb because the original reason for the state is not fixed by the data changes.

Effects of in-service reconfiguration on calls

Changes to the configuration data in Table LCMINV automatically update the configuration data in their associated tables. Because the updating inventory tables are interactive, calls in progress can be completed. The result depends on the type of reconfiguration.

C-side link reconfiguration

Changes to the C-side of subtending XPMs automatically change the host or C-side XPM. For example, changing the C-side links of an LCM automatically changes data in the LCM and its C-side LTC. When the LCM is manually busied in preparation for the data update, calls in progress between the LCM and the LTC are completed. The data reconfiguration occurs after the calls are completed.

When a P-side link of an RCC moves from one LCM to another LCM connected to the same RCC, the RCC remains InSv. The data changes occur when the RCC is InSv. Calls in progress are maintained.

As with adding C-side links, when XPMs are added, all network channels may be assigned immediately to the C-side links. The system audit updates all the data as the network channels become available.

P-side link reconfiguration

P-side link reconfiguration changes the link type in an existing tuple in a P-side inventory table. The only affected data is the static data of the LTC or the LCM.

Ring data reconfiguration

To reconfigure ring data, change the ring type in data table LCMINV. Because changes to ring type are part of an LTC node reconfiguration, it is also a stand-alone change to table LCMINV. The reconfiguration automatically updates the LCM C-side XPM.

Operating company personnel can change ring data in the LCM without causing a service outage. To reconfigure ring data for an LCM, use the following steps.

1. Switch all units in the LCE frame to ringing generator 0 (RG 0).
2. Busy unit 1 of each LCM.
3. Power down ringing generator 1 (RG 1). Remove the generator from its slot. Change the DIP switch settings to the new ring type. (Refer to Hardware Description Manual, 297-1001-805, for DIP switch settings).
4. Replace RG 1 and power it up
5. Using the table editor, go to table LCMINV and position on the LCM you want to change.

6. Change the RNGTYPE (or RNGCADNCE) field to the new ring type and apply the change.

   Note: The following events occur:

   - The ring type value for the mate LCM automatically updates because both LCMs in the LCE are required to support the same type of ring.
   - Static data for the C-side node updates for both LCMs in the LCE.
   - Unit 0 of each LCM is set to ISTb because of a mismatch in static data. A later step clears this mismatch.

7. Return unit 1 of each LCM to service.
8. Switch all units in the LCE frame to RG 1.
9. Busy unit 0 of each LCM.
10. Power down RG 0, remove it from its slot, and change the DIP switch settings to the new ring type.
11. Replace RG 0 and power it up.
12. Return unit 0 of each LCM to service.
13. Switch all units in the LCE frame to their preferred ringing generators, LCM 0 to RG 0 and LCM 1 to RG 1.

Fault conditions

Drawers that have faults

When a BIC or line card becomes defective, a line drawer has faults. Refer to “Handling a defective line drawer" on page 31-10 of this guide for more information.

Shelf circuit cards that have faults

A power converter card, LCM processor card, or digroup controller card may develop faults on the LCM. Refer to "Handling a defective shelf circuit card " on page 31-10 of this guide for more information.

Line cards that have faults

Line cards types A, B, C, D, E, message waiting converter line cards and IBERT line cards, may develop faults. Refer to "Handling a defective line card" on page 31-10 of this guide for more information.

DS30A links that have faults

The C-side links of an LCM to an LGC or LTC may develop faults. Refer to "Handling a defective DS30A link " on page 31-12 of this guide for more information.

RG frequency generator circuits that have faults

When the diagnostic tests of an LCM indicate an RG that has faults, the defective RG is set to ISTb. In this event, all drawers use the standby generator. Refer to "Handling a defective RG frequency generator circuit" on page 31-13 of this guide for more information.

Load file mismatch

A load file mismatch fault condition exists when a load in the LCM does not match a load in table LCMINV. Refer to "Handling A Load File Mismatch" on page 31-13 of this guide for more information.

To manage data store size

The size of the DS for queuing work depends on the configuration of the PM for the expected amount of traffic. The processor may not have enough DS for a sustained overload.

Automatic maintenance

Drawer testing

Drawer faults are detected by the LCM self-test and are reported to the CC. A failed self-test generates a log that indicates the test and displays a card list at the MAP level. The CC invokes the full in-service tests to ensure that the fault is not transient. These tests involve the two BICs and ensure the BIC can send and receive message and information data. When a test fails, the CC tries the test again. The second test verifies that the fault is not transient or caused by the DCC or processor card. The system LCM audit can run drawer tests every 10 minutes. Drawer tests can be run by manually testing a unit at the MAP display.

If any of the following DCC or BIC related tests fails, the LCM is not forced into takeover mode. If a full in-service tests fails, the LCM is not forced into takeover mode. If the LCM is already in the takeover mode, other fault reports to the CC are ignored.

Drawer faults tests can only run on out-of-service (OOS) drawers, or on all drawers when the LCM node is OOS. If a line drawer with an in-service trouble (I) state fails a test other than the DCC/BIC loop-around, the fault clears. The fault clears because that test cannot be run. If a drawer state changes to I or system-busy (S), the state of the LCM node changes. The state of the LCM node changes to in-service trouble or system busy.

There must be a line addition in table LININV before the LCM equips the drawer. After the line addition, testing is possible from the MAP terminal. You must add at least one corresponding line card to the drawer. Addition of the corresponding line card is necessary for a complete set of BIC tests. During the BIC tests, one of the OOS BIC tests scans all datafilled lines on the drawer. The OOS BIC scans all datafilled lines to ensure that the BIC can detect line supervision changes.

Some drawer in-service trouble conditions are only visible when the drawer or the PM is OOS. These trouble conditions include BIC scan, BIC inhibit, and BIC Activity. When drawers with these conditions return to service with an ISTb condition, the I state can clear. The I state clears when the InSv unit or drawer tests are performed.

A list of BIC/DCC self-tests follows. The self-tests are listed in the sequence that they run.

1. BIC loop-around

   Sets the drawer to the S state so that it cannot receive messages.

2. BIC scan

   Sends a scan message to the BIC. The message ensures that the scan chip is able to detect control changes on all datafilled lines. Because this self-test involves a message, the path through the DCC is like the BIC loop-around.

3. DCC loop-around

   Tests a loop within the DCC. The loop-around does not test all of the DCC hardware for the DCC/BIC communication. If a fault exists in this hardware, then the DCC loop-around passes. Following BIC loop-around tests fail, but no drawer fault exists.

4. DCC/BIC loop-around

   Sets the drawer to the I state. A failure on the speech path hardware to the drawer occurs. A channel may fail the test, but it is possible that not all channels are affected. Call processing may be possible. For this reason, the drawer state updates to I at the MAP terminal but the drawer is not prevented from handling call processing. Also, the DCC/BIC loop-around tests the PCM path by test patterns sent to the BIC. The patterns received by the transmission time switch are expected to be the same within a time-out period.

The list of full in-service tests follows:

- ACTIVITY_READ
- MSG_LOOPAROUND
- ANI_COIN_FAIL
- PARITY_TRAP_FAIL
- BIC_ACT_TEST
- POWER_CONVERTER_FAIL
- BIC_CM_TEST
- RINGING_FAIL

- BIC_INHIBIT_TEST
- RTM_CM_TEST
- BIC_LA_TEST
- RTTS_CM_TEST
- BIC_LOOPAROUND
- SANITY_TIMEOUT_FAIL
- BIC_SCAN_TEST
- SET_MSG_LOOPAROUND
- DCC_LA_TEST
- SUBCYCLE_LENGTH_FAIL
- DS1_LOOPAROUND
- SUBCYCLE_ORDER_FAIL
- IUC_LA_TEST
- TIMING_TEST
- LC_COM_TEST
- WRITE_PROTECT_FAIL
- LCC_FAIL
- ZERO_CROSSING_INT_FAST_FAIL
- LCC_LOOPAROUND
- ZERO_CROSSING_INT_SLOW_FAIL
- MEMORY_TEST

Faults that occur on a BIC drawer affect call processing no matter which unit is in-service and controlling that drawer. The full in-service tests use the DCC. The test must first determine that the fault is not in the DCC. If the DCC has a fault, takeover occurs. If takeover occurs as a result of a reported drawer fault, the DCC is at fault. The DCC is at fault even when the LCM fails BIC tests.

Real drawer faults do not take an LCM unit OOS; but, the status of the unit is in-service trouble. The in-service trouble reason is either self-test or analysis failure, depending upon which test failed and caused the in-service trouble condition. Additional analysis information is available for LCM shelves equipped with the NT6X51AB expanded memory board. After the CC detects that a LCM unit has in-service trouble, the unit can change to system busy. Too many unsolicited messages being received can change the unit to system busy.

Out-of-service unit tests

BIC tests run during OOS LCM unit tests. Only drawers that have the I or S state are tested by drawer tests. For this reason, OOS unit tests treat drawers that have faults as follows:

- When both units are OOS, any drawers that have the S state are changed to the I state. The drawers change state so that the OOS can test them. If the fault persists, the drawer is reset to S. If drawers no longer have ISTb, the • (dot).
- When only one unit is OOS, only the drawers that have the I and the • (dot) states are tested. The OOS can test these drawers because the mate unit is InSv and in control of all drawers. Drawers with state S are not changed or tested.

System audit

The CC/LCM system audit runs every ten minutes for each LCM and attempts to RTS any drawers in the S state. Drawers with the I state are also tested and handled if any faults are detected.

The LCM unit states and the corresponding tests are noted in Table 24-3.

Table 24-3 System audit test states

State	In-service Tests	Busy
InSv	in-service tests	out-of-service tests
Bsy, Sane	in-service tests	full (all) tests
Bsy, Insane	Stand-alone, in-service tests	Stand-alone, out-of-service tests

Drawer maintenance

When the system detects a card that has faults, removal of its drawer from service for testing and card replacement will not affect other call processing. Removal of the drawer will not affect LCM maintenance either. Use the LCM level of the MAP terminal to monitor and change drawer states.

In the normal load sharing mode of the LCM, CPU0 controls the even numbered drawers by DCC0. CPU1 controls odd numbered drawers by DCC1. In the takeover mode, the active LCM unit has access to all drawers through its DCC. The inactive unit DCC cannot access any drawers for call processing. The inactive unit DCC can access any drawer for testing.

Subscriber lines automatic maintenance

Automatic subscriber lines tests are performed on line circuits and loops. The lines tests are normally performed on a scheduled base, without switch operator involvement other than for first scheduling. In a DMS-100 switch office, these tests are performed under the lines maintenance subsystem (LNS).

LCM routine exercise (REx) test

LCM REx divides into two categories. The first category is in-service and out-of-service unit diagnostics (LCM REx). The second category is continuity and voltage tests on the power converters and ringing generator (LCMCOV REx). Details of the two categories of LCM REx are provided in the following sections.

LCM REx The LCM REx test consists of the following steps:

1. Unit 0 is set to system-busy state.
2. In-service diagnostics are performed on unit 1.
3. Out-of-service diagnostics are performed on unit 0.
4. Unit 0 returns to service.
5. Unit 1 is set to system-busy state.
6. In-service diagnostics are performed on unit 0.
7. Out-of-service diagnostics are performed on unit 1.
8. Unit 1 returns to service.
9. In-service tests are performed on unit 0 not in take-over.
10. 0If the LCM is an RLCM or OPM equipped with emergency stand-alone (ESA) capability, the LCM performs an ESA REx.

LCMCOV REx The LCMCOV REx test consists of the following steps:

1. Unit 0 is set to system-busy state.
2. Voltage tests are performed on the power converters and ringing generators in unit 1.
3. Unit 0 returns to service.
4. Voltage tests are performed on the power converters and ringing generators in unit 0.

The LCM performs the LCMCOV REx test on the following types of LCMs:

- 64K LCM
- 256K LCM
- 256K XLCM
- OPM
- RLCM

The power converter testing verifies voltages supplied by the power converter circuit cards. The ringing generator testing verifies continuity of the supply voltage (ANI/coin) lines from the ringing generator to the line cards. The test uses line test unit (LTU) connections. The LTU connections measure the voltages at the tip and ring points of the maintenance line card. The maintenance line card is always line card 0 in drawer 0 of unit 0. Unit 1 uses this card when unit 0 is out of service.

Scheduling The SREX controller software coordinates LCM routine exercise testing. The SREX controller software provides a central control interface for different REx tests in the DMS system. The SREX controller coordinates LCM routine exercise testing as follows:

- Datafill in table REXSCHED defines the number of LCM REx tests that can execute at the same time. The LCM can perform a maximum of four LCM REx tests at the same time. Offices with a large number of LCMs can complete REx testing of all LCMs within a seven-day period. The default value is one LCM at a time. This default value ensures that the minimum number of LCMs are placed in simplex mode at the same time.
- Only one LCMCOV REx test can execute at a time, because of hardware limits.
- LCM REx and LCMCOV REx cannot execute at the same time.
- LCM REx and LCMCOV REx cannot execute while an MS or ENET REX test is in progress.
- Office parameter NODEREXCONTROL in table OFCVAR defines start and stop times for REx tests. Office parameter NODEREXCONTROL can enable and disable all REx tests in the office.
- Use table REXSCHED to modify REx scheduling. You can modify parameters like days on which to disable a REx test and frequency of a REx test. You can modify the number of REx tests of one type which can run at the same time. Refer to the Customer Data Schema manual for your system for details on entry table REXSCHED.

Reporting of LCM REx test results LCM REx and LCMCOV REx test failures are reported in PM600 logs. Tests that pass are reported in PM181 logs.

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the DMS switch, the DMS switch provides trouble indicators. The trouble indicators reveal that a fault condition continues to exist. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and a failure of automatic maintenance. Manual interruption becomes necessary by maintenance employees at the MAP terminal to clear the fault.

Subscriber lines manual maintenance

Subscriber lines that fail to meet standards of quality are identified to the switch operator. These subscriber lines are identified by posting the failures at the line test position (LTP) or by output reports. The output reports are generated by the automatic line testing (ALT) log subsystem. (Refer to *Input/Output System Reference Manual*, 297-1001-129). The automatic maintenance failures identified are manually tested and corrected.

UEN overview

Functional description

The UEN is a shelf that resides in an NTNY01AA UE9000 Bay frame. This is a 7 ft frame that contains up to four UENs. Each UEN

- associates a DS-30B channel with a subscriber line to allow an outgoing call to be made to an incoming call to be received
- supports up to 512 lines
- provides from two to six DS-30B links to an LGC, LTC, or RCC2
- supports all current DMS voiceband services found on the LCM, except for coin, proprietary phone (P-phone), integrated services digital network (ISDN), and 1-Meg Modem (1MM)
- implements hardware and software resources for provisioning, auditing, and testing
- performs the following call processing functions
  - loop state changes and dial pulse collection dual tone multifrequency (DTMF). DTMF collection occurs in the controlling LGC, LTC, or RCC2.
  - signaling with DMS core resources to announce the detected call origination and coordinate timeswitch and loop channel assignments for call connections
  - signaling with DMS core resources to establish switch path connectivity for terminating connections
  - application of ringing with assigned cadence and frequency characteristics
  - transfer of higher level signaling onto the loop towards the subscriber from DMS core equipment, such as custom local area signaling services (CLASS) modem burst
- provides shelf interface into third-party asynchronous transfer mode (ATM) network edge switch equipment and associated UE9000 element management system (uEMS). The UEN supports asymmetric digital subscriber loop (ADSL) discreet multi-tone (DMT) loops and provides data connections between an ATM edge switch and subtending customer premise equipment. This document does not address any data support other

than the hardware managed by the DMS-100 switch. Refer to *Universal Edge 9000-DMS Data OAM&P User Guide*, 297-8391-302 for information on the data domain of the UEN.

The time division multiplex (TDM), or voice, software domain provides access and control of and access to resources shared at the shelf level, including

- GLAN (a three-wire serial interface) that provides control information
- line card presence detection
- line card LED control
- shelf-level alarms

Call processing

The line concentrating module (LCM) call processing architecture is the model for TDM call processing. The design

- concentrates pulse code modulation (PCM) channels. The UEN supports more in-service lines than there are PCM channels to the line group controller (LGC /LTC / RCC2)
- connects to an LGC, LTC, or an RCC2
- provides redundancy down to the node level. If a failure occurs, each node unit can take over the call processing of the mate unit.
- supports world line card (WLC) plain ordinary telephone service (POTS) cards

The following sections describe UEN call processing.

LSG and line card The UEN lines are in line subgroups (LSG) that have the physical boundary of a single line card. The LSGs are equivalent to logical drawers.

Ringing Each line card with voiceband services has its own ringing generator. There are no hardware resources present in the shelf to synchronize operation of these ring generators.

Hardware and software resources on the line card and at the TDM common equipment cards monitor the operation of the ringing generator on each line card to detect and report overload and failure conditions.

Zero crossings of the ringing sinusoid are monitored by hardware on the line card to coordinate several control operations that are synchronized to the ringing signal. Logic in the line card aligns requests from the TDM software to change the state of the ringing relays at the coder-decoders (CODEC) to the zero crossing.

The TDM interface card accommodates the same CLASS functionality as the LCM. The TDM interface card hardware and software coordinate the definition of the ringing and quiet intervals at a given CODEC to ensure proper delivery of analog display services interface (ADSI) (Class Modem) bit streams during call termination events. The UEN can loop PCM back to the host PM during ringing so the CLASS modem resource (CMR) card can determine when to send caller ID information.

Supervision The UE9000 DMS hardware provides time stamps of hook state changes with 125ms resolution. TDM software uses the time stamps to

- filter for various hook-switch events
- collect dial-pulse digits
- provide a low-pass filter when collecting digits. This prevents false digit reporting caused by short bursts of 50Hz and 60Hz power induced on the line

Takeover and takeback TDM software uses its nonsided time switch and nonblocking peripheral side (P-side) to handle call takeover and takeback, as follows:

- Because on-board time switch accesses make the entire PCM connection, takeover PCM connections are complete before an activity change. Follow-up work is not required to complete the connection after the activity change.
- If the time switch transactions do not cause a significant delay on the processor, the connections can occur in the inactive unit at the time of the mate update message with very little overhead. Takeovers do not require connection at the time of the activity change (takebacks *do* require connection.
- The reduction of work in remaking connections dramatically reduces the time that the unit that is dropping activity has to ignore new call processing messages. The complete channel data block (CDB) snapshot that XLCM units send on controlled takeovers is not necessary. Messages received by a unit dropping activity can route directly to the mate unit with little chance of deserializing the call processing messages. This design greatly reduces the number of calls that drop during a takeover.

Takeover/takeback code handles reconfiguration of the line card to route unsolicited notifications (that is, scan changes) to the proper unit.

Line card transactions The UE9000 DMS TDM software is based on the remote line concentrating module with extended distance capability (RLCM-EDC) architecture. A message to the drawer task performs drawer and line operations, which improves call completion rates. This practice is applied in concept to UE9000 TDM software. All line card transactions are through messages to the P-side interface task.

The P-side interface code provides individual line subgroup (LSG) performance monitoring, which facilitates operational measurements (OM) that the customer can use to redistribute traffic at the LSG level.

Connections Intra-switched connections are not provided. Connection code uses wait periods to allow more than one connection to be made or broken simultaneously.

Configuration

The UEN is a two unit PM that resides on one shelf in an NTNY01AA UE9000 DMS Bay frame. Up to four UEN shelves reside in the frame. Each UEN consists of up to 16 multicircuit line cards (MCLC). When the NTNP50AA POTS 32 line card is installed, up to 32 subscribers can connect to each card. Each line card is an LSG. This means each MCLC is an LSG. However, when the NTNP44AA ADSL DMT 4+4 line card, which has four voice lines and connection to the ATM edge switch, the four lines are one LSG.

The UEN C-side connects to an LGC, LTC, or RCC2. The UEN uses as many as six DS-30B links in each connection. The UEN can be located up to 250 feet from the host PM. However, the DIP switches on the NTKX06AA TDM interface card must be set to support the various lengths of DS-30B links. The host PMs have a maximum of 20 ports available for DS-30B links from the UENs. Up to ten UENs can connect to each host PM depending on the volume of the traffic.

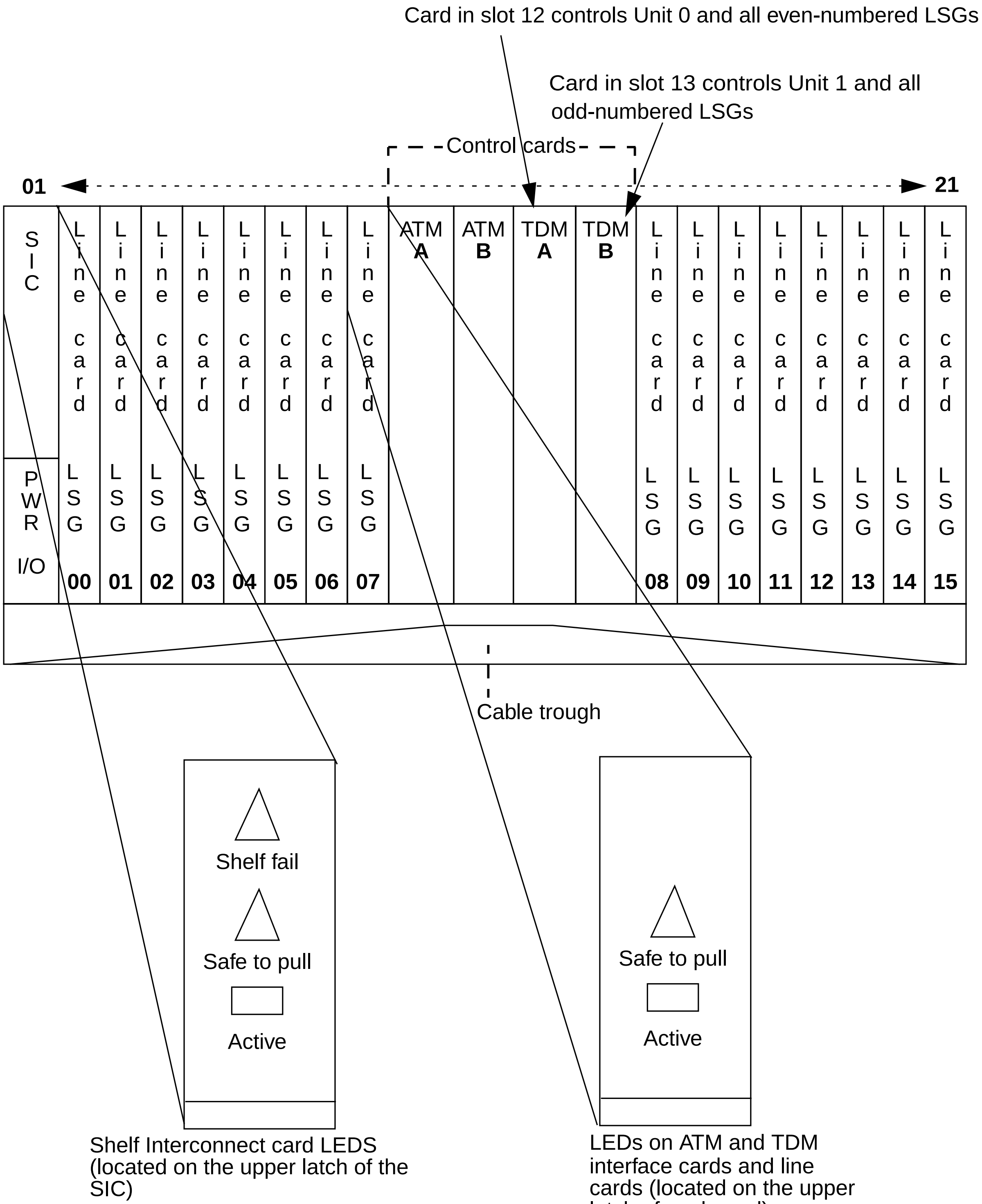
The TDM interface cards in slots 12 and 13 are the UEN processors and therefore, act as units 0 and 1, respectively. The TDM interface card in slot 12 (unit 0) controls the even-numbered LSGs. The TDM interface card in slot 13 (unit 1) controls the odd-numbered LSGs. When one unit is manually busied (ManB) or goes isystem busy (SysB). the other unit performs a takeover of the mate unit and assumes responsibility for that unit’s line cards.

The LEDs on the face of the cards in the UEN shelf indicate the following:

- a red Safe to pull LED indicates a card failure or the card is ManB and the card is in the ready-to-pull condition
- a green Active LED indicates the card is active and should not be removed

The following figure illustrates a normal UEN shelf design. This figure also shows the LSG numbering standard and the LEDs.

Figure 24-3 NTNP10BA UE9000 DMS shelf



LSG = line subgroup

Each UEN shelf has the following required cards:

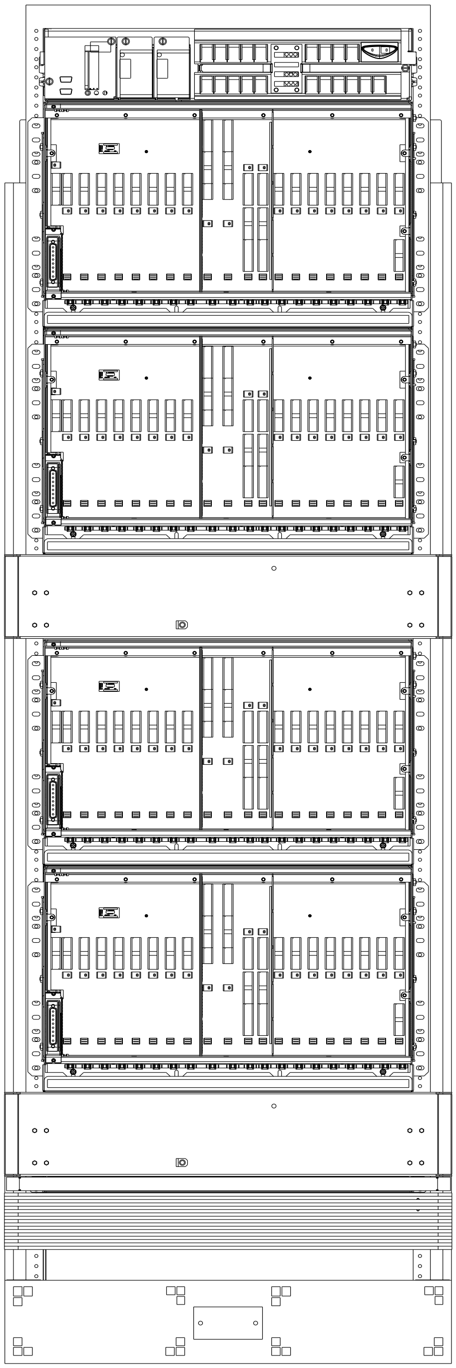
- NTNY23AA Shelf interconnect card (SIC), resides in the upper half of slot 1
- NTNP20AA Power input / output (I/O) card, resides in the lower half of slot 1
- NTKX06AA TDM Interface card, resides in slots 12 and 13

The following cards are optional cards for the UEN:

- NTNP50AA POTS 32 multicircuit line card, resides in slots 2-9 and 14-21
- NTNP44AA ADSL DMT 4+4 line card, resides in slots 2-9 and 14-21, provides POTS service only with data service available in the future
- NTNP32AA ATM DS-1 Inverse Mux ATM (IMA) card, resides in slots 10 and 11
- NTNP35AA DS3 ATM control card, resides in slots 10 and 11

The following figure shows the NTNY01AA frame equipped with four UEN shelves, showing the UEN numbering standard for each frame.

Figure 24-4 NTNY01AA UE9000 DMS Bay frame configuration, showing UEN numbering



NTNY23AA Shelf interconnect card The NTNY23AA Shelf interconnect card, located in the upper half of slot 1 of the UEN, performs the following:

- provides an interface to the Breaker Interface panel (BIP) to support
  - station alarms (critical, major, or minor) from the UEN shelf
  - user alarm outputs
- controls the metallic test access card (MTAC) buses from the UEN shelf
- monitors the signal battery A and B and Talk Battery A and B supplies voltage thresholds
- monitors signal battery supplies A and B to report the loss of power redundancy on the SIC card

NTNP20AA Power I/O card The NTNP20AA Power I/O card, located in the lower half of slot 1 of the UEN provides filtering of talk battery A/B and signal battery A/B feeds to the UEN shelf.

NTKX06AA TDM interface card The NTKX06AA TDM interface card, located in slots 12 and 13, is the voice controller for the UEN shelf. The processor on the TDM interface card performs the following:

- processes DMS-X messages from the host PM
- controls and maintains the line cards
- sets up and maintains the time switch

The TDM interface card provides the following interface between the 16 line card slots

- the GLAN bus, which carries upstream and downstream signaling
- the TDM bus, which carries PCM data in both the upstream and downstream directions and supplies a timestamp to multi-circuit line cards (MCLC)

The TDM interface card provides the connection for the two to six DS-30B links to the host LGC, LTC, or RCC2. Each TDM card owns three of the DS-30B links. When one of the NTKX06AA cards is out of service, the in-service card drives the speech channels for all six DS-30B links. The TDM interface card always drives the messaging channels that it owns.

The PCM channels that connect to the DS-30Bs also connect to the NTKX06AA time switch. The time switch

- connects a DS-30B or TDM time slot to any other TDM or DS-30B time slot
- supports P-side to P-side, P-side to C-side, and C-side to C-side connections

NTNP32AA ATM DS-1 IMA card NTNP32AA ATM Interface card, located in slots 10 and 11, contains all the ATM circuitry, the processor complex, Ethernet interface, diagnostic port, and power supply. The NTNP32AA ATM interface card receives the data from the NTNP44AA 4+4 line card and routes the data traffic to the ATM network over the ethernet connection.

NTNP35AA DS3 ATM control card The NTNP35AA DS3 ATM control card, optional in slots 10 and 11, is the data hub for the UE 9000 DMS shelf. The card contains a full-featured ATM switch fabric connected to a high speed network interface on the upstream side and 16 line card interfaces on the down stream side.

NTNP50AA POTS 32 multicircuit line card NTNP50AA POTS 32 multicircuit line card, optional in slots 2-9 and 14-21, performs the following:

- uses the single in-line package version of the World Line Card
- serves 32 subscriber loops
- has an onboard point-of-use power supply (PUPS) that generates +7 V and +15 V from a -48 V power distribution on the backplane
- is compatible with terminal sets with input and balance impedance according to North American standards.
- is protected from electronic overvoltage in hostile electrical environments
- includes software selectable loop feed current limit characteristics with software selectable automatic loss equalization for short loops
- has two test-in / test-out busses, test bus 1 and test bus 2. Each subscriber interface circuit can access either bus.
- has a hold clip circuit that allows the UE9000 DMS shelf to place all loop interface circuits into protection, thereby allowing the circuits to be removed from any external voltages
- has an interface to the backplane
- has a GLAN bus, which is a three-wire serial interface (clock, downstream data, and upstream data) that provides control oriented information

NTNP44AA ADSL DMT Combo 4 + 4 line card The NTNP44AA ADSL DMT 4+4 line card, located in slots 2-9 and 14-21, terminates four fully compliant ADSL DMT subscriber loops. The voice traffic routes to the NTKX06AA TDM common equipment cards. The data traffic routes to the ATM common equipment DMS shelf. Support for the data portion of this card is a future functionality.

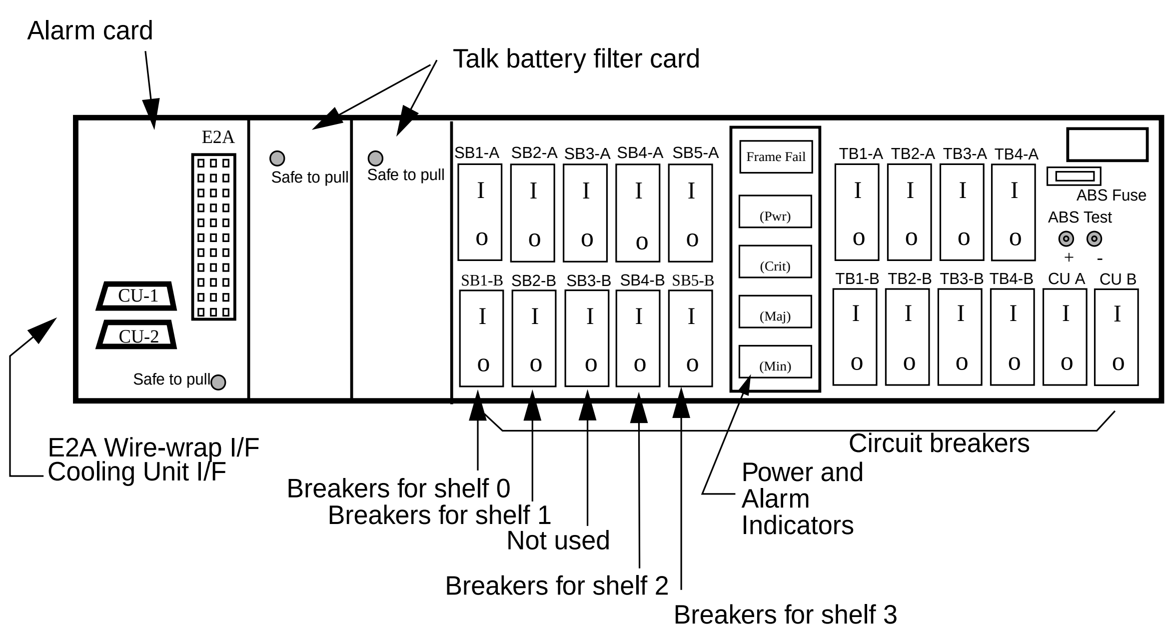
NTNY17AA Breaker interface panel

The breaker interface panel (BIP) is mounted at the top of a UE9000 DMS Bay frame, as shown in Figure 24-4. The BIP

- collects and distributes power and alarm cabling for the frame
- supports up to 120 A of power to frame assemblies

The following figure shows a front view of the BIP.

Figure 24-5 Breaker interface panel



The BIP consists of 20 breakers, two NTNY25AA talk battery filters, one NTNY25AA alarm card, talk battery A and B supply connections, signal battery A and B supply connections, alarm connections, and an alarm battery supply system (ABS) fuse.

The ABS fuse protects the end aisle lamp, the ABS test jacks on the front of the BIP, and the Critical, Major, Minor, Power, and Frame fail LEDs on the front of the BIP.

NTNY24AA Alarm card assembly The NTNY24AA alarm card assembly in the BIP

- collects
  - — alarm contacts from the fuse and circuit breakers in the BIP
  - — alarms from the four UEN shelves and the two NTNY18AA cooling unit shelves
- provides one alarm / scan point for transmission to scan points on an office alarm unit (OAU) elsewhere in the DMS system

When alarms are received, a Frame fail lamp on the BIP and an aisle lamp are lit.

The alarm card monitors

- ABS and ABS return
- converter fail for point-of-use power supply (PUPS) on UE9000 DMS cards
- fan failure
- operation of circuit breakers or fuse in the BIP in response to an overcurrent on a branch
- line card ringing generator failure
- talk battery failure

NTNY25AA Talk battery filter Up to two NTNY25AA talk battery filter modules mount inside the BIP. The NTNY25AA provides the following functions

- a filtered power feed battery supply for subscriber loops
- an alarm when a capacitor fuse fails
- a “walk-in” feature for capacitor charging that limits inrush current

NTNY18AA cooling unit and LCAP

The NTNY18AA cooling unit shelf contains eight fan assemblies. On the face of the cooling unit are nine LEDs. One LED indicates a shelf failure, meaning one or more fans have failed. The other eight LEDs indicate the specific fan in the shelf that failed. In addition to the fans, the cooling unit has a local craft access panel (LCAP). The LCAP provides

- a local talk line circuit jack for communication with the CO in the event of a complete switch failure
- an alarm cut-off (ACO) pushbutton and LED assembly used in conjunction with the NTNY24AA alarm card
- an electrostatic discharge (ESD) jack for ESD wrist straps used by technicians when performing maintenance at the frame

The transmit and receive jacks for the four shelves and the data port jacks are not used in the UEN.

Maintenance states

Each UEN is assigned a maintenance state either by the system or manual commands entered at the MAP display. Table 24-2 lists the maintenance states that apply to the LCM and also apply to the UEN.

Data tables

Like the LCM, entries in the data table SITE control the assignment of UEN site names. HOST, or any name selected by the operating company to designate the central office, is the first entry in data table SITE.

A discrimination number in the range of 0 to 99 identifies each UEE frame. This number, plus the shelf number are the parameters used with the command POST. The module shelf (0, 1, 2, or 3) indicates the bottom to top UEN shelf in the order given. The LEN that associates with each UEN (site name, frame, and shelf) is assigned in table LCMINV.

Data table LNINV records the location of the line card in the UEN shelf. Data table LNINV also records the circuit and LSG numbers.

Data table LCMDRINV identifies the logical line drawers (LSG). There are 32 circuits in each LSG, or logical drawer when the NTNP50AA is provisioned. On the other hand, when the NTNP44AA is provisioned, there are four circuits in each LSG.

Fault conditions

LSGs (line cards) with faults

When a line card becomes defective, an LSG has faults. Refer to Section, "Handling an LSG that has faults" on page 31-14 of this guide for more information.

UEN shelf circuit cards with faults

A shelf interconnect card, a power I/O card, TDM interface card, or ATM interface card may develop faults on the UEN. Refer to Section, "Locating and clearing faults in a UEN" on page 31-13 of this guide for more information.

DS-30B links that have faults

The C-side links of a UEN to an LGC, LTC, or RCC2 may develop faults. Refer to Section, "Handling a DS30B link that has faults" on page 31-15 of this guide for more information.

Ringing faults

When the diagnostic tests of a line card indicate the card has ringing generator faults, refer to Section, "Handling an LSG that has faults" on page 31-14 of this guide for more information.

Load file mismatch

A load file mismatch fault condition exists when a load in the UEN does not match a load in table LCMINV. Refer to Section, "Handling a load file mismatch in a UEN" on page 31-16 of this guide for more information.

ATM data system faults

When ATM data cards have faults, refer to *Universal Edge 9000-DMS Data Testing and Troubleshooting Guide*, 297-8391-501 for information on troubleshooting UE9000 data system components.

Automatic maintenance

Line card testing

Each NTNP50AA POTS 32 line card or NTNP44AA ADSL DMT 4+4 line card is a separate LSG.

The following table lists the in-service tests run on the UEN and the action taken by the CM

Table 24-4 UEN in-service tests

Test	Description	CM action
TSW_LA_FAIL	Time switch loop around failure	SysB the unit if the mate unit is in service
TSW_CM_FAIL	Time switch connection memory faiure	SysB the unit if the mate unit is in service
LSG_PCM_LA_FAIL	LSG PCM loop around failure	Mark the unit and the note ISTb
LSG_REG_FAIL	LSG register failure	Mark the unit and the note ISTb

Table 24-4 UEN in-service tests

Test	Description	CM action
LSG_RG_FAIL	Ring generator failure	Mark the unit and the note ISTb
LSG_RG_OVLD	Ring generator overload	Mark the unit and the note ISTb
LSG_ZC_FAST	Ring generator zero cross fast	Mark the unit and the note ISTb
LSG_ZC_SLOW	Ring generator zero cross slow	Mark the unit and the note ISTb
LSG_PWR_FAIL	Power converter / ring generator failure	Mark the unit and the note ISTb

Subscriber lines automatic maintenance
The LNS subsystem performs automatic line tests (ALT) on line circuits and loops. These tests are normally performed often. The subsystem performs the initial scheduling with a switch operator. The subsystem performs the tests that follow without a switch operator. The LNS subsystem also performs automatic line test when a line shows a fault.

UEN routine exercise (REx) test
The UEN REx uses in-service and out-of-service unit diagnostics (UEN REx).

UEN REx The UEN REx test consists of the following steps:

1. Unit 0 is set to system-busy state.
2. In-service diagnostics are performed on unit 1.
3. Out-of-service diagnostics are performed on unit 0.
4. Unit 0 returns to service.
5. Unit 1 is set to system-busy state.
6. In-service diagnostics are performed on unit 0.
7. Out-of-service diagnostics are performed on unit 1.
8. Unit 1 returns to service.
9. In-service tests are performed on unit 0 not in take-over.

Scheduling The SREX controller software coordinates UEN routine exercise testing. The SREX controller software provides a central control interface for different REx tests in the DMS system. The SREX controller coordinates LCM routine exercise testing as follows:

- Datafill in table REXSCHED defines the number of UEN REx tests that can execute at the same time. The UEN can perform a maximum of four UEN REx tests at the same time. Offices with a large number of UENs can complete REx testing of all UENs within a 7-day period. The default value is one UEN at a time. This default value ensures that the minimum number of UENs are placed in simplex mode at the same time.
- UEN REx cannot execute while an MS or ENET REX test is in progress.
- Office parameter NODEREXCONTROL in table OFCVAR defines start and stop times for REx tests. Office parameter NODEREXCONTROL can enable and disable all REx tests in the office.
- Use table REXSCHED to modify REx scheduling. You can modify parameters like days on which to disable a REx test and frequency of a REx test. You can modify the number of REx tests of one type which can run at the same time. Refer to the Customer Data Schema manual for your system for details on entry table REXSCHED.

Reporting of UEN REx test results UEN REx test failures are reported in PM600 logs. Tests that pass are reported in PM181 logs.

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the DMS switch, the DMS switch provides trouble indicators that reveal a fault condition still exists. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and a failure of automatic maintenance. Manual intervention becomes necessary as maintenance personnel attempt to clear the fault at the MAP terminal. Refer to Chapter 32, "LCM and UEN troubleshooting charts," for a procedure on alarm clearing. Refer to Chapter 26, "LCM and UEN related logs,"for log information and to Chapter 27, "LCM and UEN related operational measurements," for OM information.

Subscriber lines manual maintenance

Subscriber lines that fail to meet certain quality standards are identified to the switch operator by posting the failures at the line test position (LTP) or by output reports generated by the ALT log subsystem, The automatic maintenance failures thus identified are then manually tested and corrected. For more information, refer to the Input/Output System Reference Manual, 297-1001-129.

25 LCM and UEN preventive maintenance methods

This chapter describes routine procedures and schedules for maintaining line concentrating modules (LCM) and Universal Edge 9000 (UEN). The chapter provides general information to assist maintenance employees with experience in troubleshooting and maintaining the LCM and UEN.

The information in this chapter does not replace step-by-step documents. The information complements the step-by-step documents. Refer to *Routine Maintenance Procedures* for more detailed information.

Routine maintenance procedures

Routine maintenance procedures are tasks that you perform according to a defined schedule. These tasks include the following:

- how to inspect spare fuse holders in the LCM.
- how to test wrist strap grounding cords.
- how to test power converter voltages in the LCM.
- how to replace a filter element in a UEN filter assembly
- how to return cards or assemblies for replacement or repair.

Routine maintenance schedules

The operating company personnel must perform the following routine maintenance procedures at standard intervals. Table 25-1 lists routine maintenance tasks and the performance intervals.

Table 25-1 Schedule of routine maintenance tasks for LCM and UEN (Sheet 1 of 2)

Performance interval	Maintenance task
1 week	Inspect spare fuse holders in an LCM.
1 month	Test wrist-strap grounding cords.

Table 25-1 Schedule of routine maintenance tasks for LCM and UEN (Sheet 2 of 2)

Performance interval	Maintenance task
3 months	Test power converter voltages in an LCM.
6 months	Replace air filter element in UEN filter assembly
As required	Return cards or assemblies for replacement or repair.

26 LCM and UEN related logs

This chapter identifies the logs associated with the line concentrating module (LCM) and Universal Edge 9000 (UEN). For more information about these and other logs, refer to *Log Report Reference Manual*.

The DMS-100 switch software uses logs to record all important events that occur. Logs make the events visible to the operating company personnel at the MAP terminal. Examples of important events are an equipment fault, an equipment state change, and the failure or completion of a test. The log system in the DMS-100 switch creates a report that contains this information. The log system stores the report in data store (DS) for online retrieval. The log system distributes the report to output devices. The output devices display the information.

Log reports appear in order of occurrence. The log prioritizing feature displays the log reports with the highest alarm level first.

The system generates peripheral module (PM) log reports when a PM has a fault condition. A PM has a fault condition when a change in the PM state occurs, or the PM passes or fails a test.

PM logs 179, 180, and 181 are the most important PM maintenance logs. These logs are always generated by changes in the PM state. Table 26-1 describes these and other important logs. This table also describes the actions that operating company personnel must perform.

Table 26-1 LCM and UEN related logs (Sheet 1 of 4)

Log name	Causes	Response
IOAU112	Indicates changes to the LCM or UEN REx or LCMCOV REx schedule.	Refer to the *Log Report Manual* for problems and responses indicated by this report.
PM101	Indicates that the LCM or UEN failed a checksum test. (DMS-100 switch cannot get a data integrity value from the PM, or the value is wrong.)	Repeat the checksum test.

Table 26-1 LCM and UEN related logs (Sheet 2 of 4)

Log name	Causes	Response
PM102	Indicates when LCM or UEN state changes to system busy (SysB) by system request.	Determine the cause of the SysB alarm. Post and test the LCM or UEN. Refer to correct alarm clearing and card replacement procedures.
PM103	Indicates when LCM or UEN state changes to Offline (OffL) from manual busy (ManB) by a manual request.	Action is not required.
PM104	Indicates when LCM or UEN state changes manually from the OffL state to unequipped (UNEQ). The state changes when the user deletes the tuple in table LCMINV that corresponds to the LCM or UEN.	Action is not required.
PM105	Indicates LCM or UEN is manually busy (set to ManB state).	Action is not required.
PM106	Indicates when the LCM or UEN returns to service (RTS) from the SysB state by a system request. Indicates when the LCM or UEN is RTS from the ManB state by manual request.	Action is not required.
PM107	Indicates when the LCM or UEN state changes to central-side busy (CBsy) as a result of of a system request.	Post and test the affected LCM or UEN or links. Refer to correct alarm clearing and card replacement procedures.
PM108	Indicates the system detects a firmware or hardware error in the LCM processor card in the LCM or the TDM Interface card in the UEN. The PM108 identifies the error and the card that has faults.	If the system generates PM108 for less than two minutes, there is no action required. If the system generates PM108 for a longer period, post and test the LCM or UEN. Replace indicated cards. Perform alarm clearing procedures.
PM113	Indicates when LCM or UEN processor card encounters message congestion. Message congestion can occur on high traffic days.	If the system generates PM113 for less than two minutes, action is not required. If the system generates PM113 for a longer period, determine the cause of the congestion, and take correct action.
PM114	Indicates that problems occur when you try to load or test the LCM or UEN.	Test the LCM or UEN. The system generates an alarm and card list. Perform alarm clearing and card replacement procedures.

Table 26-1 LCM and UEN related logs (Sheet 3 of 4)

Log name	Causes	Response
PM115	Indicates when the LCM or UEN processor encounters miscellaneous trouble during normal operation.	If the system generates less than three PM115 reports in two minutes, action is not required. If the system generates more reports, test the LCM or UEN. Refer to correct alarm clearing and card replacement procedures.
PM116	Indicates when the LCM or UEN sends a message error report to the CC.	This report follows a PM108, PM115, PM124, PM125, PM126, or PM138 report. Ignore this report and investigate the preceding report.
PM117	Indicates when LCM or UEN operation encounters a link-related problem.	Test the LCM or UEN. The system generates an alarm and card list. Perform correct alarm clearing and card replacement procedures.
PM118	Indicates when the LCM or UEN processor encountered miscellaneous trouble.	If the system generates less than three PM115 reports in two minutes, action is not required. If the system generates more reports, test the LCM or UEN. Perform alarm clearing and card replacement procedures. If you cannot find a fault, the load can be corrupt. If the load is corrupt, reload the LCM or UEN.
PM179	Indicates when a hardware condition occurs that affects the normal operation of the LCM or UEN.	Refer to description of PM124 in *Log Report Reference Manual* for problems and responses indicated by this report.
PM180	Indicates when the LCM or UEN sends a PM exception report that the PM did not request.	Refer to description of PM124 in *Log Report Reference Manual* for problems and responses indicated by this report.
PM181	Indicates when the LCM or UEN fails a diagnostic test, or passes an LCM REx or LCMCOV REx test.	Refer to description of PM181 in *Log Report Reference Manual* for problems and responses indicated by this report.
PM183	Indicates when the LCM or UEN state changes to SysB as a result of a system request.	If an alarm is not present, test the LCM or UEN and refer to correct alarm clearing and card replacement procedures.
PM184	Indicates LCM or UEN returned to service (RTS).	Action is not required.

Table 26-1 LCM and UEN related logs (Sheet 4 of 4)

Log name	Causes	Response
PM185	Indicates when LCM or UEN firmware, hardware or software detects an error condition that causes a trap-interrupt. The running process stops on the instruction at fault.	Retain this report and all reports generated during the minute before this report. Contact the next level of maintenance.
PM600	Indicates failure of an LCM or UEN REx or LCMCOV REx test.	Refer to description of PM600 in *Log Report Reference Manual* for problems and responses indicated by this report.
PM777	Indicates a card and card location with faults.	Refer to correct alarm clearing and card replacement procedures.

27 LCM and UEN related operational measurements

This chapter lists the operational measurements (OM) group names that associate with the line concentrating module (LCM) and Universal Edge 9000 (UEN). Refer to *Operational Measurements Reference Manual*, *Basic Administration Procedures*, 297-1001-300 and *Service Problem Analysis Administration Guide*, 297-1001-318.

Operational measurements (OM) are data that contain records of events that occur during a given time period. The three basic types of measurements are: peg counts, use, and overflow. Use operational measurements as service-level indicators, input for maintenance, hardware and software assignment, accounting, and provisioning decisions.

OM groups that associate with the LCM include DTSR, DTSRPM, LINAC, LMD, PM, PMSTAT, PMTYP, and DS1CARR. OM groups that associate with the UEN include PM, PMTYPE, PM2, and PMSTAT. Table 27-1 describes these LCM and UEN OM groups and any associated logs.

Table 27-1 LCM and UEN OM groups overview (Sheet 1 of 2)

Group	Information
DTSR	**Description:** Provides information on the ability of the switch to return a dial tone within 3 s for a host site. **Associated logs:** There are no associated logs.
DTSRPM	**Description:** Provides information on the ability of each LCM or UEN to return a dial tone within 3 s for a host site. **Associated logs:** There are no associated logs.
LINAC	**Description:** Monitors grade of service for line access. **Associated logs:** There are no associated logs.

Table 27-1 LCM and UEN OM groups overview (Sheet 2 of 2)

Group	Information
LMD	**Description:** Counts number of times that call attempts originate from LCM / UEN or terminate at LCM / UEN **Associated logs:** There are no associated logs.
PM	**Description:** Counts errors, faults, and maintenance state changes for DMS switch peripheral modules (PM) with node numbers. **Associated logs:** There are no associated logs.
PMSTAT	**Description:** Measures amount of time that the microprocessor of the XLCM or UEN is used. **Associated logs:** There are no associated logs.
PMTYP	**Description:** Counts PM errors, faults, and maintenance state changes for a group of DMS switch PMs of the same type. **Associated logs:** There are no associated logs.
DS1CARR	**Description:** Provides information about maintenance thresholds and out-of-service (OOS) thresholds for digital trunks on digital PMs. **Associated logs:** There are no associated logs.

28 LCM and UEN related data structures

Data structures do not apply to the problem solving and maintenance of the line concentrating module (LCM) or the Universal Edge 9000 (UEN).

29 LCM and UEN related user interface commands

This chapter describes how maintenance personnel use the MAP system to support the line concentrating module (LCM) and the Universal Edge 9000 (UEN). This chapter describes correct MAP levels, system status displays, menu commands, and non-menu commands.

The following is a list of the sections in each chapter. The following also consists of a short description of the type of information in each section.

- The section "MAP user interface" briefly describes the MAP system.
- The section "Menu commands" details the menu commands that support LCMs at the LCM level and UENs at the UEN level.
- The section "Non-menu commands" details the non-menu commands that support the LCM at the LCM level.

This chapter only provides general information about the MAP system and two-shelf commands. This chapter can assist qualified maintenance personnel in problem solving and the maintenance of LCMs. For additional information, refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822.

> ***Note:*** A line group controller (LGC), line trunk controller (LTC), or remote cluster controller 2 (RCC2) controls the LCM or UEN. Maintenance performed on these host peripherals can affect the LCM or UEN.

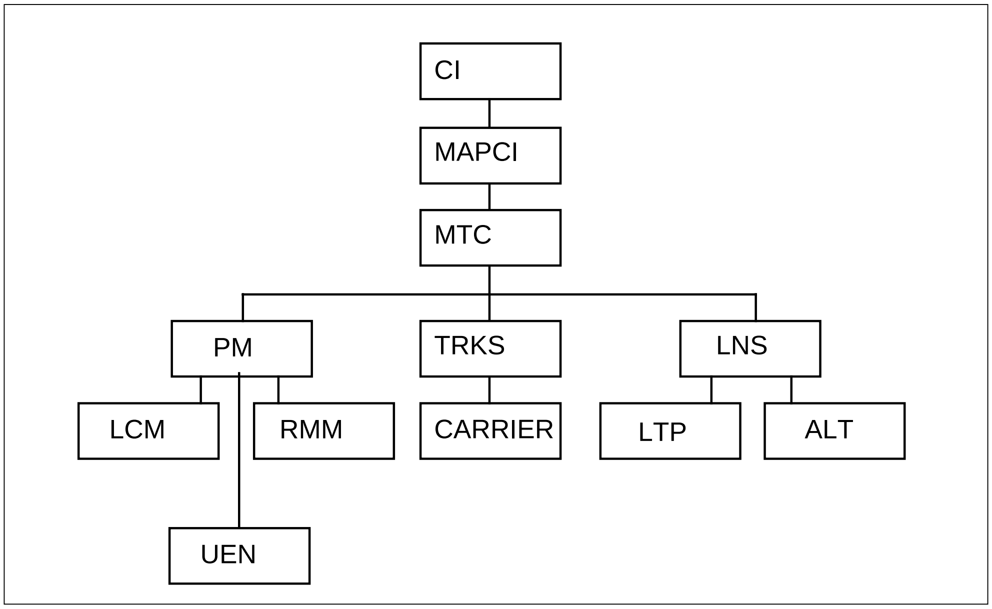
MAP user interface

Information at the MAP terminal is organized into an ordered series of display levels. This arrangement of the information starts at the command interpreter (CI) level. You can access the CI level automatically, when you log on at a MAP terminal. At the CI level, the MAPCI command accesses the next lowest level. From the MAPCI level, you can access other levels.

Each level of the MAP system has a different set of commands and system status displays. Each level has the ability to display and access information from a previous level. For example, you can use some menu commands available at the PM level as non-menu commands at the LCM and UEN levels. Status information that appears at the PM level continues to appear as you access subsequent lower levels.

Figure 29-1 illustrates the LCM and UEN-related MAP system.

Figure 29-1 LCM-related MAP levels



An operating reference identifies LCMs or UENs at the MAP terminal. This reference includes a operating abbreviation of the PM type. This reference also includes a discrimination number that identifies the specified PM of the PM type. Table 29-1 lists and describes the operating references for each type of LCM and UEN. When you enter a QUERYPM command at the MAP terminal, a list of operating references for all PMs appears.

Table 29-1 LCM and UEN identifiers

PM type	Discrimination number range	PM name
LCM	HOST 00 to 511 0 to 1	Line concentrating module (at host) (00 to 511 identifies frame) (0 or 1 identifies the lower or upper module in the LCE frame).
UEN	HOST 00 to 511 0 to 3	Universal Edge 9000 DMS (UEN) (at host) (00 to 511 identifies frame) (0, 1, 2, or 3 identify the UEN shelf in the Universal Edge equipment (UEE) frame, numbered from the bottom up)

System status display

The first three lines of the system status display are common across all levels of the MAP system. These lines identify the maintenance state of the subsystem that has faults, and the number of PMs that operate in the maintenance state. The lines also identify the alarm code for that maintenance state. In the event of multiple faults, the system status display identifies only the most important fault.

At the PM level, the system status display provides additional information on PM links and nodes. For LCMs and UENs, the codes used at the PM level are identical to the codes used at the main level.

Table 29-2 lists and describes the maintenance states for LCMs and UENs.

Table 29-2 LCM and UEN maintenance states

Code	Description
•	All PMs are in service (InSv). Alarm conditions are not in effect.
nnCBsy	The indicated number of PMs is C-side busy (CBsy).
nnISTb	The indicated number of PMs is in-service trouble. The fault is minor. The fault does not affect the service or operations of the PM.
nnLCM nnUEN	Both units of one or more LCMs or UENs are not InSv.
nnLCMDrw nnUENLSG	One or more drawers of an LCM, or one or more UEN LSGs, is in the IsTb or the SysB state, or the links are C-side busy.
nnLCMDrw nnUENLSG	One or more LCM drawers or UEN LSGs is in the InSv or SysB state.
LCMRG	Both ringing generators (RGs) of line concentrating equipment (LCE) have ISTb. The alarm is critical. When only one RG has ISTb, the alarm is minor. Does not apply to UENs.
nnManB	The indicated quantity of PMs is manual busy (ManB).
nnOffL	One or more manually busied PMs changed to offline (OFFL).
nnSysB	The maintenance system detected a severe fault. The system takes the PM automatically OOS or makes the PM SysB. The office parameter sets the percentage of the PMs that are SysB. The percentage indicates a critical or major alarm.

Status codes for LCM line drawers or UEN LSGs are like the status codes for other components. Table 29-3 lists and defines the status codes for LCM line drawers and UEN LSGs.

Table 29-3 Status codes for LCM line drawers and UEN LSGs

Code	Description
•	In service
I	In-service trouble
M	Manual busy
O	Offline
S	System busy
-	Unequipped

Refer to Chapter 31, "LCM and UEN trouble isolation and correction," for information on alarm codes for LCMs and UENs.

Circuit location display

System status displays that show the physical location of circuit cards use a standard display format. The display format is based on the identification design for the DMS-100 Family equipment. When the circuit location display is part of the response to a failed test, the circuit cards appear in a list. The circuit cards appear in the list in the order of the most possible cause of the fault. The order of the circuit cards in the list indicates the recommended sequence of card replacement.

If the fault is in the line or trunk interface circuits, the PM subsystem does not maintain the circuit cards. Fault indications appear under the LNS or TRKS subsystems.

Menu commands

Each level of the maintenance system supports a different menu of commands. The menu commands appear along the left side of system status displays. These commands are numbered and can include parameters. An underscore that follows any menu item indicates that you need a parameter as part of the entry. An underscore that precedes a menu item indicates an optional parameter.

You can enter menu commands at any MAP level by one of the following:

- the number that precedes the menu item
- the complete item name, character by character (upper or lower case letters do not affect how you enter the item name)

When you respond to a command prompt, a space must precede the menu item number.

If you experience problems when you enter a command, type and enter ABORT and enter the original command again. To obtain information about syntax and parameters that associate with a command type, enter HELP and the name of the command. If you made an error, the following message appears:

```
EITHER INCORRECT OPTIONAL PARAMETER(S) OR TOO MANY PARAMETERS
```

An explanation follows the message.

LCM level

Table 29-4 lists and describes the menu commands available at the LCM level. The entry of the HELP command with the command name at the MAP terminal provides a description of command syntax.

Table 29-4 LCM menu commands

PM commands	Code	Description
BSY	Busy	Sets a posted LCM to the ManB state.
DISP	Display	Displays a set of LCMs in a given state.
LISTSET	List set	Lists the discrimination numbers of the PM types included in the posted set.
LOADPM	Load PM	Loads the peripheral program files into the processors of one or all posted LCMs that are ManB.
NEXT	Next	Posts the next LCM in a displayed set.
OFFL	Offline	Sets a posted LCM offline.
POST	Post	Posts an LCM.
QUIT	Quit	Quits the LCM level of the MAP terminal or cancels an LCM selection.
QUERYPM	Query PM	Displays information about a posted LCM.

Table 29-4 LCM menu commands

PM commands	Code	Description
RTS	Return to service	Returns an LCM to service.
SWRG	Switch ring generators (RG)	Switches RGs for a posted LCA shelf.
TST	Test	Invokes self-diagnostics on a posted LCM.
TRNSL	Translate	Identifies the C-side or P-side links of a posted LCM.

Additional information on some of these commands follows.

TRNSL

This command identifies the C-side speech and message links, or P-side links of a posted LCM. This command also displays the status and type of the links. The translate display and link status codes appear in Table 29-5.

Table 29-5 Translate display and link status codes

Code	Meaning
CAP	Capacity of the links as MS or S
MS	Message and speech
S	Speech only
STATUS	State of the link as OK, ManB, SysB, or OffL
OK	InSv
MSG COND	Message condition as CLS, OPN, MTC, or SPCH
CLS	Closed
OPN	Open
MTC	Maintenance opened
SPCH	Speech open for message (MS) links only.

TST

This command tests one or all units of one or all posted LCMs, or one specified P-side link from a remote LCM. The remote LCM is in the control position of the posted set. The node under test must be ManB, SysB, InSv, or have ISTb. You can use the TST command to manually execute or disable LCM REx and

LCMCOV REx tests. You also can use the TST command to query the test parameters. Refer to page 24-26 for additional information on LCM REx tests.

When you test an LCM/LCME unit, you can receive a "Tst Aborted" message. This message does not appear often and indicates a problem with one of the following:

- the associated NT6X48 DS30A port interface card in the LTC/LGC
- the NT6X52 DCC card in the LCM or the NTBX35 LCME unit
- the DS30A link between the LTC/LGC and LCM/LCME
- the backplane wiring between the NT6X48 DS30A peripheral interface cards in the two LCM/LCME units.

The "Tst Aborted" message does not generate a card list, a log report, or any other status information to help you isolate the component that has faults. To clear the "Tst Aborted" message and run the test, use the problem solving procedure outlined on page 31-13 of this guide.

UEN level

Table 29-6 lists and describes the menu commands available at the UEN level. The entry of the HELP command with the command name at the MAP terminal provides a description of command syntax.

Table 29-6 UEN menu commands

PM commands	Code	Description
BSY	Busy	Sets a posted UEN to the ManB state.
DISP	Display	Displays a set of UENs in a given state.
LISTSET	List set	Lists the discrimination numbers of the PM types included in the posted set.
LOADFW (unlisted command)	Load firmware	Loads firmware into a PM or unit and is used to perform a firmware upgrade.

Table 29-6 UEN menu commands

PM commands	Code	Description
LOADPM	Load PM	Loads the peripheral program files into the processors of one or all posted UENs that are ManB. In addition to the existing parameters in the LOADPM command, the following new parameters are used with the UEN: • MATE - used when the source of the load is the active bank of the mate or standby bank of the mate, depending on whether the option ACT or STBY option is chosen • CC - used to load from the CM • SELFACT - used when the contents of the active bank are copied over to the standby bank of that unit.
NEXT	Next	Posts the next UEN in a displayed set.
OFFL	Offline	Sets a posted UEN offline.
POST	Post	Posts a UEN.
QUIT	Quit	Quits the UEN level of the MAP terminal or cancels an UEN selection.
QUERYPM	Query PM	Displays information about a posted UEN. In addition to the existing parameters in the QUERYPM command, the OOS parameter is used with the UEN. The OOS parameter queries the ManB units.
RTS	Return to service	Returns a UEN to service. In addition to the existing RTS parameters, two new parameters are used with the UEN: • The SWLD (switch load) parameter is used with a ManB unit to copy the load from the standby bank to the active bank and return the unit to service. The unit will be then be InSv and executing the new load. • The LSG_NO is used just as the DRWR_NO is with the LCM.

Table 29-6 UEN menu commands

PM commands	Code	Description
SWLD	Switch load	Copies the load in the standby bank to the active bank and returns the unit to service.
TST	Test	Invokes self-diagnostics on a posted UEN.
TRNSL	Translate	Identifies the C-side links of a posted UEN.

Additional information on the LOADFW, LOADPM, and SWLD commands follows.

LOADFW

In-service firmware downloading uses the LOADFW command. The LOADFW command distinguishes the firmware load application from the firmware upgrade application. The command syntax for the LOADFW command is shown next.

```
LOADFW: Load firmware onto a PM or unit.
         All parameter will execute LOADFW on
         all PMs in the post set of the same
         PM type displayed on the MAP.
         LOADFW UPGRADE must be used to
         activate the new firmware.
Parms:   <DEVICE> {UNIT <UNIT_NO> {0 TO 1},
                   PM,
                   INACTIVE,
                   ACTIVE}
         [<FILENAME> STRING
         [UPGRADE]
         [NOWAIT]
         [ALL]
```

The LOADFW command permits loading of firmware in a UEN unit while the unit is in service (InSv) or out-of-service (OOS). In addition, with the LOADFW UPGRADE command on an InSv UEN, the unit is busied (one unit at a time, if performing a PM upgrade) while the new firmware load is activated. When a firmware upgrade is performed, a SWLD occurs.

> ***Note:*** In-service firmware downloading refers to the loading of the firmware while the unit is InSv. The upgrade of the firmware occurs with the UEN unit out-of-service (OOS).

To download firmware to the UEN, execute one of the following commands. The following are examples of the LOADFW command.

>LOADFW PM

or

>LOADFW UNIT unit_no

or

>LOADFW INACTIVE

> ***Note 1:*** If the firmware_file is not specified with the LOADFW command, the command applies the firmware_file datafilled in table LCMINV.
>
> ***Note 2:*** By using the LOADFW command without the upgrade option, the firmware downloads to the UEN firmware standby flash area.

To check the firmware load, enter the following command at the MAP display terminal:

>QUERYPM

When performing an in-service firmware upgrade of a unit, the unit is busied, the firmware load is copied from the standby flash area to the active flash area, a restart occurs to activate the new flash load, and the unit is returned to service.

To perform a firmware upgrade, enter the following command at the MAP display terminal:

>LOADFW UPGRADE

LOADPM

The LOADPM command supports in service loading and other loading options for the UEN. The SWLD command allows the technician to manually switch the active load in a UEN. The following table shows the source and destination of the load. Refer to Figure 29-2 with the table.

Table 29-7 UEN load source and load destination

Load source		Load destination	Notes
CC		STBY load bank or STBY firmware bank	Load from CC
MATE	ACT	STBY load bank	Load from active bank of mate unit

Table 29-7 UEN load source and load destination

Load source		Load destination	Notes
	STBY	STBY load bank	Load from standby bank of mate unit
SELFACT		STBY load bank	Copy active bank to inactive bank of self unit

SWLD

The switch load (SWLD) command can be used only on an InSv UEN. The syntax of the SWLD command is provided next.

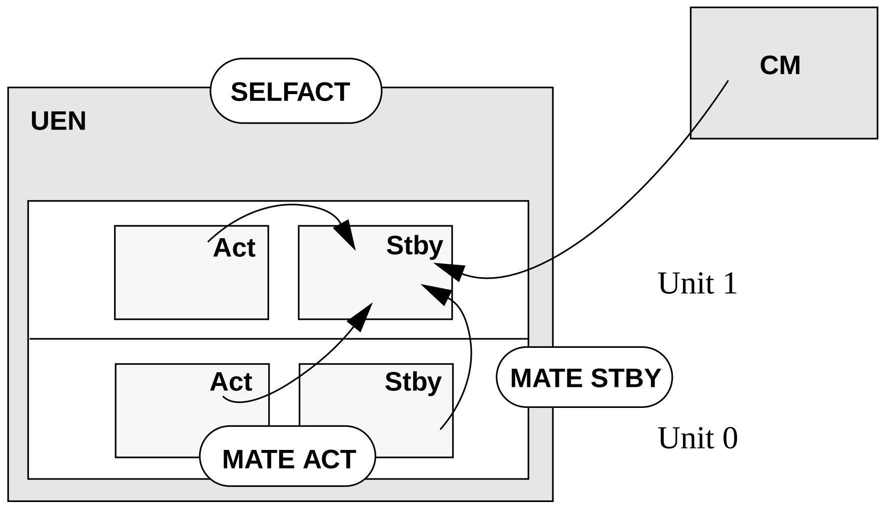
```
SWLD  <DEVICE>    {UNIT <UNIT_NO> {0 TO 1},
                   PM}
      [<NOWAIT>   {NOWAIT}]
      [<ALL>      {ALL}]
```

The SWLD command is used when activating the load on an InSv unit. During activation of the new load, the processor of the UEN unit switches the active bank to a standby state and starts executing the load in the newly active (previously standby) bank. The UEN unit must be taken out-of-service to activate the load in the standby bank.

Once a unit of the UEN has been loaded and the load has been activated, the standby bank will contain the old (previously active) load until the technician chooses to manually load the standby bank with another load. This is useful when the operating company is upgrading the UEN to a new release load. During the upgrade, the technician may choose to retain the old load until the quality of the new load has been verified. The technician may, at at any time, load the inactive bank with the same load as the active bank. This provides redundancy of loads in the UEN and can be beneficial in the event of a catastrophic load failure in the active bank.

The destination of the load in the UEN is always the standby bank. However, multiple sources for the load are available as shown in the following figure.

Figure 29-2 Sources available to load the standby bank of a UEN unit



Non-menu commands for the LCM

Table 29-8 lists and describes non-menu commands that can help you at the LCM level.

Table 29-8 LCM non-menu commands

PM commands	Code	Description
BICRELAY	Bus interface card relay	The BICRELAY command turns the BIC relay test ON or OFF, starts the test again, and queries the status of the test. The command also queries the number of LCM level tests in progress. The command also queries the next LCM that the system schedules in the system BRT.

30 LCM and UEN related card requirements

This chapter provides background on card replacement procedures for the line concentrating module (LCM) and the Universal Edge 9000 (UEN). For additional information, refer to *Card Replacement Procedures*.

Circuit card removal and replacement procedures

The following are special considerations for the bus interface card (BIC) replacement.

Bus interface cards

Use additional caution to replace bus interface cards (BIC - NT6X54). When the cards do not sit correctly in the line drawer (LD), the switch cannot power up correctly. The error message is LINE COMMUNICATION FAILURE. If this message appears in log reports and at the LCM level when you execute commands TEST and RTS, reseat the NT6X54 BIC. Reseat the NT6X54 BIC in one solid movement. Do not rock the card from top to bottom as you insert the card in the LD slot.

The message LINE COMMUNICATION FAILURE also appears for a BIC or a digroup control card (DCC) and BIC failure.

Card replacement in a UEN shelf

When replacing a card in a UEN, make sure the red “Safe to pull” LED is lit. The line cards (line subgroup [LSG]) and the NTKX06AA TDM interface card must be manually busied (ManB) to put the cards in the “Safe to pull” state.

Other equipment removal and replacement procedures

Special considerations for removal and replacement of equipment other than circuit cards are not present in this document.

31 LCM and UEN trouble isolation and correction

This chapter provides general descriptions of the procedures to correct faults in the line concentrating module (LCM) and Universal Edge 9000 (UEN). This chapter also describes the fault isolation tests and diagnostic tests that you can use to support the LCM and UEN.

This chapter provides only general information to assist qualified maintenance personnel in problem solving and the maintenance of LCMs and UENs. For additional or detailed information, refer to one of the following documents.

- *Operational Measurements Reference Manual*
- *Log Report Reference Manual*
- *Alarm and Performance Monitoring Procedures*

Problem solving procedures

Trouble condition indicators

Trouble conditions can appear in many forms that include the following:

- operational measurements (OM)
- log reports
- alarms

Operational measurements

The OM monitors and counts events in the system. The OM are the best means to detect current and potential system problems. Use the OM thresholding feature to monitor and report key peripheral module (PM) activity. The OM makes these reports daily or weekly. These reports are the primary method of trouble detection.

Log reports

Logs are used as an analysis tool. Logs provide detailed information on call errors, diagnostic results, and system status. Logs also are good indicators of problem conditions when any of the following conditions are present:

- sudden increase in volume of logs
- message not printed reports
- large number of logs that are alike

Alarms

Audible and visible alarms indicate that correcting action is required. Appropriate routine system maintenance and use of OMs and logs minimize the occurrence of alarms.

The level of the alarm indicates alarm severity and corresponding need for correcting action. The alarm can be minor, major, or critical. Table 31-1 describes these alarm codes.

Table 31-1 Alarm codes

Alarm	MAP display	Description
None	•	Indicates normal operations.
Minor	(blank)	Does *not* affect service.
Major	(M)	Indicates a service degrading, threatening condition.
Critical	(*C*)	Indicates a service power failure or potential service power failure.

Follow these guidelines when you respond to alarms:

1. When more than one alarm of the same severity appears on the MAP screen, clear the alarms. Clear the alarms from the left to the right of the screen.
2. If an alarm of greater severity occurs while you fix an alarm, respond to the new alarm. Do not continue attempts to clear the less severe alarm.

For alarm clearing procedures, see *Monitoring Alarm and Performance Procedures*.

Locating and clearing faults in an LCM

The standard procedure on how to isolate and clear faults is as follows:

1. Silence audible alarms.
2. To isolate the fault, read status displays and trace fault codes to the menu level needed to clear the fault.
3. Off-stream (busy) the hardware to remove system access to the component that has faults. This step allows you to perform maintenance activity without system interference.
4. Test the component that has faults. Identify the card that you will replace. Replace the card that has faults. Test the component again.
5. Return the hardware to service.

The following are summaries of the trouble isolation and correction procedures for LCM faults. These summaries provide only background information for qualified maintenance personnel to use in the maintenance of LCM. Refer to specified step-by-step documents.

Adding or deleting lines to drawers

When you add a line to a drawer, update data table LNINV. The associated drawer becomes equipped (set to the OffL state). You must manually return the drawer to service before call processing is possible for any line on the drawer.

> ***Note:*** To delete lines from a drawer, the drawer must be in the OffL state. When you delete the last line to an OffL drawer pair, the drawer pair becomes unequipped.

Removing line drawers or connecting line drawers again

When you isolate problems in the LCM, the requirement to remove or connect the NT6X05 line drawers can be present. When this action is required, use special caution to make sure that you protect components within the line drawer from power surges. Power surges can occur when you connect or remove a line drawer.

Use the following guidelines when you remove the NT6X05 line drawers:

1. Busy and offline both line subgroups (LSG) that associate with the physical line drawer that you remove.
2. Remove the NT6X54/BX36 BIC from the line drawer.
3. Remove the -48 volt fuse that associates with the line drawer.
4. Remove the +15 volt fuse that associates with the line drawer.
5. Remove the +5 volt fuse that associates with the line drawer.

6. Disconnect the main distribution frame (MDF) cables.
7. Disconnect the C and D connectors from the line drawer.

When you connect a NT6X05 line drawer again, use the following procedures:

1. Remove the NT6X54/BX36 BIC from the line drawer.
2. Remove the -48 volt fuse that associates with the line drawer.
3. Remove the +15 volt fuse that associates with the line drawer.
4. Remove the +5 volt fuse that associates with the line drawer.
5. Connect the C and D connectors.
6. Connect the MDF cables.
7. Insert the +5 volt fuse.
8. Insert the NT6X54/BX36 BIC.
9. Insert the +15 volt fuse.
10. Insert the -48 volt fuse.
11. Busy and return to service both LSGs that associate with the line drawer.

Recovering an LCM after a switch goes down

When a switching system goes down, you must recover operation of the system as soon as possible. With feature package NTX270, the maintenance actions that speed recovery of the LCMs are the following:

- use of broadcast loading with the LOADPM command for PM of the node type LCM
- use of the parameter pm_type of the next command to specify the type of PM in the posted set
- use of the LOADPM command with parameters ALL and RTS. Use the parameters to return the remaining LCMs to service.

Note: The RECOVER command uses the entries in table PMLOADS.

Handling a loss of ringing

The following procedure addresses conditions where a loss of ringing occurrs to subscribers served by line concentrating equipment (LCE).

> **CAUTION**
> **Loss of service**
> Use the following procedure, if loss of ringing occurred to subscribers served by the LCE frame. Do not use this procedure if ringing is available from one ringing generator (RG) or for only one unit. Loss of subscriber service occurs if you use this procedure while ringing is available.

Use of the following procedure requires a knowledge of the DMS-100 ringing system and the actions between LCM units and ringing generators (LG).

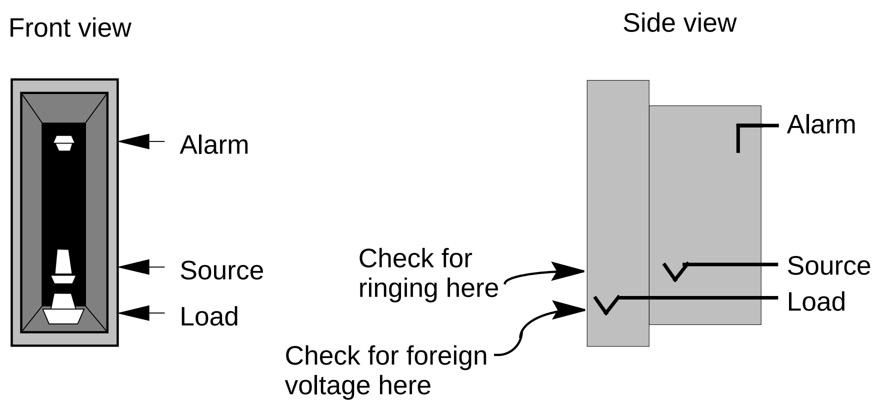
1. Remove all RA and RB fuses in the affected LCE frame.
2. Attempt to return all units to service.
   a. If units do not go InSv, go to Item 3.
   b. If units go InSv, go to Item 9.
3. Replace the NT6X30 RGs one at a time. Use the following procedure in an attempt to recover ringing each time. You can recover ringing, if you perform all steps correctly.
   a. Reset any tripped circuit breakers. The circuit breakers must remain set.
   b. Verify that RG LEDs are off.
   c. Return LCMs to service.
   d. Use SWRG command to set LCM 0 to RG 0, and LCM 1 to RG 1. For remotes with only one LCM, set unit 0 to RG 0, and unit 1 to RG 1.
   e. Perform an in-service test on all LCMs.
4. If you fail to recover ringing, replace the NT6X53 power converters one at a time. Attempt to recover ringing each time.
5. If you fail to recover ringing, replace the NT6X51 processor cards one at a time. Reload and attempt to recover ringing each time.
6. If you fail to recover ringing, busy and offline the LSGs, and disconnect the line drawers one at a time. Attempt to recover ringing each time. Refer to "Removing line drawers or connecting line drawers again" on

page 31-3 for guidelines on how to remove line drawers and connecting line drawers again.

> ***Note:*** If you recover ringing, assume that the last drawer disconnected is bad. Connect the other line drawers again and return these line drawers to service one at a time. If problems occur again, when you connect a drawer again and return the drawer to service, assume the drawer is bad.

7. When you isolate the problem to a single line drawer, remove the NT6X54/BX36 BIC and connect the drawer again.
   a. If ringing problems do not occur again with the BIC removed, the problem is in the BIC or a line card in the drawer. Go to Item 8.
   b. If ringing problems occur again, the problem is with the NT6X05 line drawer. Replace the drawer and restore LCMs to service.
8. Install a new BIC and RTS the LSGs that associate with the line drawer.
   a. If no problems occur again, the original BIC caused the ringing problems. Restore LCMs to service.
   b. If problems occur again, remove all line cards from the drawer. Insert the line cards again, one at a time. Insert the cards while you watch for problems to occur again. If problems occur again, when you insert a line card again, the line card is bad. Replace the line card and restore LCMs to service.
9. If a meter is available, check for ringing at the RA and RB fuse blocks. To check for ringing, connect the ground lead to the ground jack on the NT6X53 power converter. With the other probe, contact the source side of the fuse block. Refer to Figure 31-1 for additional information.

Figure 31-1 RA/RB fuse block



Note: Ringing is a low-frequency ac voltage that can vary during the ringing cycle. Readings of 67 to 155 V can be normal. Ringing voltages are placed over a dc voltage that you can measure in dc mode. The dc voltage can be 36 to 60 V. Superimposed ringing can turn positive during part of the ringing cycle.

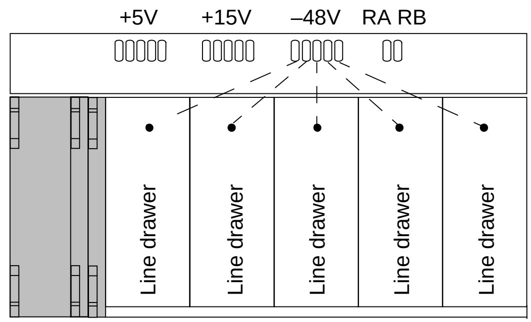
If a meter is not available, go to Item 12.

10. If ringing is not present at the RA and RB fuse blocks, go to step 18. If ringing is present at the fuse blocks, check for not normal voltages on the load side of the fuse block. Refer to the preceding diagram. An example of a not normal voltage is -48 V. If you do not find not normal voltage, go to Item 12.
11. If a not normal voltage is present on an RA or RB fuse block, you isolate the problem to one of five LSGs. The LSG associates with the five line drawers on the shelf below the fuse. Remove the fuses that associate with the not normal voltage, one at a time, for each drawer in the shelf. Figure 31-2 illustrates the line drawers that associate with these fuses.

Figure 31-2 Line drawers that associate with fuses

If the not nomal voltage detected is –48 V, +5 V, or +15 V, you can isolate the problem to a line drawer. To isolate the problem, remove fuses, one at a time, that associate with the voltage detected.

Three blocks of fuses, one for each voltage, are in the baffle above each shelf. Each block contains five fuses. Each fuse corresponds to one of five line drawers as illustrated for the –48 V talk battery fuses.



Removal of the fuse for a specified drawer causes the not normal voltage to disappear at the RA or RB fuse block. You isolated the problem to a single drawer. Go to Item 15.

If you cannot isolate the problem to the drawer level, go to Item 13.

12. Insert the RA and RB fuses, one at a time, while you watch for problems to occur again. If you insert a fuse that causes problems to occur again, you isolate the fault to one of five LSGs. The LSG is within the five line drawers on the shelf below the fuse. Remove the fuse.
13. Busy, offline, and disconnect all five line drawers. Insert the fuse again. If the problem occurs again with all the line drawers disconnected, the problem is in the wiring, or on the backplane.
14. If the problem does not occur again, connect the line drawers again one at a time. Return to service both LSGs that associate with each line drawer. If this action causes the unit to go ISTb or SysB, assume the line drawer is bad. Disconnect the bad line drawer and attempt to recover ringing.
15. You isolated the problem to a single line drawer. Offline and disconnect the drawer or remove at least one of the RA/RB fuses that serve the shelf. Remove the fuse to prevent the problem from occurring again. Remove the NT6X54/BX36 BIC from the drawer.

16. If you disconnected the drawer, connect the drawer again. If you removed the RA/RB fuse, insert the RA/RB fuse again.
    a. If ringing problems occur again, the defect is in the line drawer. Replace the line drawer. Return the LCMs to an in-service condition.
    b. If ringing problems do not occur again, the defect is in the BIC or the line cards.
17. Install a new BIC and RTS the LSGs that associate with the drawer.
    a. If problems do not occur again, the defect was in the original BIC. Restore LCMs to service.
    b. If ringing problems occur again, remove all line cards from the drawer, and RTS the LSGs that associate with the drawer. Insert line cards again, one at a time, while you watch for problems to occur again. If problems occur again, when you insert a line card again, the line card is bad. Replace the line card. Restore LCMs to service.
18. Determine which RG corresponds to the fuse or fuses where ringing is not present. To determine the corresponding RG, check the post screen at the MAP terminal. Compare the information on the screen with the information in Table 31-2.

Table 31-2 Cross-reference of LCMs and RGs

Shelf location	04	21	38	55
LCM number	0	0	1	1
Odd LSG	RB	RA	RA	RA
Even LSG	RA	RB	RB	RB

19. Execute the SWRG command on the PM that associates with the fuse.
    a. If you restore ringing, the problem is the RG. Replace the damaged RG. Restore the LCMs to service.
    b. If ringing problems occur again after you replace the ringing generator, replace the NT6X53 power converter. If this action corrects the problem, restore the LCMs to service.
    c. If ringing problems remain, contact your technical assistance service.

Restarting drawers status

Restarts affect drawers as follows:

- RELOAD: Drawers that are not OffL or unequipped are set I
- COLD: Drawer states do not change. Restarts treat drawers like a warm restart.
- WARM: Drawer states do not change.

Handling a line drawer that has faults

To handle a line drawer that has faults:

1. Post, busy, test, and return to service (RTS) the drawer
2. If the test or RTS commands fail with a card list, replace cards with a correct card replacement procedure. Test and RTS the drawer.
3. If the test or RTS commands fail without a card list, perform correct tests indicated by the MAP response. RTS the drawer.

Handling a shelf circuit card that has faults

To handle a shelf circuit card that has faults:

1. Post LCM.
2. Determine if any fault indicators are present.
3. Busy unit with defective card.
4. Perform appropriate card replacement procedures.
5. Test and return the LCM unit to service.

Handling a line card that has faults

During line card diagnostics, a single card failure can cause a complete LCM unit to fail. The location of the single card can be a difficult task. Use the following two procedures to handle a line card that has faults.

CAUTION
Possible service interruption
Perform each of the following procedures during a maintenance window to avoid possible service interruptions. Qualified technicians can perform these procedures during the day, if you take appropriate precautions.

Procedure 1

1. To find the vertical connection to the LCM that has faults, use table MTAVERT.
2. Access the backplane of the MTADRIVER with a butt set.

3. Perform one of the following steps, depending on the tone you hear.
   a. Dial tone -- Dial the operator. Ask the operator what number you are on. The tone originates from a 6X17 card. This card is your line card that has faults.
   b. 8 kHz tone -- This tone is a data line card 6X71 or 6X76.
   c. Talk battery -- Use a Meridian business set (MBS) to call the operator to see what directory number (DN) you are on.
4. If you do not hear a tone that uses a butt set, try other instruments datafilled in the LCM. These instruments include ground start lines.

Procedure 2

1. Access the LTP level of the MAP terminal.
2. Post any line equipment number (LEN) that is on the damaged LCM.
3. Put a tone on the posted LEN.
4. Access the mainframe with a butt set. Listen to all other LENs on the LCM. You will find two LENs with tone. One LEN is the posted LEN. The other LEN is the LEN with the line card that has faults.

Handling a DS30A link that has faults

To handle a DS30A link that has faults:

1. Post the LCM.
2. Determine if any fault indicators are present.
3. Display C-side links.
4. Post the host XMS-based peripheral module (XPM). Determine the PM state of host XPM.
5. If the host XPM is in service (InSv), display P-side links. Busy, test, and return to service (RTS) host XPM.
6. If host XPM is in the in-service trouble (ISTb) state, busy and test host PM in search of card list.
7. Perform correct card replacement procedures.
8. Return the host XPM to service.

Note: If these procedures fail to correct the DS30A link that has faults, check the physical DS30A connection on the LCM and host XPM. A bad DS30A connection can generate alarms in the PM and LNS subsystems. A bad connection also can hinder the ability of documented procedures to clear the alarm.

Handling RG frequency generator circuit that has faults

To handle a RG frequency generator circuit that has faults:

1. Test the RG.
2. If test fails, replace the RG.

Handling a load file mismatch

To handle a load file mismatch:

1. Post the LCM.
2. Use the QUERYPM command to display the PM load that is in the LCM.
3. Determine the correct LCM PM load.
4. Correct table LCMINV, if the table has the wrong PM load for LCM.
5. If table has the correct PM load for LCM, obtain the correct PM load and reload the LCM.

Fault isolation tests in an LCM

Handling a test aborted response

When you test an LCM/LCME unit, you can receive a "Tst Aborted" message. This message is a rare occurrence. The message indicates a problem with one of the following:

- the associated NT6X48 DS30A port interface card in the LTC/LGC
- the DCC in the NT6X52 LCM or the NTBX35 LCME unit
- the DS30A link between the LTC/LGC and LCM/LCME
- the backplane wiring between the NT6X48 cards in the two LCM/LCME units.

The "Tst Aborted" message does not generate a card list, a log report, or any other status information to help you isolate the defective component. To clear the "Tst Aborted" message and run the test, use the following problem solving procedure:

1. Query the LTC/LGC to make sure that the two units are in sync. If the two units are not in sync, wait 10 min and query the LTC/LGC again. When the units are in sync, SWACT the LTC/LGC.
2. Test the LCM/LCME again. If the test passes after the SWACT in Item 1, proceed to Item a to isolate the problem to the NT6X48 card or bad backplane wiring. If the test fails, proceed to Item 3.
   a. Replace the NT6X48 card in the originally active LTC/LGC unit. Wait for sync and warm SWACT back to this unit. Test the

LCM/LCME again. If the test passes, stop problem solving. Assume the fault was a bad NT6X48 card. If the test aborts, proceed to Item b.

b. Verify that the fault is in the backplane wiring between the two NT6X48 cards. Move the message link connector from the aborting unit to the other LTC/LGC in the same link location. The test will pass, if the first test in step 2 passed. Inspect and repair the backplane wiring between the units that go between the NT6X48 cards.

3. Replace the DCC and test the damaged LCM/LCME unit again. If the test aborts again, the DCC functions correctly. The defect is with the cables or wiring.
4. Check the DS30A cable and connections. Make sure that all connections seat completely and that you correctly placed all connections. Check the cable for physical damage, for example, breaks or cuts. If the cable has faults, repair or replace the cable.

Locating and clearing faults in a UEN

The standard procedure on how to isolate and clear faults is as follows:

1. Silence audible alarms.
2. To isolate the fault, read status displays and trace fault codes to the menu level needed to clear the fault.
3. Off-stream (busy) the hardware to remove system access to the component that has faults. This step allows you to perform maintenance activity without system interference.
4. Test the component that has faults. Identify the card that you will replace. Replace the card that has faults. Test the component again.
5. Return the hardware to service.

The following are summaries of the trouble isolation and correction procedures for UEN faults. These summaries provide only background information for qualified maintenance personnel to use in the maintenance of UEN. Refer to specificied step-by-step documents.

Adding or deleting lines to LSGs in a UEN

When you add a line to an LSG, update data table LNINV. When the first line is being added to the LSG, the associated LSG becomes equipped (set to the OffL state). You must manually return the LSG to service before call processing is possible for any line on the LSG.

Note: To delete lines from an LSG, the LSG must be in the OffL state. When you delete the last line to an OffL LSG, the LSG becomes unequipped.

Recovering a UEN after a switch goes down

When a switching system goes down, you must recover operation of the system as soon as possible. The maintenance actions that speed recovery of the UENs are the following:

- use of the parameter pm_type of the next command to specify the type of PM in the posted set
- use of the LOADPM command with parameters ALL and RTS. Use the parameters to return the remaining UENs to service.

> ***Note:*** The RECOVER command uses the entries in table PMLOADS.

Handling a loss of ringing

When a loss of ringing occurs to subscribers served by an LSG, there is a problem with the line card. Since ringing is an integral part of the line card, refer to the next section.

Handling an LSG that has faults

To handle an LSG that has faults:

1. Post the UEN and busy, test, and return to service (RTS) the LSG.
2. If the test or RTS commands fail with a card list, replace the line card using the correct card replacement procedure. Test and RTS the LSG.
3. If the test or RTS commands fail without a card list, perform correct tests indicated by the MAP response. RTS the LSG.

> **CAUTION**
> **Possible service interruption**
> Perform each of the following procedures during a maintenance window to avoid possible service interruptions. Qualified technicians can perform these procedures during the day, if you take appropriate precautions.

Procedure 1

1. To find the vertical connection to the UEN that has faults, use table MTAVERT.
2. Access the backplane of the MTADRIVER with a butt set.

3. Perform one of the following steps, depending on the tone you hear.
   a. Dial tone -- Dial the operator. Ask the operator what number you are on. The tone originates from an NTNP50AA or NTNP44AA card. This card is your line card that has faults.
   b. Talk battery -- Use a Meridian business set (MBS) to call the operator to see what directory number (DN) you are on.
4. If you do not hear a tone that uses a butt set, try other instruments datafilled in the UEN. These instruments include ground start lines.

Procedure 2

1. Access the LTP level of the MAP terminal.
2. Post any line equipment number (LEN) that is on the faulty UEN.
3. Put a tone on the posted LEN.
4. Access the mainframe with a butt set. Listen to all other LENs on the line card. You will find two LENs with tone. One LEN is the posted LEN. The other LEN is the LEN with the line card that has faults.

Handling a DS30B link that has faults

To handle a DS30B link that has faults:

1. Post the UEN.
2. Determine if any fault indicators are present.
3. Display C-side links.
4. Post the host XMS-based peripheral module (XPM). Determine the PM state of host XPM.
5. If the host XPM is in service (InSv), display P-side links. Busy, test, and return to service (RTS) host XPM.
6. If host XPM is in the in-service trouble (ISTb) state, busy and test host PM in search of card list.
7. Perform correct card replacement procedures.
8. Return the host XPM to service.

> ***Note:*** If these procedures fail to correct the DS-30B link that has faults, check the physical DS-30B connection on the UEN and host XPM. A bad DS-30B connection can generate alarms in the PM and LNS subsystems. A bad connection also can hinder the ability of documented procedures to clear the alarm.

Handling a load file mismatch in a UEN

To handle a load file mismatch:

1. Post the UEN.
2. Use the QUERYPM command to display the PM load that is in the UEN.
3. Determine the correct UEN PM load.
4. Correct table LCMINV, if the table has the wrong PM load for UEN.
5. If table has the correct PM load for UEN, obtain the correct PM load and reload the UEN.

Fault isolation tests in a UEN

Handling a test aborted response

When you test a UEN unit, you can receive a "Tst Aborted" message. This message is a rare occurrence. The message indicates a problem with one of the following:

- the associated NT6X48 DS30B port interface card in the LTC/LGC/RCC2
- the TDM interface card in the UEN unit
- the DS30B link between the LTC/LGC/RCC2 and UEN
- the backplane wiring in the LGC/LTC/RCC2 between the NT6X48 cards for the two UEN units.

The "Tst Aborted" message does not generate a card list, a log report, or any other status information to help you isolate the defective component. To clear the "Tst Aborted" message and run the test, use the following problem solving procedure:

1. Query the LTC/LGC/RCC2 to make sure that the two units are in sync. If the two units are not in sync, wait 10 min and query the LTC/LGC/RCC2 again. When the units are in sync, SWACT the LTC/LGC/RCC2.
2. Test the UEN again. If the test passes after the SWACT in Item 1, proceed to Item a to isolate the problem to the NT6X48 card or bad backplane wiring. If the test fails, proceed to Item 3.
   - Replace the NT6X48 card in the originally active LTC/LGC/RCC2 unit. Wait for sync and warm SWACT back to this unit. Test the UEN again. If the test passes, stop problem solving. Assume the fault was a bad NT6X48 card. If the test aborts, proceed to Item b.
   - Verify that the fault is in the backplane wiring between the two NT6X48 cards. Move the message link connector from the aborting unit to the other LTC/LGC/RCC2 in the same link location. The test will pass, if the first test in step 2 passed. Inspect and repair the backplane wiring between the units that go between the NT6X48 cards.

3. Replace the TDM Interface card in the UEN and test the faulty UEN unit again. If the test aborts again, the TDM interface card functions correctly. The fault is with the cables or wiring.
4. Check the DS30B cable and connections. Make sure that all connections are completely seated and that you correctly placed all connections. Check the cable for physical damage, for example, breaks or cuts. If the cable has damage, repair or replace the cable.

Diagnostic tests

XPM bit error ratio testing

With feature package NTX885, the XPM Bit Error Ratio Test (XBERT) does the following:

- detects and measures PCM bit errors that occur in LCM and XPM cards
- commissions DS-1 and PCM-30 links and trunks that you physically looped back at the remote end without the use of a remote node.

The XBERT detects bit errors in the transmission of high speed data in XPM and LCM cards in the following XPMs:

- digital trunk controller (DTC)
- line group controller (LGC) and international line group controller (ILGC)
- line trunk controller (LTC)
- message switch and buffer for CCIS7 and CCITT7 (MSB7)

> ***Note:*** To use XBERT, each of the PMs must have an NT6X69AB message protocol card or a NT6X69AA message protocol card with a NT6X79 tone card.

The XBERT can perform six separate tests that handle different hardware components in the PM speech and data paths. The test names and cards that correspond with the test names appear in Table 31-3.

Table 31-3 XBERT tests and corresponding cards

Test	Related cards
XBERTINT	NT6X41, NT6X42, NT6X44, NT6X48, NT6X69
XBERTPSL	NT6X44, NT6X48, NT6X69
XBERTDCC	NT6X44, NT6X48, NT6X69, NT6X52/BX35
XBERTBIC	NT6X44, NT6X48, NT6X69, NT6X52/BX35, NT6X54/BX36
XBERTHLP	NT6X44, NT6X69, NT6X50, NT6X27 and associated carrier

The ISOLATE parameter, if specified, automatically runs tests to isolate a fault to a given set of cards. The number of cards in a card list can vary from one to three, depending on the separate test results.

One manual request can test P-side ports in sequence or LCM bus interface cards (BIC).

In each XBERT test, if the XPM P-side port tested is a DS-1 port instead of a DS-30A port, the NT6X50 card is tested instead of the NT6X48 card.

For accurate fault detection tests, each of the XBERT tests must run on an active InSv XPM unit. The fault detection tests also can run on an out-of-service (OOS) unit. For tests XBERTDCC and XBERTBIC, at least one unit of the LCM must be in service.

> ***Note:*** You cannot use XBERT as a tool to provide accurate bit error ratio evaluations. The XBERT does not use standard test patterns of the Consultative Committee for International Telephone and Telegraph (CCITT) in the test procedure. The XBERT uses XPM tone pulse code modulation (PCM) to provide the 64-kbps test bit stream.

All of the tests function in the same method. Each test checks the following:

- presence of specified hardware
- channel and data connections
- concurrency of tests

In the beginning, all of the tests check for the presence of the NT6X44 time switch and the NT6X69 message protocol cards. If these cards are not accessible, XBERT displays a response and the remainder of the test is aborted. If the cards are accessible, XBERT checks for the presence of the XPM P-side interface card that controls the port that you will test manually. The XPM P-side interface card is NT6X48 or NT6X50.

If all of the hardware presence tests pass, the system invokes separate XBERT tests. The tests set up the channel connections for the separate test paths. When XBERT sets up the test path, XBERT sends data through the looped test path and verifies the test path. The XBERT verifies the test path as XBERT returns through the loop. Verification continues for a maximum of 9 h or until the manual testing.

The XBERT can run at the same time on all of the valid XPM types in an office. The XBERT cannot test more than one test path at a time in any single XPM unit. The XBERT can manually busy the P-side ports requested for testing. XBERT cannot test a specific channel on that port to test unless test XBERTHLP runs. If test XBERTHLP runs, you must specify a channel.

While XBERT tests are run on InSv or OOS units, degradation is not present in call processing. Interference is not from other XPM tests.

At the end of a test, XBERT releases the test path connections and displays the bit error statistics based on the completed test run. These statistics can display at any time during the test run.

ISOLATE parameter

The XBERT tests can be run completely in any order to isolate a card that has faults. If you request the ISOLATE parameter, XBERT runs several tests in sequence on the specified XPM P-side port.

For XPMs to test with an LCM on the P-side of the port, XBERT starts the specified test for the specified duration. If this test passes and does not detect cards that have faults in the test path, the separation tests are ended. If the XBERTBIC test fails, the XBERT separation tests continue. The XBERT runs the next test on the specified port. If this test also fails, XBERT continues to run other tests on the specified link. This XBERT process continues until one of the tests passes or until all of the tests run and all failed.

If failures are detected in any of the tests, XBERT determines the cards most probably to be at fault. The fault is based on the XBERT test or tests that failed. During the separation test runs, the system stores XBERT generated messages. The system reviews the tests when the tests are completed. The number of cards in a card list can change between one and three cards, depending on the separate test results.

Test XBERTDCC

To test the digroup control cards (DCCs), the XBERTDCC test path travels through the following cards:

- NT6X69 message
- NT6X44 time switch
- NT6X48/6X50/6X27 DS-30A I/F / DS-1 I/F / PCM30 I/F
- NT6X52/BX35 DCC

XBERTDCC sets up the test path to attempt to establish a loop-around of a manually specified P-side port at the NT6X52/BX35 LCM DCC. If the attempt is not complete, a response appears and the test is aborted. If the LCM loop-around is correctly allocated, the test runs.

XBERTDCC requires that only one P-side port (P1) be manually specified for testing. The port can be DS-30A, DS-1, or PCM30.

Test XBERTBIC BICs

To test the BICs, the XBERTBIC test path travels through the following cards:

- NT6X69 message
- NT6X44 time switch
- NT6X48/NT6X50 DS-30A Interface / DS-1 Interface
- NT6X73 Link Control Card (for RLCM only)
- NT6X52/BX35 DCC
- NT6X54/BX36 BIC

XBERTBIC attempts to establish a loop-around of the manually specified P-side port. The loop-around is at an LCM or RLCM NT6X54/BX36 BIC to set up the test. The BIC that the test loop is to terminate on must be manually specified. If the attempt is not complete, a response displays and the test aborts. If the NT6X54/BX36 loop-around correctly allocates, the test runs.

XBERTBIC requires that only one P-side port (P1) be manually specified for testing. The port can be either DS-30A or DS-1. Also, the BIC for the loop must be manually specified.

For LCME line equipment numbers (lens), the DGRP optional parameter specifies the digroup XBERTBIC testing. Valid digroup numbers are 0, 1, or 2. If you do not specify the DGRP parameter, the default is 0.

To control the BIC that the test loop terminates, specify a BIC digroup used for the test. BIC contains two digroups that interface with 32 line cards. Different LCM units control each of these two digroups. LCM units control half of each of the ten BIC in the LCM. The system specifies that the XBERTBIC loop terminates on any of these ten BICs. Maintenance tests only half of the NT6X54/BX36 card as each test of the XBERTBIC runs. The other half of the card test runs the XBERTBIC test on the same NT6X54/BX36 card. Maintenance uses a port controlled by the mate LCM unit.

Testing multiple port BICs

You can specify a number of XPM P-side ports to test with any of the following tests:

- XBERTPSL test
- XBERTDCC test
- XBERTBIC test
- XBERT fault isolation tests

In addition, the XBERTBIC and ISOLATE tests allow a maximum of ten specified different BICs. If you use the multiple port BIC parameter, each specified path tests in a sequence. Only one path tests at a time. The test continues on each path until the specified test duration time expires or until the test fails on that path. When a test ends on a path for either of these two reasons, the results are stored. Testing continues with the next specified path.

You cannot use the multiple ports parameter with the multiple BIC parameter. But you can specify up to two XPM P-side ports when you use the multiple BIC parameter.

Lines maintenance

Line circuits (LC), subscriber loops, and stations are tested under the lines maintenance subsystem (LNS). Line circuits and subscriber loops are tested manually and automatically in this subsystem.

Line testing helps determine if an LC loop, or LC and loop group function correctly. If the line has faults, line tests will also determine if the fault lies in the LC or the attached loop. When a fault is in the loop, maintenance normally refers the fault to another department (for example, plant maintenance). When the fault is in the LC, replace and retest the line card to verify that the fault cleared.

Performing manual line tests

The switch operator performs manual line tests on LC, loops, and stations. Line circuits and loops are tested separately. The results of the test appear to the switch operator after the tests, at a visual display unit (VDU).

Lines tested manually are part of routine maintenance. Maintenance includes when either the system generates a customer report or an automatic line test (ALT) failure. Manual line testing occurs at the line test position (LTP) level. The testing uses any of the four levels of the LNS subsystem: ALT, LTP, LTPMAN (LTP manual), and LTPLTA (LTP line test access).

Manual line testing at the ALT level defines one line to test immediately. At the other three levels, performance of manual testing occurs. Place the line to act on in the control position. The switch operator controls this line, that you can manipulate. You must post a line before you place the line in the control position.

Performing automatic line tests

Automatic line tests occur on line circuits and loops, and occur on a scheduled condition. The tests occur without switch operator involvement other than for scheduling first. Automatic line tests also occur when a line shows a fault.

Automatic line testing in a DMS-100 switch office occurs under the LNS subsystem, and includes testing both line circuits and the attached loops.

The system identifies lines that fail to meet fixed standards of quality to the switch operator. The system posts the failures at the LTP or provide the output reports generated by the ALT log subsystem. The failures identified are tested manually and corrected.

Station testing

Station testing occurs under the Lines subsystem at a MAP terminal. Testing also can occur from the silent switchman (SSMAN) and station ringer (SR) tests, or from a station. Stations are tested manually.

Station test results appear at the VDU, except for the SR and SSMAN tests. The results of these tests return to the station.

Station testing helps determine if a station connected to a loop and line circuit group functions correctly.

The P-side link diagnostic consists of four separate tests: the hardware presence test, DS-30A, DS-1 presence test, and full peripheral test.

Product specific test tools

Line maintenance cutover

Along with the feature package NTX057, the automatic board-to-board testing (ABBT) feature (during commissioning) uses the line maintenance cutover (LMCUT) facility. The LMCUT facility transfers or cutovers InSv lines from an existing switch to a DMS switch. This feature also provides message recording of all the LMCUT command executions in a development file.

The LMCUT commands are supported on LCMs. The LMCUT commands are correct on LCMs while the DN cuts over the switch. The cutover occurs according to DNs or according to LENs. The commands for cutover by DN and LEN are separate with the exception of the commands OPRTCO, RLSCO, and NOBTST.

The LMCUT commands allow the user to do the following:

- set or query the cutover mode of the switch (by DN or LEN)
- enable, disable, clear, or query the progress message recording
- operate, release, or verify the cutover relays on a range of DNs or LENs
- operate, release, or query the hold relay setting on a drawer

32 LCM and UEN troubleshooting charts

This chapter summarizes the line concentrating module (LCM) and Universal Edge 9000 (UEN) alarms, the possible causes of these alarms, and actions to take about these alarms.

Table 32-1 only serves as an overview for qualified maintenance personnel to use in troubleshooting and maintaining LCMs. For additional information, refer to *Alarm and Performance Monitoring Procedures*.

Table 32-1 Clearing LCM alarms (Sheet 1 of 3)

Alarm condition	Possible cause	Action
Critical	Processor cards that have faults in both line concentrating arrays (LCAs) Converter cards that have faults in both LCAs All DS30A message ports are closed	1. Identify and post the system busy (SysB) LCM. 2. Busy both units of the LCM that has faults. 3. Return to service (RTS) the LCM that has faults. 4. If the RTS fails, load the LCM that has faults. 5. Test and RTS the LCM that has faults.

Table 32-1 Clearing LCM alarms (Sheet 2 of 3)

Alarm condition	Possible cause	Action
Major	LCM processor card that has faults Digroup control card (DCC) that has faults Power converter card that has faults Ringing generator (RG) automatic number identification (ANI) and coin generator circuit that has faults Closed DS30A message port Line group controller (LGC) or line trunk controller (LTC) forces activity switch in LCM	1. Identify and post the in-service trouble (ISTb) LCM. 2. Identify fault indicators with the QUERYPM FLT command. 3. If the LCM is C-side busy (CBsy), identify the C-side links to host PM. 4. Post the host PM for the P-side links that have faults. 5. Busy, test, and RTS the P-side links that have faults. 6. Post, busy, test, and RTS the LCM that has faults. 7. If the LCM is SysB, busy and test the LCM unit that has faults. 8. If the test fails and the system generates a card list, replace any cards. Test and RTS the LCM unit that has faults. 9. If the test fails with no card list, retest and RTS the LCM unit that has faults. 10. If LCM is manually busy (ManB), test the LCM unit that has faults. 11. If test fails with card list, replace any cards, and test and RTS the LCM unit that has faults. 12. If test fails with no card list, retest and RTS the LCM unit that has faults.

Table 32-1 Clearing LCM alarms (Sheet 3 of 3)

Alarm condition	Possible cause	Action
Minor	RG frequency generator circuit that has faults Activity mismatch Data error Diagnostic failure Load file mismatch Self-test failure	1. Identify and post ISTb LCM. 2. Identify fault indicators with the QUERYPM FLT command. 3. If LCM is CBsy, identify C-side links to host PM. 4. Post host PM for P-side links that have faults. 5. Busy, test, and RTS P-side links that have faults. 6. Post, busy, test, and RTS LCM that has faults. 7. If LCM is SysB, busy and test LCM unit that has faults. 8. If test fails with a card list, replace any cards, and test and RTS LCM unit that has faults. 9. If test fails with no card list, retest and RTS LCM unit that has faults. 10. If LCM is ManB, test LCM unit that has faults. 11. If test fails with card list, replace any cards, and test and RTS LCM unit that has faults. 12. If test fails with no card list, retest and RTS LCM unit that has faults.

Table 32-2 only serves as an overview for qualified maintenance personnel to use in troubleshooting and maintaining UENs. For additional information, refer to Alarm and Performance Monitoring Procedures

Table 32-2 Clearing UEN alarms (Sheet 1 of 2)

Alarm condition	Possible cause	Action
Critical	Both TDM interface cards that have faults Shelf interconnect card with faults All DS-30B message ports are closed	1. Identify and post the system busy (SysB) UEN. 2. Busy both units of the UEN that has faults. 3. Return to service (RTS) the UEN that has faults. 4. If the RTS fails, load the UEN that has faults. 5. Test and RTS the UEN that has faults.
Major	A TDM interface card has faults Line card that has faults Shelf interconnect card that has faults Closed DS-30B message port Line group controller (LGC), line trunk controller (LTC), or remote cluster controller2 (RCC2) forces activity switch in UEN	1. Identify and post the in-service trouble (ISTb) UEN. 2. Identify fault indicators with the QUERYPM FLT command. 3. If the UEN is C-side busy (CBsy), identify the C-side links to host PM. 4. Post the host PM for the P-side links that have faults. 5. Busy, test, and RTS the P-side links that have faults. 6. Post, busy, test, and RTS the UEN that has faults. 7. If the UEN is SysB, busy and test the UEN unit that has faults. 8. If the test fails and the system generates a card list, replace any cards. Test and RTS the UEN unit that has faults. 9. If the test fails with no card list, retest and RTS the UEN unit that has faults. 10. If UEN is manually busy (ManB), test the UEN unit that has faults. 11. If test fails with card list, replace any cards, and test and RTS the UEN unit that has faults. 12. If test fails with no card list, retest and RTS the UEN unit that has faults.

Table 32-2 Clearing UEN alarms (Sheet 2 of 2)

Alarm condition	Possible cause	Action
Minor	Ringing failure in line card Activity mismatch Data error Diagnostic failure Load file mismatch Self-test failure Line card fault	1. Identify and post ISTb UEN. 2. Identify fault indicators with the QUERYPM FLT command. 3. If UEN is CBsy, identify C-side links to host PM. 4. Post host PM for P-side links that have faults. 5. Busy, test, and RTS P-side links that have faults. 6. Post, busy, test, and RTS UEN that has faults. 7. If UEN is SysB, busy and test UEN unit that has faults. 8. If test fails with a card list, replace any cards, and test and RTS UEN unit that has faults. 9. If test fails with no card list, retest and RTS UEN unit that has faults. 10. If UEN is ManB, test UEN unit that has faults. 11. If test fails with card list, replace any cards, and test and RTS UEN unit that has faults. 12. If test fails with no card list, retest and RTS UEN unit that has faults.

33 LCM and UEN advanced troubleshooting procedures

This chapter details advanced troubleshooting procedures used to maintain the line concentrating module (LCM) and Universal Edge 9000 (UEN).

Under normal conditions, a unit that has faults is busied and tested. As a result of the testing, the MAP terminal displays a list of cards. The card at the top of the list often causes problems for the unit. When you replace the problem card, the original unit is tested again. If the unit passes this test, the unit returns to service and the troubleshooting procedure is complete.

When normal troubleshooting procedures do not restore a unit to service, the unit can require advanced troubleshooting procedures. Qualified operating company personnel can use MAP terminal responses from troubleshooting attempts that did not complete to formulate a maintenance plan. Operating company personnel can use more advanced step-action procedures to repair a fault.

Advanced troubleshooting procedures for the LCM

Powering up the LCM

The LCM is part of the host office, and the LCM powers up within the general host office turn on procedure. Use the following steps to power up only the LCM:

1. Post the LCM.
2. Insert all +15-V and -48-V fuses in the line concentrating arrays (LCA). The fuses are located in the baffles above the LCAs.
3. Insert power converters and ringing generators.

4. Switch the circuit breakers to the ON position. CB1 and CB2 are for LCM 0. CB3 and CB4 are for LCM 1. CB5 is for RG0 and CB6 is for RG1.
5. To load the PM, type

   >LOADPM UNIT unit no CC

   where

   unit no is the number of the PM unit

Powering down the LCM

The LCM is part of the host office, and the LCM uses the general host office powering down procedure to power down. Use the following steps to power down only the LCM.

1. Post the LCM.
2. Busy the LCM.
3. To identify the C-side links, type

   `> TRNSL C`
4. Post the C-side PM
5. To identify the P-side links, type

   `> TRNSL P`
6. To busy the links, type

   `> BSY link`

   where

   link is the number of the link associated with the LCM
7. Place the circuit breakers associated with the LCM in the OFF position. CB1 and CB2 control LCM 0. CB3 and CB4 control LCM 1.
8. Unseat the NT6X53 power converters.
9. Remove all +15-V and -48-V fuses.

Troubleshooting dial tone problems in the LCM

Use the following steps when troubleshooting dial tone problems in the LCM.

1. If the even line sub groups (LSGs) do not have dial tone, reseat and/or replace the NT6X52 in unit 0.
2. If the odd LSGs do not have dial tone, reseat and/or replace the NT6X52 in unit 1.
3. If LSGs 0 through 9 do not have dial tone, verify that toll break in 1 (TB1) lug 7 reads -48-V with a voltmeter. Locate this terminal block on the back

of the frame supervisory panel (FSP). This voltage is the talk-battery supply for these drawers. This voltage comes from the power distribution center (PDC) for this frame. Check the fuse in the PDC if the voltage is missing.

4. If LSGs 10 through 19 do not have dial tone, verify that TB1 lug 8 reads -48-V with a voltmeter. This LSG is the talk-battery supply for these drawers.
5. If you still do not have dial tone, contact your next level of support.

Troubleshooting ringing generator problems in the LCM

Use the following steps for troubleshooting ringing generator problems in the LCM.

1. Replace the ringing generator (RG).
2. Remove the RA and RB fuses one shelf at a time and observe the light emitting diodes (LEDs). The RA fuse supplies ringing to the even subgroups for the respective shelf. The RB fuse supplies ringing to the odd subgroups for the respective shelf. If the LED extinguishes when you remove a fuse, proceed to step 4. If the LEDs do not extinguish, then continue at step 3.
3. Busy one unit at a time, unseat the NT6X51, NT6X52, and NT6X53 and watch for the cycling to stop. This procedure isolates the trouble to that unit. Replace the above cards.
4. Reseat the cards in the unit that has problems. Start the removal of fuses for each drawer in the shelf. Make sure to pull all three fuses (5, 15, and 48 V) for the drawer. If the cycling does not stop, replace the fuses for that drawer and proceed to the next drawer until the cycling stops.
5. If you removed all the fuses and the cycling does not stop, more than one drawer that has faults can be present. In that event, remove all fuses for all drawers in that shelf at the same time. Replace the three fuses for each drawer and note when cycling starts. When the cycling starts for a given drawer, remove those fuses again and go to the next drawer. This procedure isolates all the drawers that are at fault.
6. When you isolate the drawer or drawer, insert the fuses back for that drawer or drawers. Unplug the controller cable on the back of the line drawer or drawers. Controller cable is the center cable, labeled C and D.
7. Replace the NT6X54 in the isolated drawer or drawers and connect the controller cable back into position.
8. If the cycling continues, you must unseat the line cards one at a time in the suspect subgroup or subgroups. This procedure can locate the line card that has faults, or you must replace the line drawer.
9. Contact your next level of support.

Advanced troubleshooting procedures for the UEN

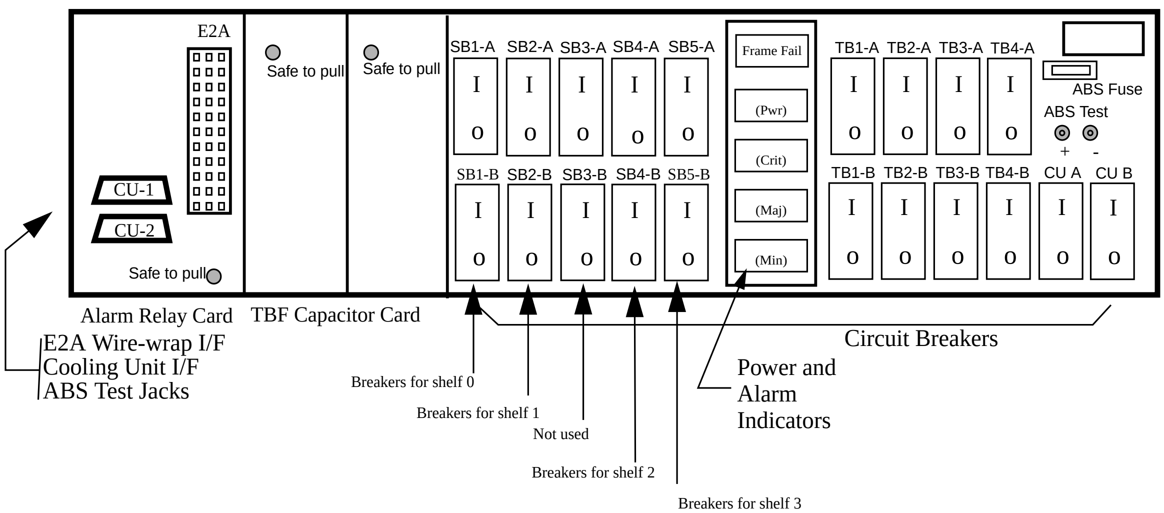
Powering up the UEN

The UEN is part of the host office, and the UEN powers up within the general host office power up procedure. Use the following steps to power up only the UEN shelf. These steps must be repeated for other UEN shelves in the frame.

1. Post the UEN
2. Set all circuit breakers on the breaker interface panel that apply to the UEN to be powered to the ON position.

   Refer to the following graphic to determine the correct breakers to set to the ON position for the UEN to be powered up.

Figure 33-1 UEN breaker interface panel



3. To load the PM, type

   > LOADPM PM CC

Powering down the UEN

The UEN is part of the host office, and the UEN uses the general host office powering down procedure to power down. Use the following steps to power down only the UEN shelf.

1. Post the UEN
2. Busy the UEN
3. To identify the C-side links, type

   > TRNSL C
4. Post the C-side PM

5. To identify the P-side links, type

   > TRNSL P

6. To busy the links, type

   > BSY link

   where

   link is the number of the link associated with the UEN

7. On the breaker interface panel, set the circuit breakers associated with the UEN in the OFF position.

   - SB1-A and SB1-B control UEN 0 signal battery feed and TB1-A and TB1-B control UEN 0 talk battery
   - SB2-A and SB2-B control UEN 1 signal battery feed and TB2-A and TB2-B control UEN 1 talk battery
   - SB4-A and SB4-B control UEN 2 signal battery feed and TB3-A and TB3-B control UEN 2 talk battery
   - SB5-A and SB5-B control UEN 3 signal battery feed and TB4-A and TB4-B control UEN 3 talk battery

8. Set all breakers that apply to the UEN shelf to the OFF position. .

Troubleshooting dial tone problems in the UEN

Use the following steps for troubleshooting dial tone problems in the UEN.

1. If a line sub group (LSG) does not have dial tone, reseat and/or replace the LSG in question.
2. If more than one LSG does not have dial tone, check the talk-battery supply for the line cards that comes from the power distribution center (PDC) for this frame. Check the fuse in the PDC if the voltage is missing. Also check the talk battery breakers on the BIP for the UEN with dial tone problems.
3. If you still do not have dial tone, contact your next level of support.

Troubleshooting ringing problems in the UEN

Test the LSG with ringing problems and if necessary, replace the card during a period of low traffic.

34 VLCM maintenance summary

This document provides the basic maintenance plan for the virtual line concentrating module (VLCM). This document provides qualified maintenance personnel with background information to use to troubleshoot the VLCM.

Functional description

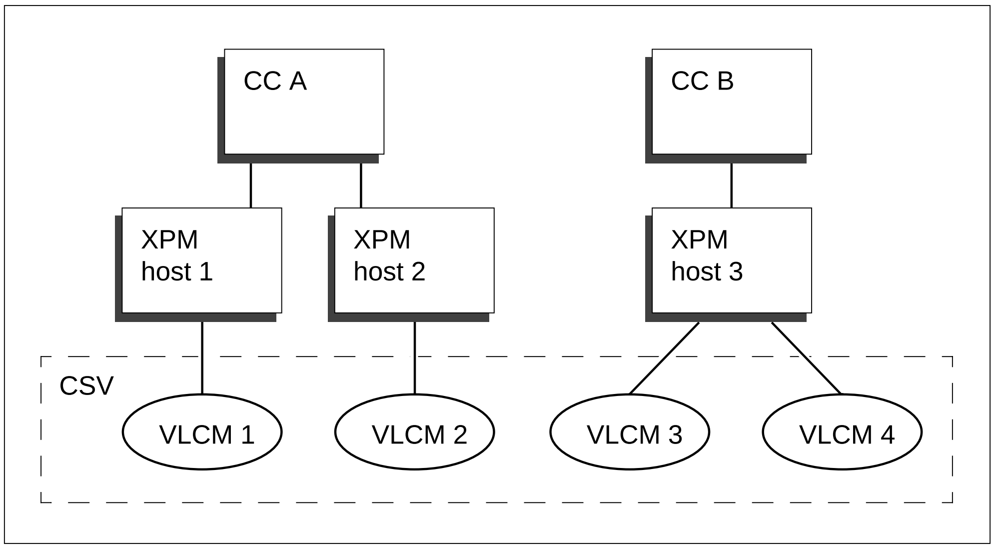
The CornerStone Voice Access Node (CSV) and the Proximity-I are units that provide telephony services to subscribers. From the DMS-100 view, the CSV or Proximity-I unit is a peripheral module. This module is the Virtual Line Concentrating Module (VLCM). You can configure a maximum of eight VLCMs in one CSV unit. You can configure a maximum of four VLCMs in one Proximity-I base station.

The VLCM uses E1 links to connect a PCM30 line group controller (PLGC). The E1 links can connect with a maximum of 640 analog line through PMC30 or EI links. The primary functions of the VLCM include the following:

- associate an E1 channel with a subscriber line. This association allows a caller to make an outgoing call or the called party to receive an incoming call.
- support Meridian Digital Centrex (MDC) services and plain old telephone service (POTS)
- supports card code type VLCMCD that identifies a CSV VLCM line
- supports card code type of VLCMPR that identifies a Proximity-I VLCM line
- perform low-level call processing functions, like:
  - — line scanning for changes of state
  - — dial pulse digit collection
  - — monitoring of power and ringing generation functions
  - — detection of mate processor failures
  - — message handling to and from a PLGC for 640 lines

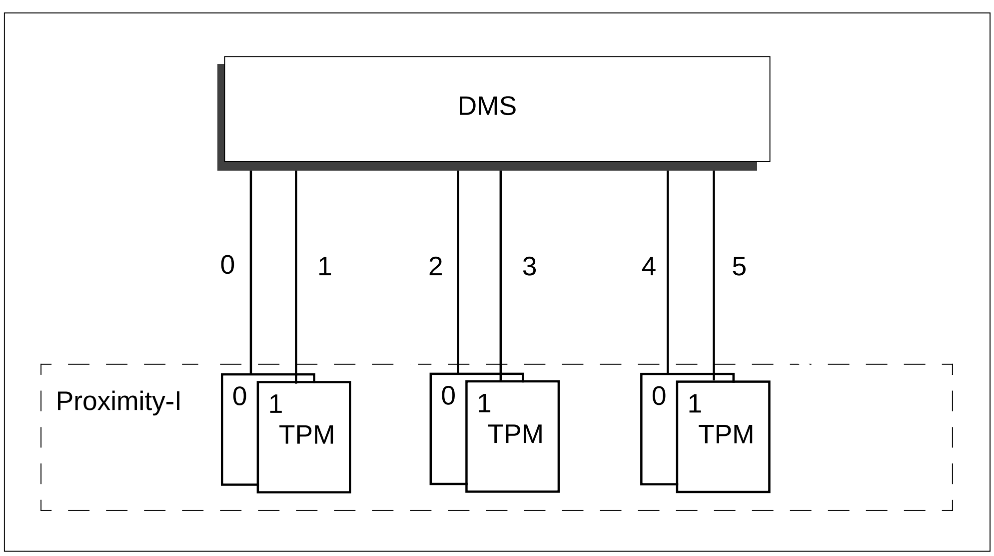
Figure 34-1 illustrates a CornerStone Voice Access Node unit configured to four VLCMs. In the following figure, the four VLCMs connect to two different DMS nodes.

Figure 34-1 VLCM on the CornerStone Voice Access Node



A Proximity-I base station configured to three VLCMs appears in Figure 34-2. In the figure, the three VLCMs connect to one DMS switch through six E1 links. Each VLCM has two transceiver processing modules (TPM).

Figure 34-2 VLCM on the Proximity-I base station



Configuration

The C-side of the VLCM connects to an PLGC or LTC. The VLCM connects through a minimum of two or a maximum of six PCM30 or EI links. The volume of traffic can determine the number of VLCMs that connect to each PLGC. One to ten VLCMs can connect to each PLGC.

Maintenance states

The system assigns a maintenance state for each VLCM. The system assigns the maintenance state or receives manual commands that the user enters at the MAP display.

Table 34-1 PM Maintenance States

PM State	Code	Descriptions
Central side busy	CBsy	PM cannot communicate with the central control (CC). The E1 links, that carry messages between the PM and the DMS-100 switch, are not available.
In service	In Sv	The PM is free of faults that affect service. The PM can support intended processes, like call processing.
In service trouble	IsTb	The PM is in service (InSv) and has a minor fault
Manual busy	ManB	The PM is busy because the switch operator that the Busy (BSY) command issued from the MAP position
Offline	Offl	The switch operator removes the PM from service for commissioning testing or to hold the PM out of service (OOS).
System busy	SysB	System maintenance removes the PM from service because of faults

References to the maintenance states and codes appear in this document.

Data tables

Use table LCMINV to provision VLCM as a PM. The VLCM does not support the following functions:

- emergency stand alone (ESA)
- remote maintenance module (RMM)
- intraswitching

Use table LNINV and SERVORD to provision VLCM lines.

Reconfiguring nodes or links

If you reconfigure a node or link between XPMs, the MAP message STATIC DATA MISMATCH normally appears. The involved XPMs receive the status in-service trouble.

To change VLCMs in table VLCMINV, perform the following functions:

- change central-side links
- change central-side nodes
- ring data
- add or delete tuples

> ***Note:*** Remove convertible VLCMs from service for these changes.

Limits for the implementation of modification data

You can not change every XPM while the XPMs are in service. Make sure you set the in-service XPMs to manual busy before you change the table.

When the system sends the data change to the XPMs, the following system limits are present:

- The system cancels a system audit in progress.
- The update waits for maintenance tasks to complete. If the XPM remains in-service
  - — The system tries five times every 20 s to make the data change.
  - — If the attempts are not successful, the system aborts and sets the XPM to in-service trouble.
- A messaging error by the system causes the XPMs to become system busy or central side busy.
- An update that is not complete or not correct causes the XPMs to become in-service trouble.
- The interactive table changes that affect static data. The modification does not support these changes. Table changes can cause the XPM to go in-service trouble.

> ***Note:*** The system sends the supported changes.

Effects of in-service modification on calls

Changes to the modification data in table VLCMINV update the modification data in the associated tables. Because of the inventory tables that update, calls in progress can complete. The result depends on the type of modification.

Central-side link modification

If you change the central-side of an attached XPM, the machine changes the central-side of host XPM. For example, changes to the central-side links of the VLCM changes data in the VLCM and the central-side PLGC. Manually busy the VLCM to prepare for the data update. Calls in progress between the VLCM and the PLGC complete before the data modification occurs.

The peripheral-side links of a PLGC can move from one VLCM to another VLCM. The PLGC remains in-service while the data changes take effect. The system maintains calls in progress.

When addition of an XPM occurs, you can assign network channels to the central-side links. The system audit updates the data as the network channels become available.

Peripheral-side link modification

Peripheral-side link modification changes the link type in an current tuple in a peripheral-side inventory table. The modification changes the static data of the PLGC or the VLCM.

Manual maintenance

When automatic maintenance fails to correct a fault condition, the DMS-100 switch provides trouble indicators that reveal a fault. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and a failure of automatic maintenance. Maintenance personnel must clear the fault at the MAP terminal.

Subscriber lines manual maintenance

Subscriber lines that do not meet quality standards are identified to the switch operator. The failures appear at the line test position (LTP). Refer to *Input/Output System Reference Manual*, 297-1001-129. The system tests and corrects the identified automatic maintenance failures.

VLCM-related logs

Current PM and LINE logs apply to VLCM and VLCM lines. For additional information about these and other logs, refer to "Log Report Reference Manual."

VLCM-related operational measurements

The operational measurements (OM) group names that associate with the VLCM appear in this chapter. Refer to *Operational Measurements Reference Manual*, *Basic Administration Procedures*, 297-1001-300, and *Service Problem Analysis Administration Guide*, 297-1001-318.

Operational measurements (OM) are records of events that occur during a time period. Three basic types of measurements are available: peg counts, use, and overflow.

You can use operational measurements for:

- service-level indicators
- input for maintenance
- hardware and software assignment
- accounting and provisioning decisions

The OM groups that associate with the VLCM include PM, PMTYP, PM2 and PMSTAT. The PCM30 carrier is part of the OM group PCMCARR.

VLCM-related data structures

Data structures do not apply to the troubleshooting and maintenance of the VLCM.

VLCM-related user interface commands

This section describes how maintenance personnel can use the MAP system to support the VLCM. This section describes the correct MAP levels, system status displays, and menu and hidden commands.

This section provides general information about the MAP system and dual-shelf commands. The information assists maintenance personnel to troubleshoot and maintain VLCMs. For additional information, refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822.

> ***Note:*** A line group controller (PLGC) controls the VLCM. Maintenance that occurs on the host peripherals can affect the VLCM.

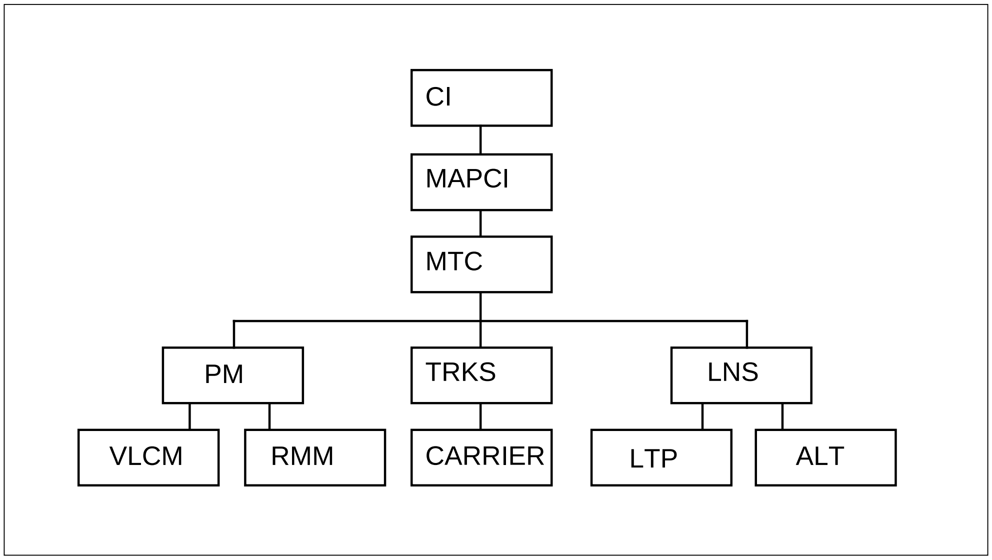
MAP user interface

The arrangement of information at the MAP terminal is in a ordered series of display levels. The first level is the command interpreter (CI) level. A user logging on at a MAP terminal accesses the CI level. At the CI level, the MAPCI command accesses the next lowest level. From the MAPCI level, the user can move to other levels.

Each level of the MAP system has a set of commands and system status displays. Each level can display and access information from a previous level. For example, the system can use some menu commands available at the PM level as hidden commands at the VLCM level. Status information that appears at the PM level appears as the user accesses lower levels.

The VLCM-related MAP system appears in Figure 34-3.

Figure 34-3 VLCM-related MAP levels



A working reference identifies VLCMs at the MAP terminal. This reference includes a working abbreviation of the PM type. This reference also includes a discrimination number that identifies the specified PM of that type.

The VLCM MAP display appears in figure

Figure 34-4 VLCM MAP display

```
       SysB    ManB    OffL    CBsy     ISTb    InSv
PM      1        3       5       7        6      12
VLCM    0        0       0       0        1       0

VLCM REM 00 0  InSv  Links  OOS: Cside 0  Pside 0
Unit0: Insv
Unit1: InSv

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

System status display

The first three lines of the system status display are common to levels of the MAP system.

These lines identify the maintenance state of the following:

- a subsystem that has defects
- the number of PMs in that maintenance state
- the alarm code for that maintenance state

If multiple faults occur, the system status display identifies the most important fault.

At the PM level, the system status display provides additional information on PM links and nodes. For VLCMs, the codes that the system uses the same codes at the PM level and the main level.

The maintenance states for VLCMs appear in table 34-2.

Table 34-2 VCLM maintenance states

Code	Description
•	Every PM is in service. Alarm conditions are not in effect.
Cbsy	The indicated number of PMs is C-side busy.
IsTb	The indicated number of PMs is in-service trouble. The fault is minor and does not affect the service or operations of the PM.
ManB	The indicated quantity of PMs is manually busy.
Offl	One or more manually busy PMs go offline.
SysB	The maintenance system detects a major fault that requires the system to take a PM out-of-service; system busy. An office parameter sets the percentage of the PMs that are system busy, that indicate a critical or major alarm.

Status codes for VLCM line drawers are like the status codes for other parts. The status codes for VLCM line drawers appear in table 34-3.

Table 34-3 VCLM maintenance states (Sheet 1 of 2)

Code	Description
•	In service
|	In service trouble
M	Manual busy
O	Offline

Table 34-3 VCLM maintenance states (Sheet 2 of 2)

Code	Description
S	System busy
-	Unequipped

For information on alarm codes for VLCMs, refer to the section "VLCM trouble isolation and correction" in this guide.

Circuit location display

For information on hardware, refer to CornerStone Voice Access Node manuals.

Menu commands

Each level of the maintenance system supports a different menu of commands. Each menu appears along the left side of system status displays. These commands are numbered and can include parameters. An underscore that follows a menu item indicates that a parameter is required as part of the entry. An underscore that precedes a menu item indicates an optional parameter.

You can enter menu commands at different MAP levels through one of the following methods:

- the number that precedes the menu item
- the item name, typed character by character, in upper or lower case letters

When you respond to a command prompt, enter a space before the menu item number.

If you have problems with the entry of a command, type and enter ABORT and enter the original command again. Enter HELP and the name of the command to obtain information about the syntax and parameters for a command type. If you make an error, the following message appears:

```
EITHER INCORRECT OPTIONAL PARAMETER(S) OR TOO MANY
PARAMETERS.
```

An explanation follows the message.

Table 34-4 lists and describes the menu commands available at the VLCM level. Enter the HELP command at the MAP terminal to obtain a description of command syntax.

Table 34-4 VLCM menu commands

PM command	Code	Description
BSY	Busy	Sets a posted VLCM to the manual busy state.
DISP	Display	Displays a set of VLCMs in a specified state.
OFFL	Offline	Sets a posted VLCM offline.
POST	Post	Posts an VLCM.
QUIT	Quit	Quits the VLCM level of the MAP terminal or cancels an VLCM selection
QUERYPM	Query PM	Displays information about a posted VLCM.
RTS	Return to service	Returns an VLCM to service.
TRNSL	Translate	Identifies the C-side links of a posted VLCM.

Additional information appears in the following sections.

TRNSL

This commandidentifies the central-side speech and message links, or peripheral-side links of a posted VLCM. The command also displays the status and type of the links. The translate, display and link codes appear in Table 34-5.

Table 34-5 Translate, display and line status codes (Sheet 1 of 2)

Code	Description
CAP	Capacity of the links as message and speech (MS) or speech (S)
MS	Message and speech
S	Speech
STATUS	State of the link as in-service, manual busy, system busy, or offline
OK	In service

Table 34-5 Translate, display and line status codes (Sheet 2 of 2)

Code	Description
CLS	Closed
OPN	Open
MTC	Maintenance - opened
SPCH	Speech open for message (MSG) links

VLCM trouble isolation and correction

This section provides general descriptions of the procedures to correct faults in the VLCM. This section also describes the fault isolation tests and diagnostic tests that support the VLCM.

This section provides general information to assist maintenance personnel to troubleshoot and maintain VLCMs. For additional or detailed information, refer to one of the following documents:

- "Operational Measurements Reference Manual
- "Log Report Reference Manual
- "Alarm and Performance Monitoring Procedures

Troubleshooting procedures

Trouble condition indicators

The following indicators indicate trouble conditions:

- operational measurements (OM)
- log reports
- alarms

Operational measurements

Operational measurements monitor and count events in the system. Operational measurements detect current and possible system troubles. The system can use OM thresholding feature to monitor and report key peripheral module (PM) activity. These reports normally occur every day or every week. These reports are the primary method of trouble detection.

Log reports

Logs, as an analysis tool, provide detailed information on call errors, diagnostic results, and system status. Logs also indicate trouble conditions like:

- a sudden increase in the volume of logs
- reports of messages that do not print
- a large number of the same type of logs

Alarms

Audible and visible alarms indicate that a problem requires correction. Correct routine system maintenance and use of OMs and logs can reduce the number of alarms.

The level of the alarm indicates the severity of the alarm and the need for corrective action. Alarms can be minor, major, or critical. Descriptions of the alarm codes appear in Table 34-6.

Table 34-6 Alarm Codes

Alarm	Map Display	Description
None	&0xb7;	Often indicates normal operations
Minor	(blank)	Often does not affect service
Major	M	Often indicates service degradation or threats to operations
Critical	C	Often indicates interrupted operations or potential interruptions to operations

To respond to alarms, follow these guidelines:

- More than one alarm of the same severity can appear on the MAP screen. Clear the alarms from the left to the right.
- If you clear an alarm and an alarm of greater severity occurs, respond to the new alarm. Do not attempt to continue to clear the less severe alarm.

For alarm clearing procedures, refer to *Alarm and Performance Monitoring Procedures*.

Locating and clearing faults

The standard procedure with which to isolate and clear faults follows:

1 Silence audible alarms.

2 To isolate the fault, read status displays and trace fault codes to the menu level needed to clear the fault.

3 Manually busy the hardware to remove system access to the defective part. This action allows maintenance activity to occur without system interference.

4 Return the hardware to service.

The summaries for the trouble isolation and correction procedures for specified VLCM faults appear in the following sections. These summaries provide background information for maintenance personnel to use to maintain the VLCM. Always refer to specified step-by-step documents.

Recovering a VLCM after a switch goes down

When a switching system goes down, recover the operation of the system immediately. With feature package NTX270, the maintenance actions that help to recover the VLCMs include:

- use the parameter pm_type of the next command to specify the type of PM in the posted set
- use all to manually return the VLCMs that remain to service

Handling a E1 link that has faults

Perform the following procedure to correct a E1 link that has defects:

1 Post the VLCM.

2 Determine fault indicators are present.

3 Display central-side links.

4 Post the host XMS-based peripheral module (XPM) and determine the PM state of the host XPM.

5 If the host XPM is in-service, display P-side links, busy, test, and return to service the host XPM.

6 If the host XPM is in the in-service trouble state, busy and test host PM in search of the card list.

7 Perform the correct card replacement procedures.

8 Return to service the host XPM.

> ***Note:*** If these procedures fail to correct the E1 link that has defects, check the physical E1 connection on the VLCM and the host XPM. A bad E1 connection can generate alarms in the PM and LNS subsystems. The connection that has defects can prevent documented procedures from clearing the alarm.

Lines maintenance

Tests of line circuits (LC), subscriber loops, and stations occur under the lines maintenance subsystem (LNS). The system can test line circuits and subscriber loops. The switch operator can test line circuits and subscriber loops manually.

Line tests help determine if an LC loop, or LC and loop combination function properly. When a line contains a fault, line tests can determine if the fault is in the LC or the attached loop. When a fault is in the loop, the fault often refers to another department; for example, plant maintenance. When the fault is in the LC, personnel replace the line card. The system tests the line again to verify that the fault clears.

Manual line testing

The switch operator performs manual line tests on LC, loops, and stations. The switch operator tests line circuits and loops separately. After the tests are complete, the switch operator receives the results of the test at a visual display unit.

The switch operator tests lines manually as part of routine maintenance or when the system generates a customer report. Manual line testing occurs at the line test position (LTP) level through the LTP level of the LNS subsystem.

Automatic line testing

The system performs automatic line tests on line circuits and loops. The tests follow a schedule. The system performs the tests without switch operator involvement, except for initial scheduling. The system also performs automatic line tests when a fault appears on a line.

The system performs automatic line testing in a DMS-100 switch office under the LNS subsystem. The tests include tests of line circuits and the attached loops.

Lines that fail to meet certain standards of quality are identified to the switch operator. The failures appear at the LTP or the ALT log subsystem generates output reports. The switch operator tests the failures manually and corrects the failures.

Line maintenance personnel can also enter data in table ALTSCHED (Automatic Line Testing Schedule) to define the test parameters for automatic line testing procedures. The tests occur without interference by maintenance personnel.

> ***Note:*** The VLCM lines do not support ALT-level menu commands. If maintenance personnel attempt to enter data in table ALTSCHED with a VLCM line, the following error message displays:

```
ALT command is not valid for VLCM lines
```

This message also appears if maintenance personnel attempt to use an ALT-level command on a VLCM line.

35 Link peripheral processor

This document provides maintenance information on some of the DMS-100 peripheral modules (PM) that reside in the host office. This guide written for qualified maintenance personnel, provides background information to assist in troubleshooting and maintaining these PMs.

This guide provides information on four types of PMs: single-shelf PMs, two-shelf PMs, the line concentrating module (LCM), and the link peripheral processor (LPP). The following chapters describe maintenance activities for the LPP and LPP PMs.

Chapter 36 through 45 provide the following information:

- Chapter 36, "LPP maintenance overview," describes the basic maintenance strategy for the LPP and LPP PMs. Chapter 35 describes the functions and potential fault conditions associated with the LPP. Chapter 36 also identifies audits and system actions that attempt to correct these fault conditions, and the chapter explains when activities should be escalated to manual maintenance.
- Chapter 37, "LPP preventive maintenance methods," describes the routine maintenance procedures and schedules for the LPP.
- Chapter 38, "LPP related logs," identifies the logs that may be generated for the LPP.
- Chapter 39, "LPP related operational measurements," identifies the operational measurement group names associated with the LPP.
- Chapter 40, "LPP related data structures," identifies the data structures associated with the LPP.
- Chapter 41, "LPP related user interface commands," describes how maintenance personnel might use the MAP system to support the LPP. The chapter describes appropriate MAP levels, system status displays, and menu commands.
- Chapter 42, "LPP related card requirements," provides background on card replacement procedures for the LPP.

- Chapter 43, "LPP trouble isolation and correction," provides descriptions of the procedures to correct faults in the LPP. The chapter also describes fault isolation tests and diagnostic tests that can be used to support the LPP.
- Chapter 44, "LPP troubleshooting chart," is a high-level table that lists symptoms of LPP faults, possible causes of these faults, and actions that can be taken to correct them.
- Chapter 45, "LPP advanced troubleshooting procedures," describes in detail the procedures to resolve more complex faults in the LPP.

36 LPP maintenance overview

This chapter provides the maintenance plan for the link peripheral processor (LPP). The chapter provides qualified maintenance personnel with background information to use in troubleshooting and maintaining the LPP and its components.

A list of the sections in this chapter follows along with a description of the type of information in each section.

- The section "Functional description" describes the configurations, components, and cards of the LPP. It describes how the LPP and its peripheral modules (PM) interact with other DMS-100 Family switch components.
- The section "Fault conditions" describes hardware and software faults possible with the LPP and related components.
- The section "Automatic maintenance" describes the actions the system takes to diagnose and repair these faults.
- The section "Increase to manual maintenance" describes the rationale for handling maintenance manually.

> ***Note:*** This guide discusses general LPP configurations and maintenance requirements. Qualified maintenance personnel can apply these general descriptions to the configurations of the LPPs in their switch.

Operating description

Link peripheral processor

The link peripheral processor (LPP) is not a PM. The LPP is a modular equipment package that consists of small, processor-based PMs. The LPP PMs, working separately or together, create a single platform. This single platform (the LPP) supports a wide range of advanced applications and services. Some of the support provided by LPP PMs involve the following:

- provide voice services for call-processing applications like an Automated Directory Assistance Service (ADAS) and DMS-100 Mail
- support frame relay and X.25/X.75/X.75' packet handling applications, like a DMS Packet Handler and DataSPAN
- support Common Channel Signaling 7 (CCS7) nodes and signaling links, like a service switching point (SSP), signaling transfer point (STP), and service control point (SCP)
- interface with local area networks (LAN) for integrated operations, administration, and maintenance (OAM) functions

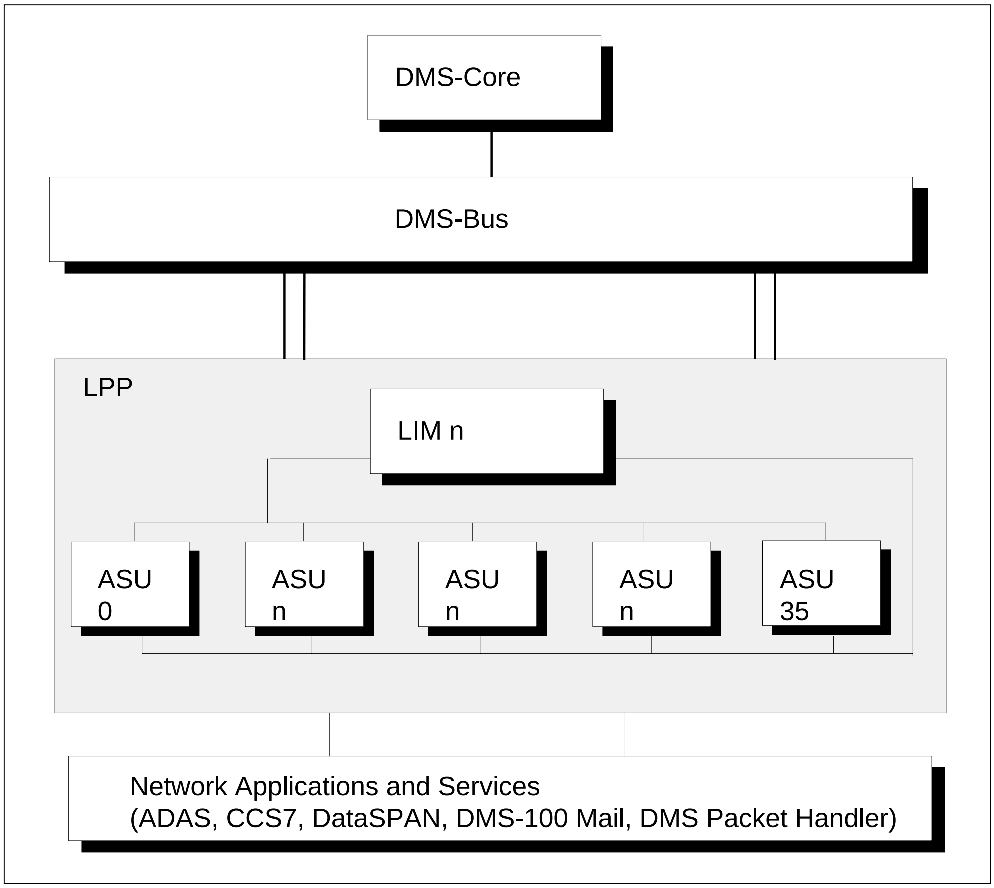
Each switch contains an LPP to support an application or service or a group of applications or services. An LPP that supports CCS7, for example, is different from an LPP that supports DataSPAN. A single DMS-100 Family switch can support up to 17 LPPs.

> ***Note:*** Maintenance is not performed on the LPP. The LPP is an equipment package and not a physical entity. PMs receive the maintenance direct through the MS or PM levels of the MAP system.

Each LPP has two types of PMs: link interface modules (LIM) and application-specific units (ASU). The composition of the LIM depends on the LPP configuration. Both the types and number of ASUs depend on the applications and services supported by that LPP.

Figure 36-1 illustrates the operating structure of the LPP.

Figure 36-1 LPP operating structure



Link interface module

The link interface module (LIM), like the LPP, is an equipment package and not a physical component. But, the components are maintained and accessed through the MAP terminal as a entity, like a LIM 12.

The LIM consists of two PMs. The duplicated local message switches (LMS), identified as units of the LIM is the first PM. The duplicated frame transport buses (F-bus) is the second PM. LIM unit 0 (LMS 0) has a dedicated F-bus 0 (LMS 0). LIM unit 1 (LMS 1) has a dedicated F-bus 1. The LIM units serve as the communications hub, supporting messaging within the LPP and between the LPP and the switch. The F-buses connect the LIM units and the ASUs

> ***Note:*** The terms *LPP* and *LIM* are not equal. *LPP* refers to the LIM and ASUs. *LIM* refers only to the duplicated local message switches (LMS) and frame transport bus (F-bus) units. The terms *LIM unit* and *LMS* are equal.

Application specific unit

Application specific units (ASU) are a group of hardware and software components that support a function for a particular application or service. Each ASU works separately or together with other ASUs or PMs.

Table 36-1 lists the seven types of ASUs that the LPP support. The LPP shares standards with the ASUs, each ASU has different functions and maintenance requirements.

Table 36-1 Types of ASUs (Sheet 1 of 2)

ASU	Description
Application processor unit (APU)	The APU provides a voice processing environment for voice service call processing, like an ADAS and DMS-100 Mail
CCS7 link interface unit (LIU7)	The LIU7 processes the CCS7 messages that enter and leave an LPP through an individual signaling link
Ethernet interface unit (EIU)	The EIU connects the switch to an Ethernet-based LAN and supports several applications and services
Ethernet link interface unit (ELIU)	Combines the use of the LIU7 and the EIU. The ELIU, which uses existing computing module and EIU hardware, is one end of a virtual CCS7 link. The ELIU enables CCS7 messages to be exchanged with the ServiceBuilder SCP over an Ethernet local area network. The ELIU generates transmission control protocol/internet protocol (TCP/IP) messages.
Frame relay interface unit (FRIU)	The FRIU provides the physical connection for T1 carriers at the LPP to support DataSPAN frame relay services
Network interface unit (NIU)	The NIU provides channelized access for several types of applications and services. An NIU is a duplicated, warm-spared unit that transfers data between the DMS network and the C-bus.
X.25 link interface unit (XLIU)	The XLIU provides protocol processing for DMS Packet Handler

Table 36-1 Types of ASUs (Sheet 2 of 2)

ASU	Description
Voice processing unit (VPU)	Supports voice service call processing applications, like ADAS and DMS-100 Mail. The VPU verifies call quality, records responses, and removes any first or final silences in the recording.

Additional information on the functions of each type of ASU begins on page 36-25. Refer to page 36-46 for more information on LPP-supported applications and services.

> ***Note:*** The link interface unit (LIU) is a type of ASU that enables the switch to interface with an outside network or service. The LIU7, EIU, ELIU, FRIU, NIU, and XLIU are LIUs. All LIUs are ASUs, but not all ASUs are LIUs.

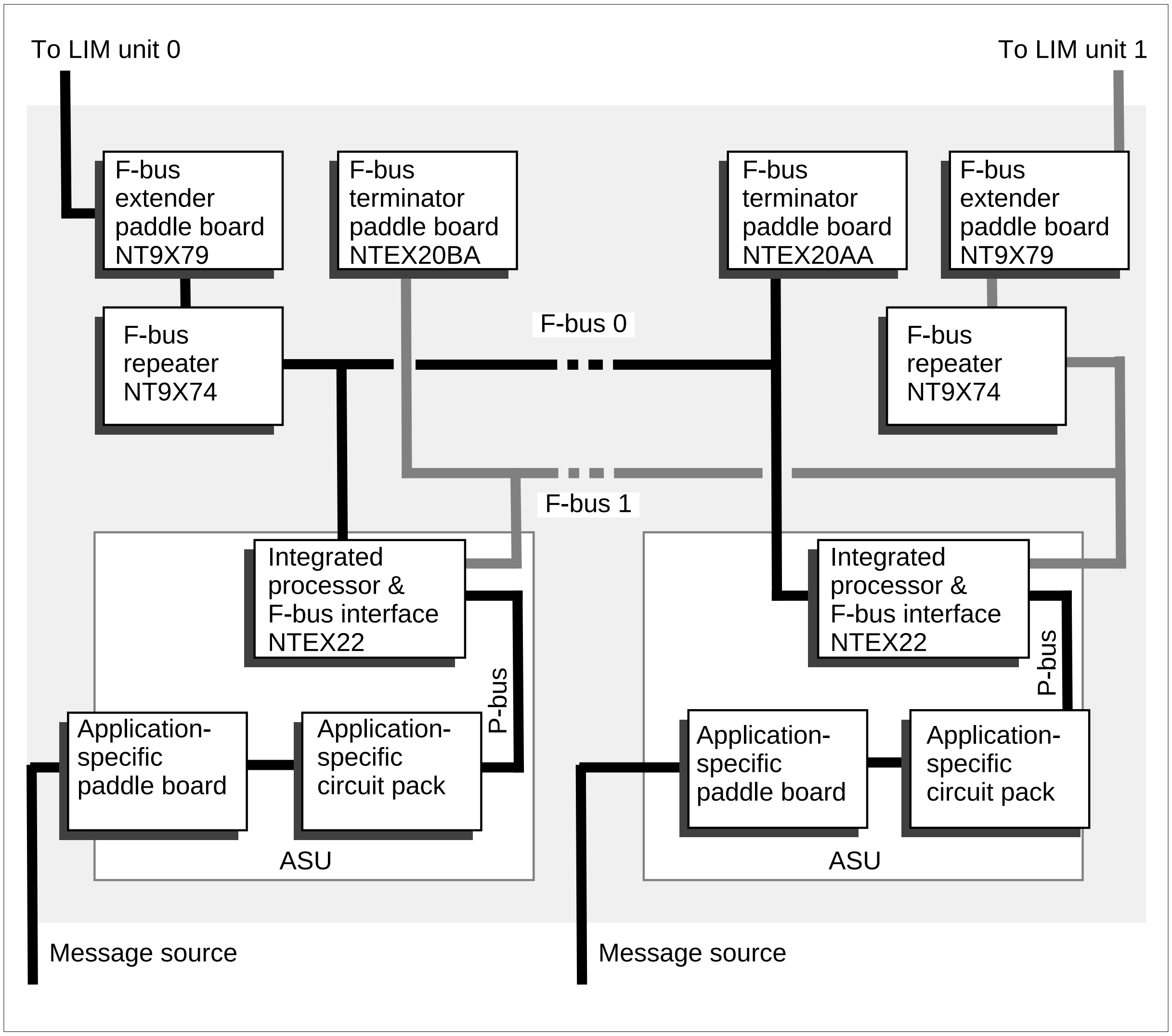
Link interface shelves (LIS) normally contain ASUs. A single LIS can hold a maximum of 12 ASUs and the same shelf can contain different types of ASUs.

The NT9X30 +5V power supply modules located on each end of the shelf provide power for each LIS. Each power supply module provides power for up to six ASU slots. The LIS can also be equipped with NTDX16 power converters which provide power redundancy.

A two-slot ASU requires two slots on the LIS, and consists of an integrated processor/F-bus circuit pack, an application circuit pack, and an application paddleboard.

Figure 36-2 illustrates the F-bus connection of a normal two-slot ASU.

Figure 36-2 F-bus connection to a two-slot ASU



Differences between the LPP and other PMs

The PMs in the LPP are different from other PMs. Compared to different PMs, LPP PMs are not large. The LPP PMs reside on a single DMS SuperNode shelf, and some consist of only two circuit packs and a paddleboard. The same shelf can contain an ASU that supports CCS7 as an ASU supporting frame relay.

The LPP PMs run in a different way from other PMs. Some LPP PMs are two-unit PMs that operate in load-sharing mode. Both units can handle traffic during normal operations, but either unit has the capacity to handle the full traffic load. If one unit fails, the second unit automatically takes over the full traffic load. Other LPP PMs are single-unit PMs that are in 77pairs. These LPP

PMs operate in either load-sharing or hot-standby mode. Other LPP PMs are single-unit PMs that operate in simplex without provisions for redundancy.

The operating design of the LPP is different from the operating design of other PMs. Most PMs are linked to the processing platform of the switch through the switching matrix. The switch in DMS-100 SuperNode switches is either the Enhanced Network (ENET) or the Dual-Shelf Network (DSN). The LPP, is linked to the processing platform through the messaging component, which in DMS-100 SuperNode switches is the DMS-Bus.

LPP DMS SuperNode configurations

Two LPP DMS SuperNode configurations are present: a full-sized LPP and a single-shelf LPP. While maintenance procedures are the same for each configuration, the functions of the PMs are different. Descriptions and figures for each configuration follow.

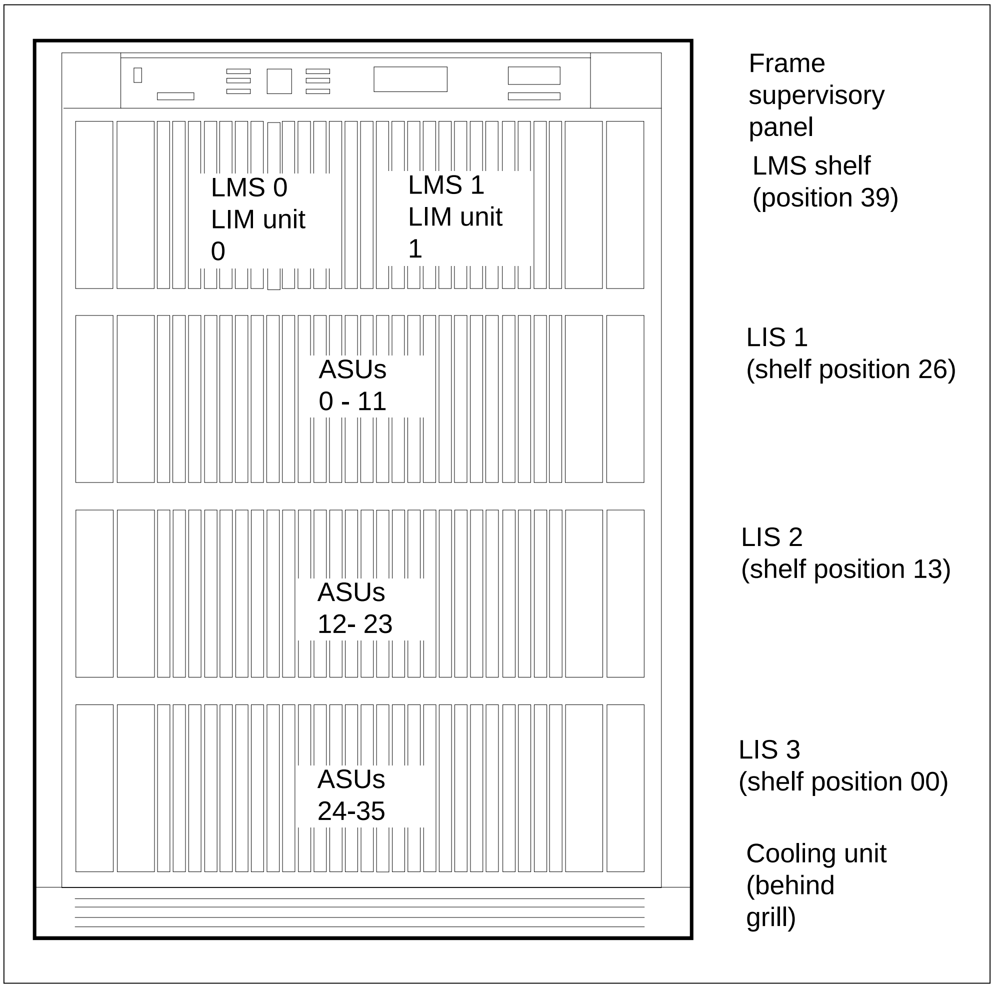
> ***Note:*** Different LPP configurations for DMS SuperNode SE swiches exist. The DMS SuperNode SE is a smaller version of DMS SuperNode that normally supports small offices with up to 20,000 lines. Refer to page 36-12 of this guide for information on LPP SuperNode SE configurations.

Full-sized LPP in DMS SuperNode

A full-sized LPP occupies a complete LPP cabinet (NT9X70AA/BA), which is a standard SuperNode-type equipment cabinet. The LPP consists of a single LIM (with duplicated LMS and F-bus units) and up to three LISs. Each LIS can hold a maximum of 12 ASUs. A full-sized LPP can hold a maximum of 36 ASUs.

Figure 36-3 illustrates the layout of a full-sized LPP cabinet.

Figure 36-3 Layout of full-sized LPP



Common components in the cabinet can power the shelf. The common components are the frame supervisory panel (FSP) and the core cooling unit. The FSP accepts the battery feed and ground return from the power distribution center and distributes power to the shelves in the LPP. The LPP houses the FSP in the top shelf of the cabinet, while other PM cabinets house the FSP in the middle shelf. The core cooling unit provides the mechanical ventilation for the equipment housed in the cabinet.

Each full-sized LPP contains a single LIM, identified at the MAP terminal by number, such as LIM 12. A SuperNode cabinet can support one full-sized LPP, but a DMS SuperNode switch can support up to 17 LPPs.

Duplicate DS30 links support message signaling between the LPP and the DMS-Bus. DS30 links are 10-bit, 32-channel, 2.048 megabits per second

(Mbps) links. The two DS30 links connect each LIM unit to each DMS-Bus plane.

The following buses support communications for a full-sized LPP:

- Frame transport bus (F-bus), which supports communication between the LIM units and the ASUs
- Processor bus (P-bus), which supports communications between cards in a LIM unit or an ASU
- Channel bus (C-bus), which supports channelized access between ASUs on a single LIS
- DS30 voice links, which provide a direct link between the DMS SuperNode switching matrix and a type of ASU called a network interface unit (NIU)
- Transaction bus (T-bus), which supports logical-to-physical address mapping between the LIM unit and the DMS-Bus

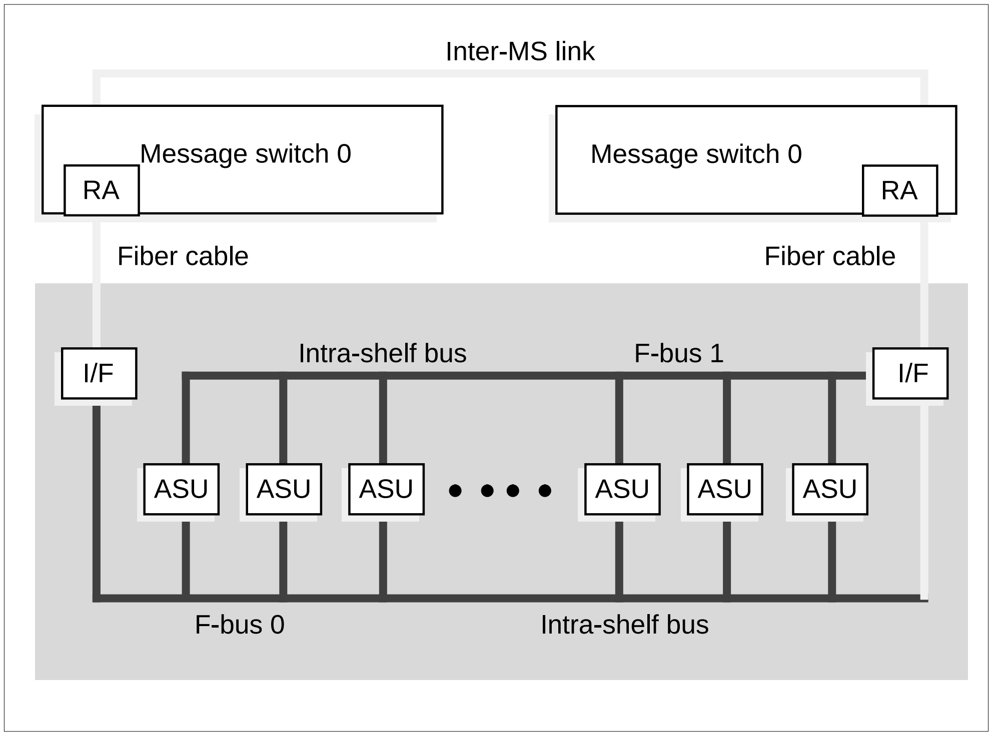
Single-shelf LPP in DMS SuperNode

The single-shelf LPP design is for smaller switching offices that do not require a large number of ASUs. The single-shelf consists of a duplicated F-bus and up to two LISs.

An important architectural difference exists between a single-shelf LPP and a full-size LPP. The single-shelf LPP has a direct fiber interface between the LIS and the DMS-Bus. The LIM consists only of the duplicated F-bus, and a resident rate adapter (RA) in the message switch provides LPP functionality to the system.

Figure 36-4 illustrates the operating structure of a single-shelf LPP.

Figure 36-4 Operating structure of single-shelf LPP

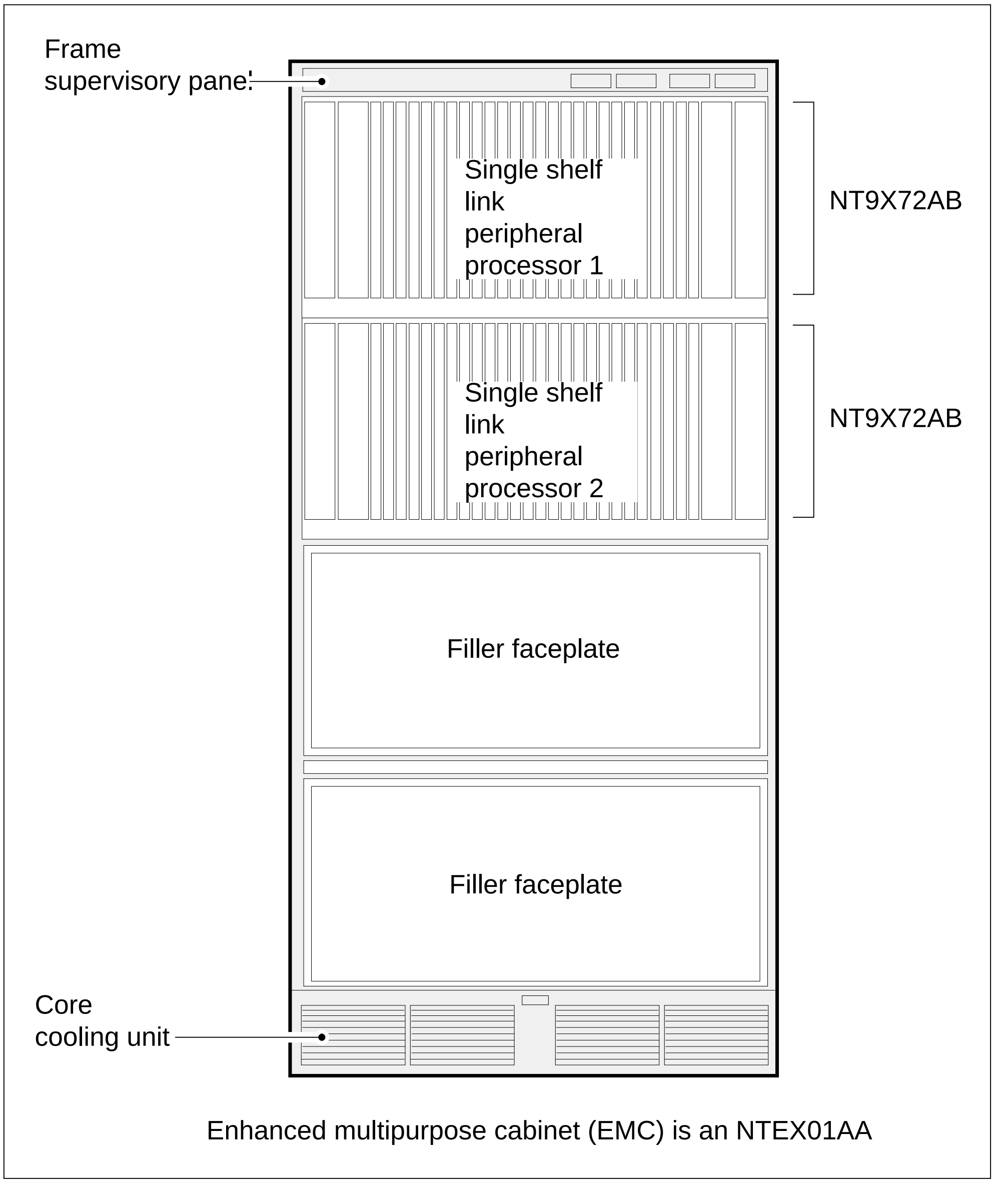


Buses that support internal and external communications in a full-sized LPP include the following:

- Frame transport bus (F-bus), which supports communication between the LIM units and the ASUs
- Processor bus (P-bus), which supports communications between cards in a LIM unit or an ASU
- Channel bus (C-bus), which supports channelized access between ASUs on a single LIS
- DS512, which is the fiber optic interface to the DMS-Bus in a single-shelf LPP
- Transaction bus (T-bus), which supports logical-to-physical address mapping between the LIM unit and the DMS-Bus
- DS30 voice links, which provide a direct link between the DMS SuperNode switching matrix and a type of ASU called a network interface unit (NIU)

In DMS SuperNode switches, the single-shelf LPP is mounted in one of the top two shelves of an enhanced multipurpose cabinet (EMC). Figure 36-5 illustrates an EMC provisioned with two single-shelf LPPs.

Figure 36-5 EMC provisioned with two single-shelf LPPs



Each shelf supports 12 ASUs. NT9X30 +5V and NT9X31 -5V power supplies power the shelf. NTDX16 power supply units that provide both operating voltages (+5V and -5V), and redundant power capability can also power the shelf.

LPP DMS SuperNode SE configuration

The DMS SuperNode SE system combines the core elements of the DMS SuperNode structure in a single cabinet. DMS SuperNode SE switches provide LPP functionality with the methods that follow:

- on a Enhanced Network and interface (ENI) shelf in a SuperNode combined core (SCC) cabinet
- on a single LIS in a SCC cabinet

While maintenance procedures are the same for each configuration, the functions of the PMs are different. Descriptions and illustrations for each configuration follow.

ENI shelf in DMS SuperNode SE

The Enhanced Network (ENET) is a non-blocking, junctorless, full availability, single-stage timeswitch that provides voice and data connections between PMs and message paths to the DMS-Bus. The DMS SuperNode SE system provides the option of ENET on a single ENI shelf. With ENET provisioned, the ENI shelf can support two ASUs, normally CCS7 link interface units (LIU7).

The ENI shelf is optional, all DMS SuperNode SE cabinets are initially provisioned with the ENI shelf assembly. When shelf functionality is not required, blank filler panels are used to satisfy forced air cooling requirements.

LIS in DMS SuperNode SE

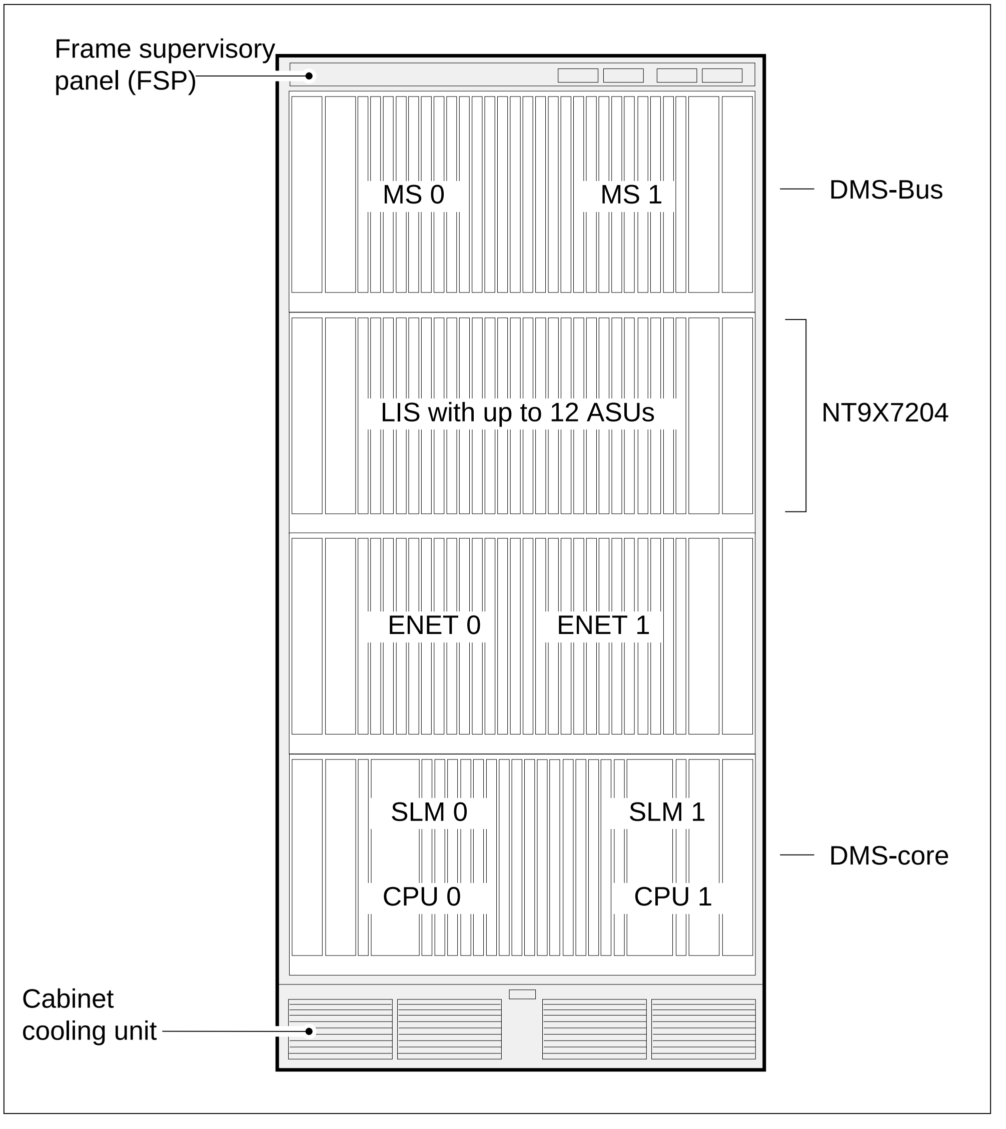
When a DMS SuperNode SE switch requires more than two ASUs, a single LIS can be provisioned in an SCC cabinet. Up to 12 ASUs can be located on a single LIS.

Although the LIS is optional, all DMS SuperNode SE systems are initially provisioned with the LIS assembly. Blank filler panels are used when shelf functionality is not required.

Power for the LIS is provided by NT9X30 +5V power supply modules located on each end of the shelf. Each power supply module provides power for up to six ASU slots. The LIS can also be equipped with NTDX16 power converters which provide power redundancy.

Figure 36-6 illustrates an SCC equipped for one LIS.

Figure 36-6 SCC provisioned with one LIS



Link interface module in full-sized LPP

The link interface module (LIM) is the communications hub for the LPP, controlling messaging among LPP components and between the LPP and the DMS-Bus. Like the LPP, the LIM is an equipment package. The LIM consists of duplicated local message switches (LMS) and frame transport buses (F-bus).

Some specific functions of the LIM include the following:

- maintains DS30 links with the DMS-Bus
- supports F-bus link with ASUs

- transfers messages between the ASUs and DMS-Bus
- reports status information to the DMS-Core for inclusion in MAP displays and alarms, log reports, and operational measurements
- detects and isolates faults in the F-bus
- detects faults in ASUs, performs diagnostics, and takes the ASU out-of-service if necessary

Each LIM contains duplicated LMS units: LMS 0 and LMS 1. These are identified at the MAP terminal as LIM Unit 0 and Unit 1. These units reside in tandem in the top shelf of the LPP cabinet.

The two LIM units normally operate in a load-sharing mode, but each unit can process the full messaging load if one unit fails. Failure of an entire LIM would indicate that both LIM units had failed.

Communications paths for the LIM in a full-shelf LPP

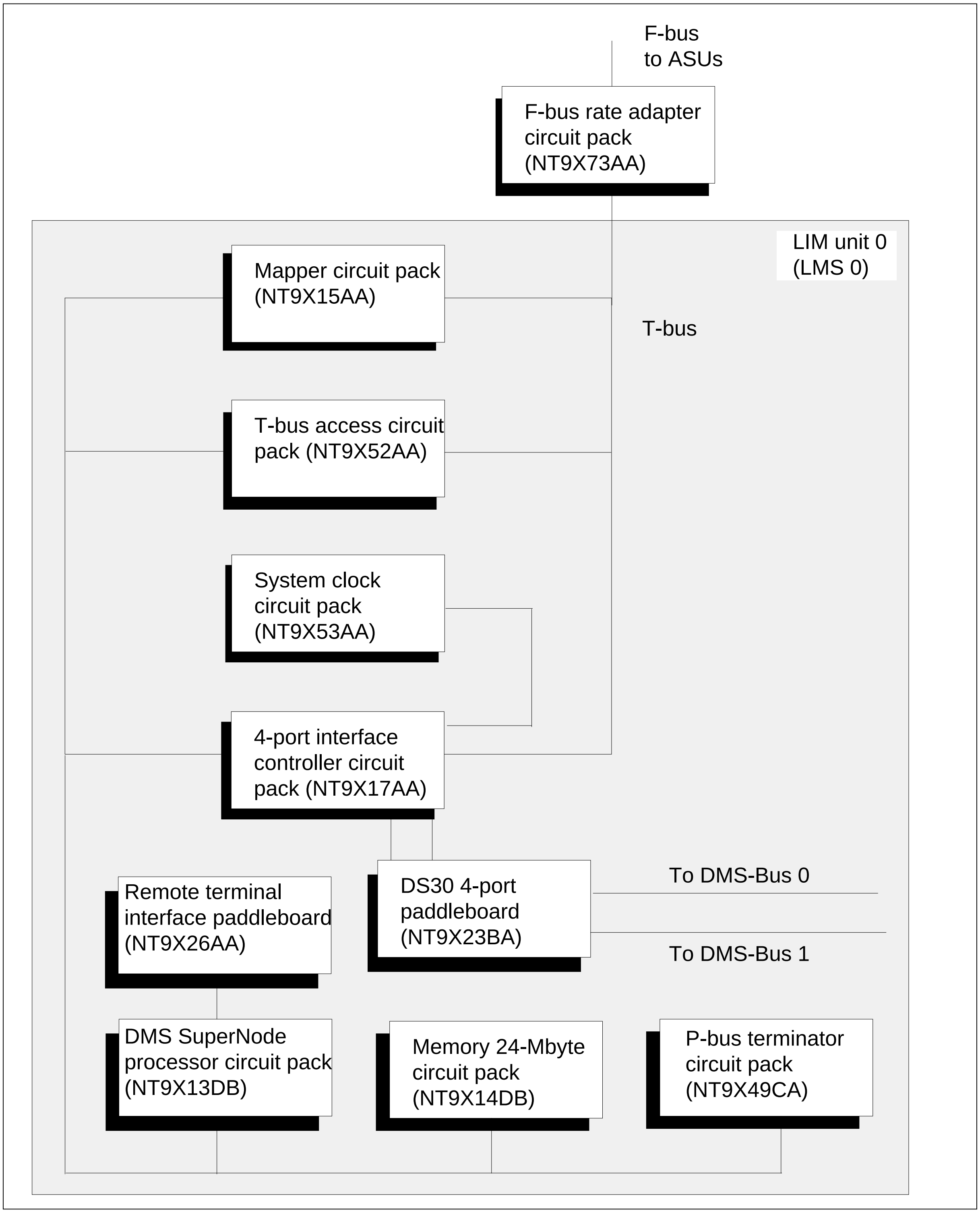
In addition to the two DS30 links that connect each LIM unit to each DMS-Bus plane, duplicate DS30 links also connect the two LIM units. If both links to a DMS-Bus plane fail, these cross links allow the LIM to transmit through the DMS-Bus links of its mate.

Two USART RS-232 links connect the LIM units. This cross-link is only used for maintenance-related messaging between the two LIM units. If one LIM unit fails, the USART link allows maintenance personnel to access the defective unit through its mate and troubleshoot the fault.

The F-bus provides LPP communications, allowing the LIM to communicate with its ASUs. Each LIM unit has a tap to both F-buses. Each LIM unit has two taps to every ASU in its cabinet.

Figure 36-7 illustrates the operating structure and key components of a LIM unit in a full-sized LPP.

Figure 36-7 Functional architecture of a LIM in full-sized LPP



LIM cards in a full-sized LPP

Table 36-2 lists the cards that comprise each LIM unit in a full-sized LPP. All cards except the power converter are on the LMS shelf.

Table 36-2 Cards for each LIM unit in a full-sized LPP (Sheet 1 of 2)

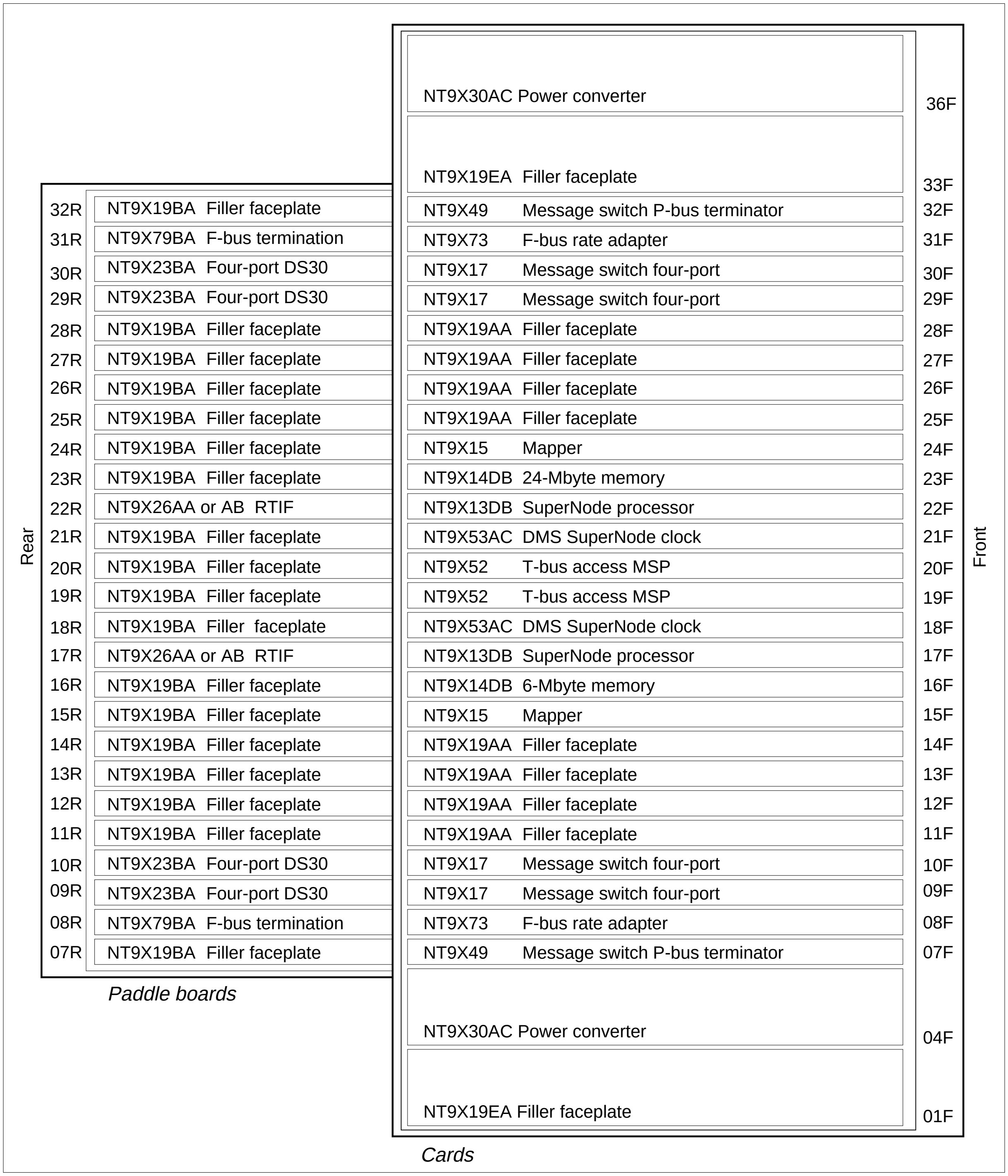
Card	# cards per unit	Description
DMS SuperNode processor circuit pack (NT9X13DB)	1	Performs diagnostic and routine maintenance on PMs, accepts and reloads program and database updates from DMS-Core, configures and maintains other LMS cards. Includes Motorola 68020 processor and one MB co-resident memory.
Memory 24-Mbyte circuit pack (NT9X14BB)	1	Provides software storage for processor card. Contains three 8-Mbyte memory modules.
Mapper circuit pack (NT9X15AA)	1	Performs logical-to-physical address translation.
F-bus rate adapter circuit pack (NT9X73AA)	1	Converts signals from 32-bit T-bus to 8-bit rate of F-bus.
4-port interface controller circuit pack (NT9X17AA)	2	Controls DS30 4-port paddleboards.
DS30 4-port paddleboard (NT9X23BA)	2	Provides C-side DS30 ports.
Remote terminal interface paddleboard (NT9X26AA)	1	Monitors and decodes commands and passes them to LMSP as control signals. Supports USART link between LIM units.
+5 volt power converter circuit pack (NT9X30AA)	1	Housed on each LPP shelf. Provides operating voltage to the cards on one half of the shelf.
P-bus terminator circuit pack (NT9X49CA)	1	Provides passive termination of bus signals.

Table 36-2 Cards for each LIM unit in a full-sized LPP (Sheet 2 of 2)

Card	# cards per unit	Description
T-bus access circuit pack (NT9X52AA)	1	Provides 32-bit wide bus that carries LMS message traffic.
System clock circuit pack (NT9X53AA)	1	System time source for LIM unit. Contains a stratum 3 digital phase locked loop that provides 10.14 MHz system clocks. Slaved to/from the DMS-Bus clock by DS30 links.

Figure 36-8 illustrates a normal LMS shelf layout for a full-sized LPP. This layout includes LIM unit 0 (LMS 0) and LIM unit 1 (LMS 1). Filler faceplates (NT9X19) are inserted in empty slots.

Figure 36-8 Layout of LMS shelf in full-sized LPP



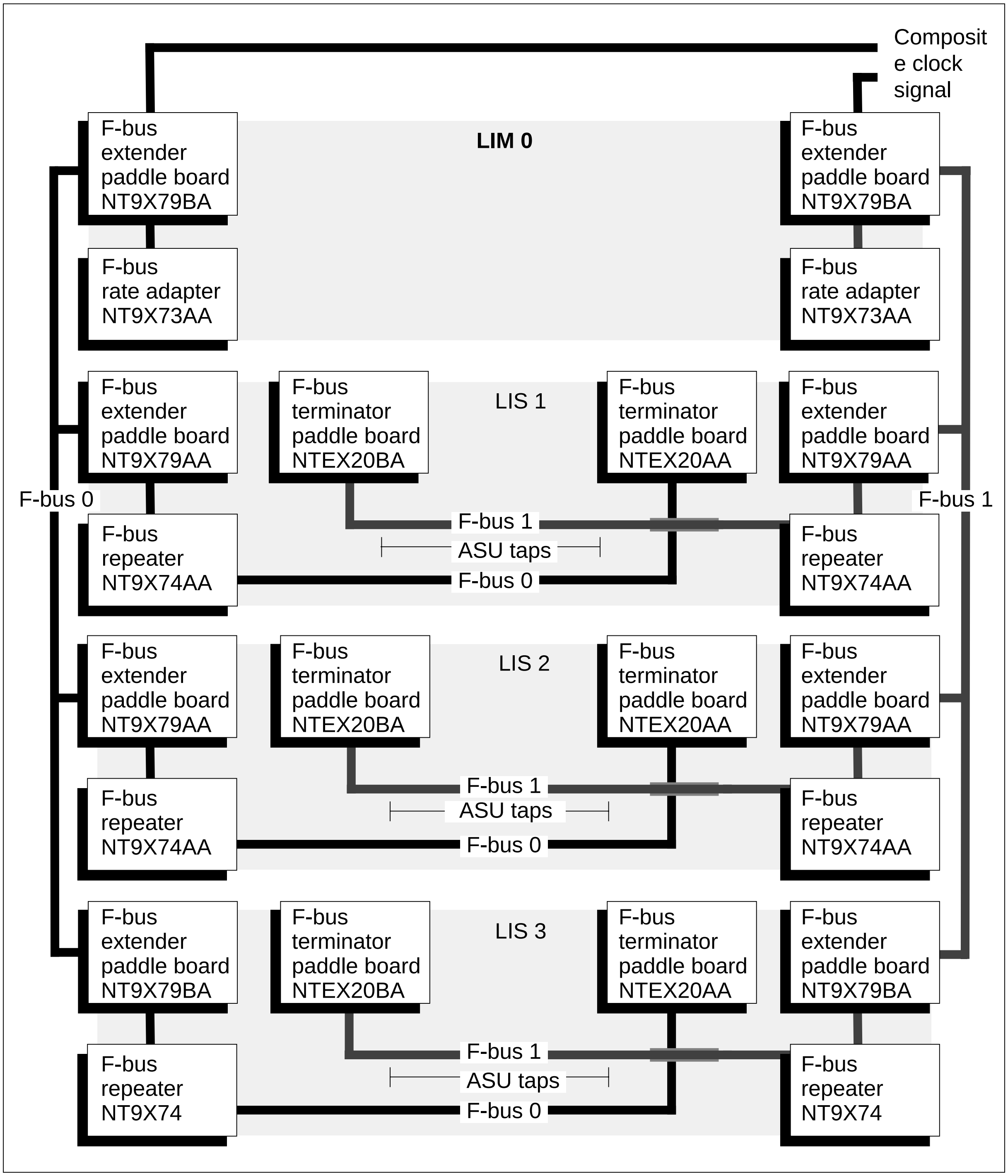
Frame transport bus in full-sized LPP

The frame transport bus (F-bus) connects each LIM unit with a maximum of 36 ASUs. The f-bus has duplicates in two units, F-bus 0 and F-bus 1, with one F-bus dedicated to each LIM unit. Each F-bus normally operates in a load-sharing mode. In the event of failure either plane can handle the complete volume of traffic for that LIM unit.

The rate adapter card in the LIM unit is the master of the F-bus. The rate adapter also provides the LIM unit with access to the F-bus. It converts signals from the 8-bit rate of the F-bus to the 32-bit rate of the P-bus.

Figure 36-9 illustrates the operating structure of the F-bus in a full-sized LPP.

Figure 36-9 F-bus operating structure in a full-sized LPP



A bus consists of a maximum two types of resources: taps and a medium. A tap is the access to the bus. The F-bus tap in a full-sized LPP includes the rate adapter and PFI cards. The medium is the F-bus and includes the repeaters and terminators.

F-bus cards in a full-sized LPP

Table 36-3 describes the cards that comprise the F-bus in a full-sized LPP. These cards are housed on the LMS shelf and on each LIS.

Table 36-3 F-bus cards in a full-sized LPP

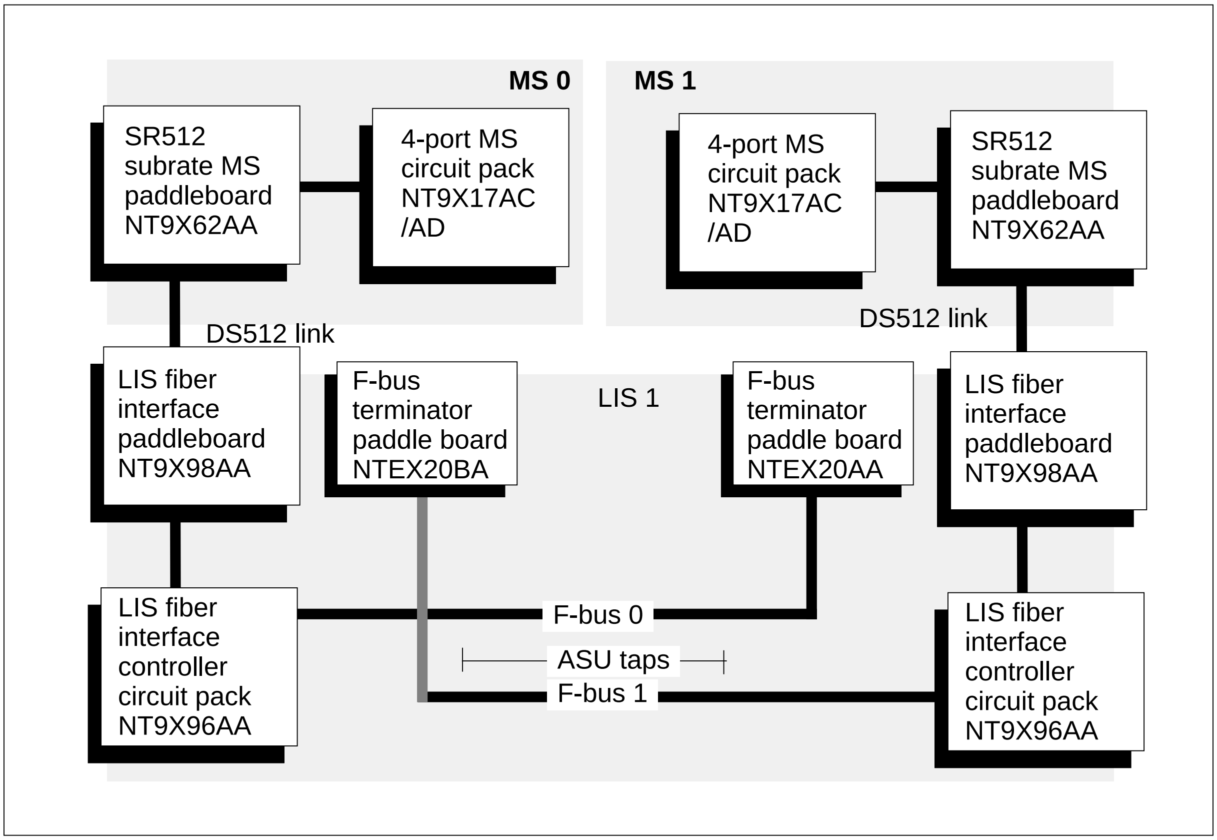
Card	Description
F-bus/C-bus termination circuit pack (NTEX20AA/BA)	Terminates intra-shelf segment of F-bus. NTEX20AA terminates F-bus 0 and C-bus 0, and NTEX20BA terminates F-bus 1 and C-bus 1.
F-bus repeater circuit pack (NT9X74AA)	Extends F-bus from LIM to each LIS. Each plane requires a repeater card for each LIS.
F-bus extension paddleboard (NT9X79AA/BA)	One NT9X79BA is used on each F-bus plane on both the top and bottom LPP shelf to extend and terminate the F-bus signal. One NT9X79AA is used on each middle LPP shelf to extend the F-bus signal.

Frame transport bus in single-shelf LPP

The frame transport bus (F-bus) connects a maximum of 12 ASUs in a single-shelf LPP. Duplicated into two planes, F-bus 0 and F-bus 1, each F-bus plane normally operates in a load-sharing mode. In the event of failure either plane can handle the complete volume of traffic.

Figure 36-10 illustrates the operating structure of the F-bus in a single-shelf LPP.

Figure 36-10 Operating structure of single-shelf LPP



The LIS F-bus controller card (NT9X96AA) circuit pack and LIS fiber interface paddle board (NT9X98AA) provide a direct link by fiber cable between the LIS and the DMS-Bus. A resident rate adapter in the Message Switch provides LPP functionality in the DMS SuperNode SE.

Table 36-4 describes the cards that comprise the F-bus.

Table 36-4 F-bus cards in a single-shelf LPP (Sheet 1 of 2)

Card	Description
F-bus/C-bus termination circuit pack (NTEX20AA/BA)	Terminates intra-shelf segment of F-bus. NTEX20AA terminates F-bus 0 and C-bus 0, and NTEX20BA terminates F-bus 1 and C-bus 1.

Table 36-4 F-bus cards in a single-shelf LPP (Sheet 2 of 2)

Card	Description
LIS fiber interface controller circuit pack (NT9X96AA)	Handles messaging between the ASUs and provides shelf control.
LIS fiber interface paddleboard (NT9X98AA)	Provides direct interface of F-bus to fiber optic link. Provides system clock and out-of-band reception.

Frame transport bus in an ENI shelf (DMS SuperNode SE)

A maximum of 2 ASUs are on an ENI shelf in a DMS SuperNode SE switch. , The shelf requires additional components to house these ASUs. Table 36-5 lists and describes the additional components.

Table 36-5 Required components to support ASUs on ENI shelf

PEC	Component
NT9X74CA	F-bus repeater card
NT9X79BA	F-bus extender paddle board
NTEX20AA	F-bus A terminator paddle board
NTEX20BA	F-bus B terminator paddle board

Refer to the *DMS SuperNode SE Product Guide*, 297-5301-010 for additional information on the ENI shelf.

Frame transport bus in an LIS (DMS SuperNode SE)

Table 36-6 lists and describes the F-bus cards required by an LIS in a SuperNode SE.

Table 36-6 F-bus cards in an LIS (DMS SuperNode SE

Card	Description
F-bus/C-bus termination circuit pack (NTEX20AA/BA)	Terminates intra-shelf segment of F-bus. NTEX20AA terminates F-bus 0 and C-bus 0, and NTEX20BA terminates F-bus 1 and C-bus 1.
F-bus repeater circuit pack (NT9X74AA)	Extends F-bus from LIM to each LIS. Each plane requires a repeater card for each LIS.
F-bus extension paddleboard (NT9X79AA/BA)	One NT9X79BA is used on each F-bus plane on both the top and bottom LPP shelf to extends and terminates the F-bus signal. One NT9X79AA is used on each middle LPP shelf to extend the F-bus signal.

Refer to the *DMS SuperNode SE Product Guide*, 297-5301-010 for additional information on the LIS in a DMS SuperNode SE.

Application processor unit

The application processor unit (APU) is functionally different from other PMs. The APU is a processor that powers secondary PMs. The APU supports the DMS-Core and the APU does not provide a direct interface to applications or services external to the LPP.

The APU performs the following functions:

- powers a call processing application, like ADAS or DMS-100 Mail
- collects logs, alarms, and operational measurements from the LPP and the application and transfers the logs, alarms, and operational measurements to the DMS-Core
- controls the voice processing services provided by the voice processing unit (VPU)

APU operations are closely tied to the VPU and the network interface unit (NIU). The APU and the VPU form the voice processing platform (VPP) for an application, and the NIU provides the VPP with channelized access to the network. More information on the VPU, NIU, and channelized access is available later in this chapter.

The APU is application independent. All APUs contains identical hardware. Software determines the functionality and application support of the APU.

The application or function the APUs support often identify the APUs in maintenance documentation. For example, an APU that supports ADAS is identified as an ADAS APU, and an APU supporting a VPU is identified as a VPU APU.

APUs are processors, and all processors require an operating system. The primary operating system for DMS SuperNode processors is the support operating system (SOS), which establishes the environment for loading and executing application software in DMS-100 Family switches.

The APU with UNIX[1] (APUX) runs two operating systems: SOS and UNIX. This process allows the APUX to run parallel to other applications written for UNIX-based environments. This process supports capabilities like integrated billing and maintenance. Both ADAS and DMS-100 Mail require APUXs.

> ***Note:*** For the balance of this guide, APU refers to both types of APU. Most functions and maintenance activities are common to both types of APUs.

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[1] UNIX is a registered trademark of UNIX System Laboratories, Inc.

APUX will be used when functions and maintenance activities are specific to the APUX.

APU cards

Table 36-7 lists and describes the cards in the APU.

Table 36-7 APU cards

PEC	Card	Function
NT9X14DB	Memory circuit pack	Provides 24 megabytes of RAM.
NTEX22AA	Integrated processor and F-bus (IPF) circuit pack	Provides MC68030-based processor and taps to F-bus.
Note: Unlike other LPP PMs, the APU has no paddleboard.		

The APU is a simplex unit. For reliability, install the APU in pairs.

Communications paths

Different from other LPP PMs, the APU does not provide an interface between the switch and the outside environment. The APU is a processor that supports the VPU to provide voice services to call processing applications. The APU does not require a direct interface with these applications. Voice channels to the subscriber are provided by the VPU and the NIU.

Like other LPP PMs, the APU uses the F-bus for data communications to the LIM unit. The LIM unit forwards messages over DS30 links through the DMS-Bus to the DMS-Core. The APU also uses the F-bus to signal the VPU and communicate with other ASUs.

The APU uses an application protocol to exchange messages with the DMS-Core. Some of these messages relate to the following:

- information required to perform a directory assistance database search
- network connections
- call dispositions

Call processing

During a call, the VPU performs the role of operator and interacts with the subscriber. The VPU performs prompt playback and uses voice channel connections over the network. The APU controls the VPU through messaging sent through the F-bus.

Each call to be processed through the LPP requires a service circuit which consists of the following:

- a voice channel to a VPU
- a data path to that VPU
- a call processing channel on an APU in the same LPP as the VPU
- a corresponding data path to the APU.

The voice channel to the VPU provides for VPU/subscriber interaction and operator playback. The APU uses the data path to signal the VPU to play recorded announcements or subscriber responses.

Collection of alarms, logs, and operational measurements

The UNIX application environment (UAE) is the primary platform for UNIX programming. UNIX includes a set of base services that application programmers can use to provide data collection, user interfaces, and process communication. The UAE data collector provides the ability to generate OAM data messages in any application task. The UAE data collector also can collect the messages on the APUX. The UAE data collector can distribute the messages to local and remote devices.

The UAE data collector consists of the following components:

- local generators, which reside within the UAE and gather data
- local receivers, which reside on each APUX and collect data from the local generators
- central receivers, which reside on a single APUX, and perform the following functions:
  - gather data from the local receivers
  - total the data counts for the VPP
  - send the total counts to the DMS-Core

When the APUX that houses the central receiver of the LPP is busied, a loss of communications between the DMS-Core and that APUX occurs. Loss of any data present on the APUX occurs.

In addition, the central receiver accepts connections from a UNIX OM DISPLAY tool. The receiver allows you to examine OMs without connecting to the DMS-Core.

CCS7 link interface unit

The CCS7 link interface unit (LIU7) provides the hardware interface between a DMS-100 switch and a CCS7 network. It allows signaling information to pass between the switch and the CCS7 network.

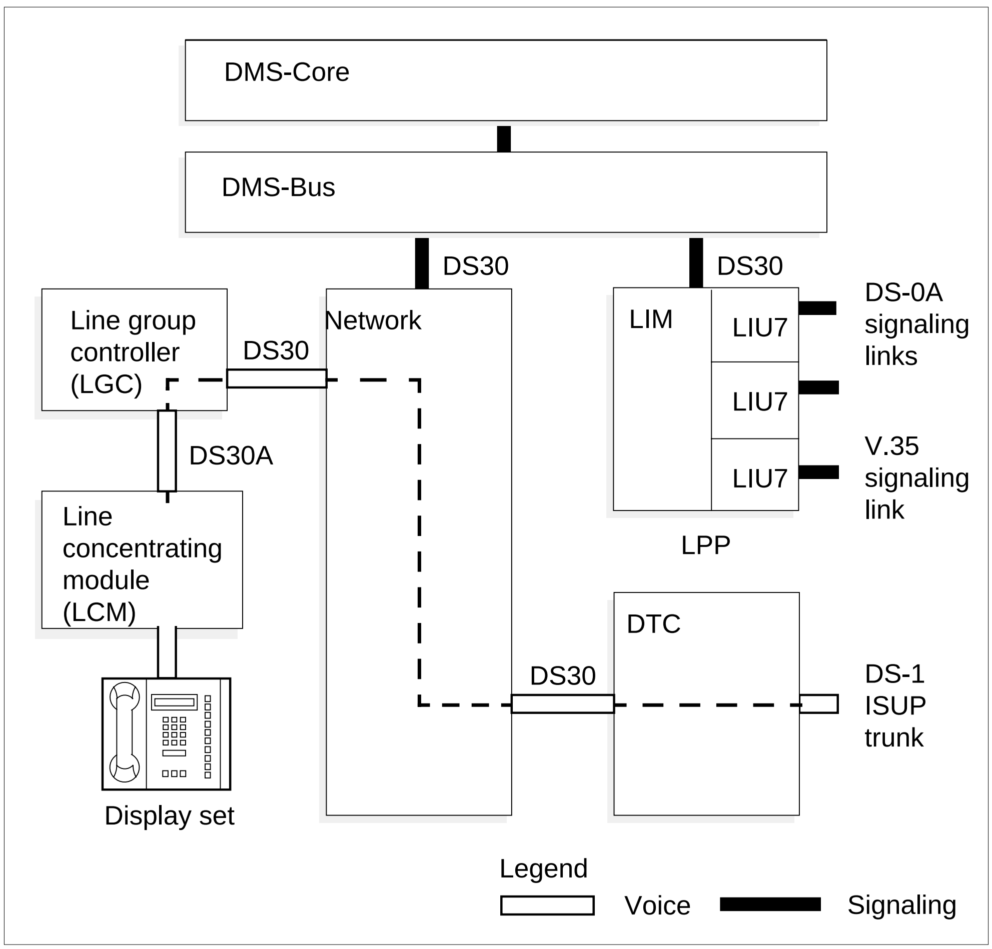
Common channel signaling

A telephone call has two components: a signaling component and a voice/data component. In normal signaling for each trunk, both components are transmitted on the same trunk. In out-of-band signaling, the two components are separated and transmitted on separate trunks.

Signaling links (SL) and voice trunks are the two trunks used in CCS7 signaling. SLs, normally DS-0A or V.35 carriers, transmit the signaling component to the LIU7. Voice trunks, normally DS-1 carriers, transmit the voice and data components to the digital trunk controller (DTC).

Figure 36-11 illustrates an LPP-supported CCS7 network.

Figure 36-11 LPP-supported CCS7 network



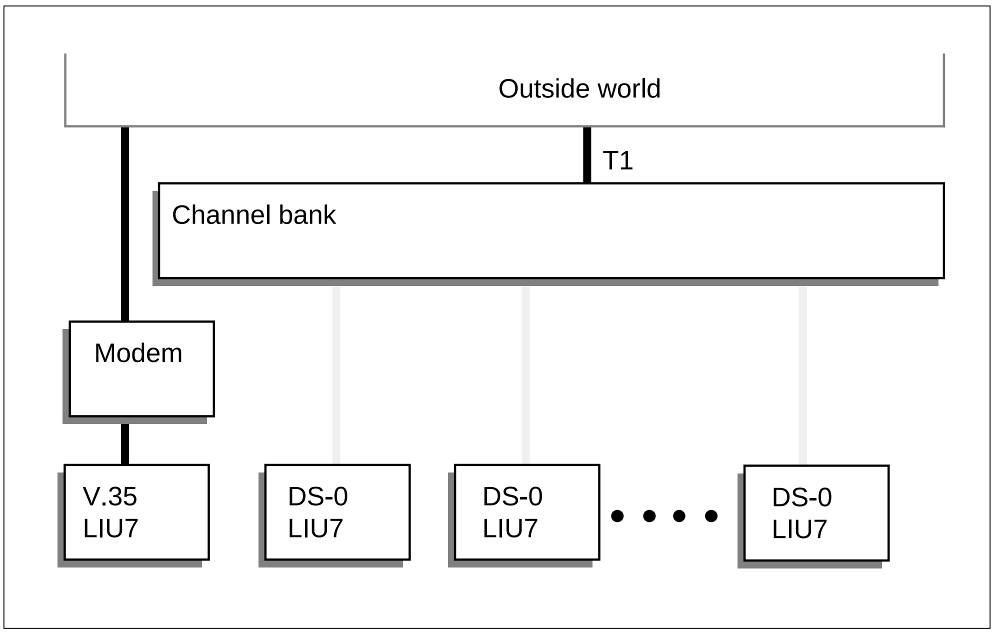
With an Ethernet interface unit (EIU), the LIU7 can implement the CCS7 message detail recording (MDR7) system. Copy and route selected messages to an external store-and-forward processor (SFP) on a local area network

(LAN) that uses Ethernet[2] technology. EIUs also provide the interface between an SCP and the operational support system (OSS) provided by the operating company.

Communications path

Dedicated links to a modem or through a carrier channel bank provide communication between the CCS7 network and the LIU7. The process is known as non-channelized link access. Figure 36-12 illustrates non-channelized access for the LIU7.

Figure 36-12 LIU7 non-channelized access

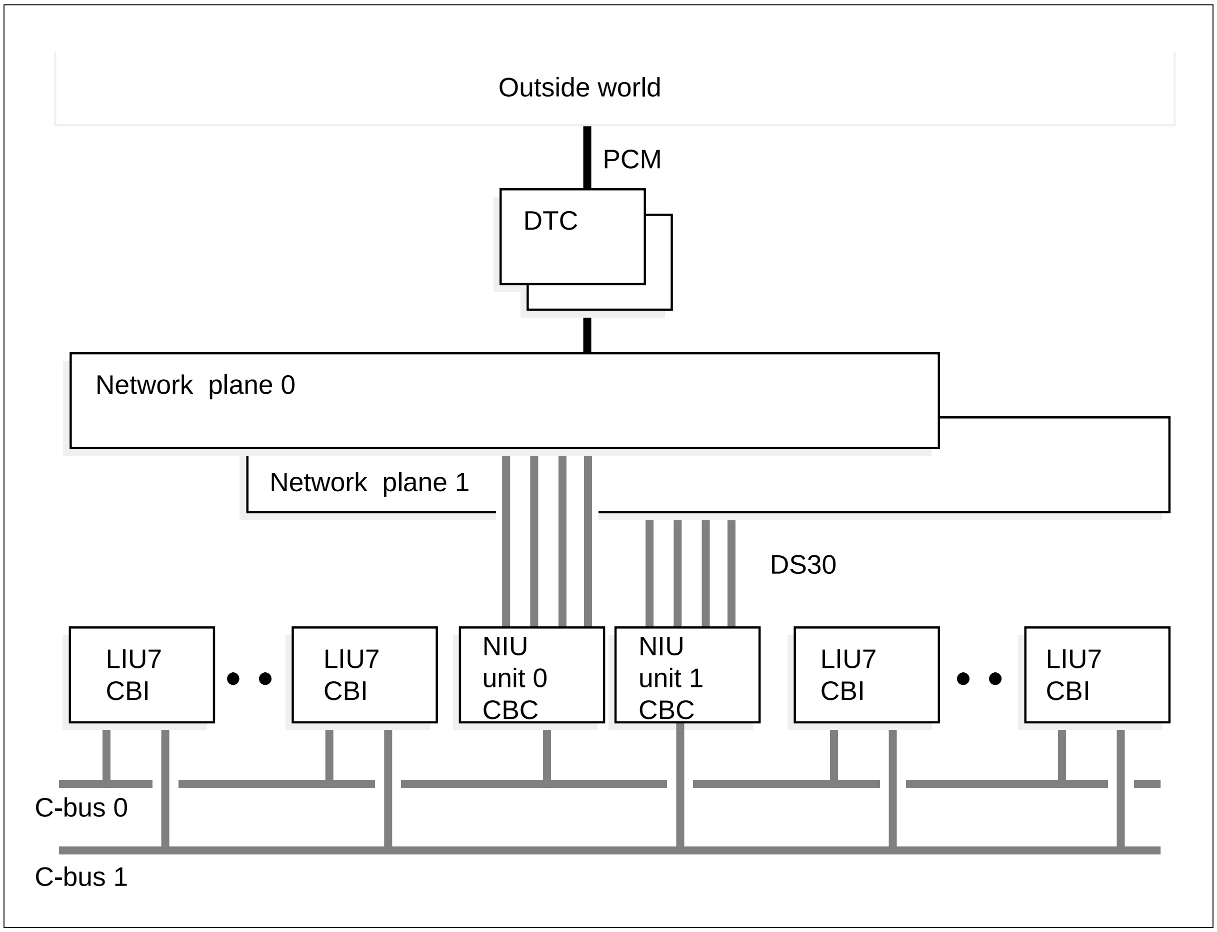


When provisioned with a network interface unit (NIU), the LIU7 has channelized link access. Channelized access allows the LIU7 to receive signals directly from the network. The NIU allows the LIU7 to transmit signals over a channel bus (C-bus) within the LIS.

Figure 36-13 illustrates channelized access for the LIU7.

[2] Ethernet is a trademark of Xerox Corporation.

Figure 36-13 LIU7 channelized access



The NIU acts as a switch between the C-bus and the DS30 links to the network. More information on the NIU and the C-bus is available later in this chapter.

In both configurations, the LIU7 communicates with the two LIM units through the F-bus. The LIM communicates with the network and other switch components through DS30 links.

Cards

An LIU7 consists of an integrated processor and F-bus (IPF) circuit pack, and provides a signaling terminal circuit pack and one of three interface paddleboards: DS-0A, V.35, or channel-bus interface (CBI).

> ***Note:*** While the LIU7 supports three types of interfaces, the LIU7 can only contain one interface.

Table 36-8 lists and describes the cards in a two-slot LIU7.

Table 36-8 LIU7 cards (2-slot)

PEC	Card	Function
NT9X76AA	Signaling terminal circuit pack	Terminates signaling link (SL). Performs error detection and correction, signal-unit alignment and synchronization, and flow control. Consists of a master processor (MP) and a data link processor (DLP).
NT9X77AA	DS-0A interface paddleboard	Provides the physical interface between the SL and the LIU7.
NT9X78BA	V.35 interface paddleboard	Provides the physical interface between the SL and the LIU7.
NTEX22AA	Integrated processor and F-bus (IPF) circuit pack	Provides message processing for associated SL and one tap to each F-bus. Consists of a micro-controller subsystem (MCS) and two F-bus interface controller (FIC) application-specific integrated circuits (ASIC).
NTEX26AA	Channel bus interface (CBI) circuit pack.	Provides the physical interface between the LIU7 and the C-bus.

The two-slot LIU7 is on the NT9X72BA LIS.

Ethernet interface unit

The Ethernet interface unit (EIU) provides a link between a DMS-100 SuperNode switch and a local area network (LAN) using Ethernet technology. The EIU performs the following functions:

- provides the physical connection between the switch and the LAN
- converts data from LAN-supported protocols to DMS SuperNode-supported protocols

The EIU supports a range of applications, including ADAS, CCS7, and DMS-100 Mail. The EIU normally works in tandem with another ASU, like an application processor unit (APU), CCS7 link interface unit (LIU7), or network interface unit (NIU). The EIU also allows a switch operator to integrate OAM functions for an application on to a single UNIX workstation.

EIU operations

> ***Note:*** An ability to use LAN technologies is not required to maintain the EIU. Working knowledge of these subjects can help you understand the function of the EIU, log reports and OMs and problem solving EIU faults.

A LAN is a network that connects a group of computers. The LAN allows computers to communicate to each other and share resources like printers and data storage devices. A node identifies each computer, device, or printer on the LAN. The EIU provides the physical link between the switch and a LAN that uses Ethernet technology. The LAN identifies the EIU as a node in its network.

Nodes are connected by one of four types of media:

- thick wire (10Base5)
- thin (10Base2)
- unshielded twisted pair (UTP)
- fiber optic

The type of media within an Ethernet-based LAN depends on the age of the LAN, the amount of traffic, and the types of nodes. The type of media also determines the length of the LAN. Most LANs support approximately 30 computers and involve a single facility or group. Groups of LANs can be connected to form wide area networks (WAN).

Data transmits over LANs in packets. A packet includes both data and control information, like the source node address and the destination node address. An Ethernet LAN transmits packets at up to 10 megabits per second.

Protocols are the rules for communications between computers. Protocols vary from environment to environment, and from application to application. The EIU supports multiple protocols, allowing it to transfer data from the Ethernet environment to the DMS SuperNode environment.

EIU supported protocols include the following:

Transmission control protocol

Transmission control protocol (TCP) manages the communications path. TCP provides connection oriented communications services for programs, including end-to-end flow control, connection setup and termination, and status exchange.

Internet protocol

Internet protocol (IP) establishes the communications path. IP provides a datagram-oriented service, so that hosts can access other hosts resident on the same or different sub-network. IP does not enhance the reliability of the datagrams, but only allows these messages to be delivered between network nodes.

Frame Transport System

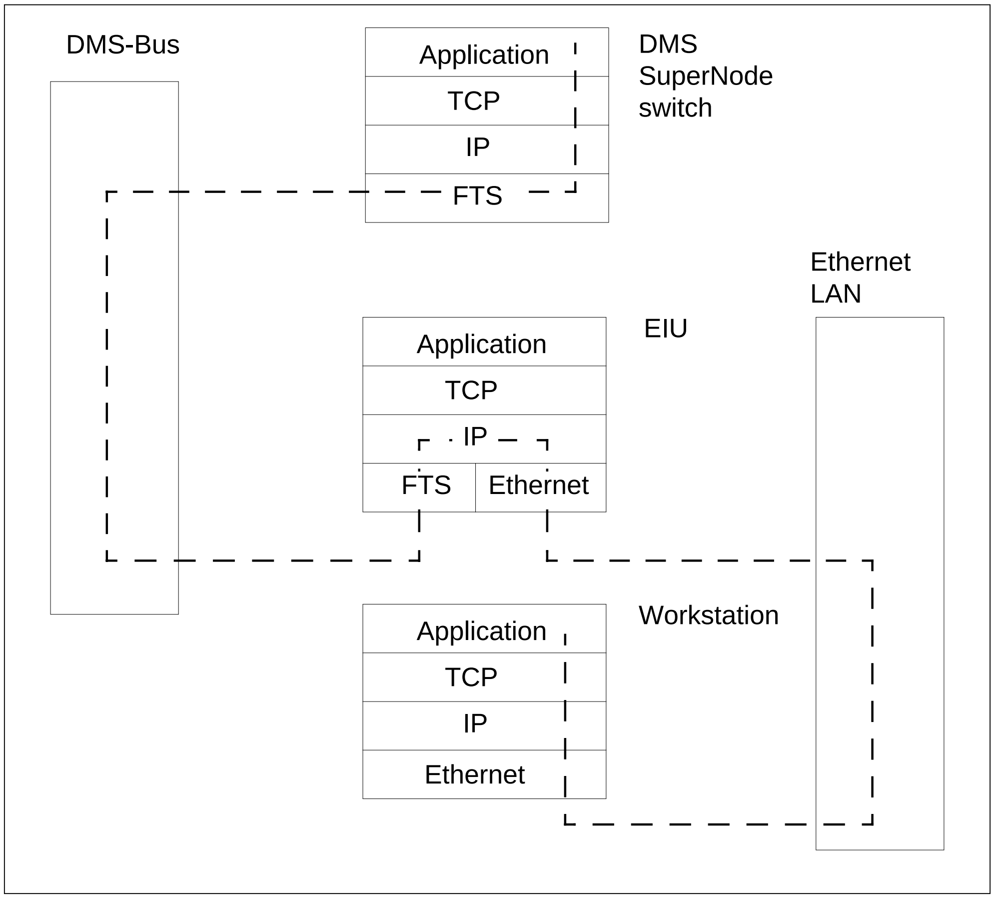
The frame transport system (FTS) is the proprietary network used to transfer TCP/IP segments within SuperNode processors.

TCP and IP are separate protocols, but they are normally packaged together and operate as a single entity (TCP/IP). The EIU supports a group of protocols known as the TCP/IP stack.

When the FTS transmits packets from the switch to a LAN, the EIU replaces the FTS section of the address of the packet with an Ethernet section. When the FTS transmits a packet from a LAN to the switch, the EIU replaces the Ethernet section of the address of the packet with an FTS section.

Figure 36-14 illustrates the protocol path between the switch and a LAN that uses an EIU.

Figure 36-14 Protocol path between DMS SuperNode switch and Ethernet LAN



Packets can be routed to the following nodes:

- support operating system nodes in the DMS SuperNode switch
- UNIX-based nodes in the DMS SuperNode switch
- workstation nodes on a single Ethernet LAN
- workstation nodes on multiple Ethernet LANs

EIU configuration

Every LAN connected to the switch requires a single EIU. Two EIUs for each LAN are recommended. The EIUs that support a single LAN are identified as a set.

The two EIUs provide fault-tolerant communications to the LAN, and they can operate in either hot-standby or load-sharing mode. In hot-standby, one

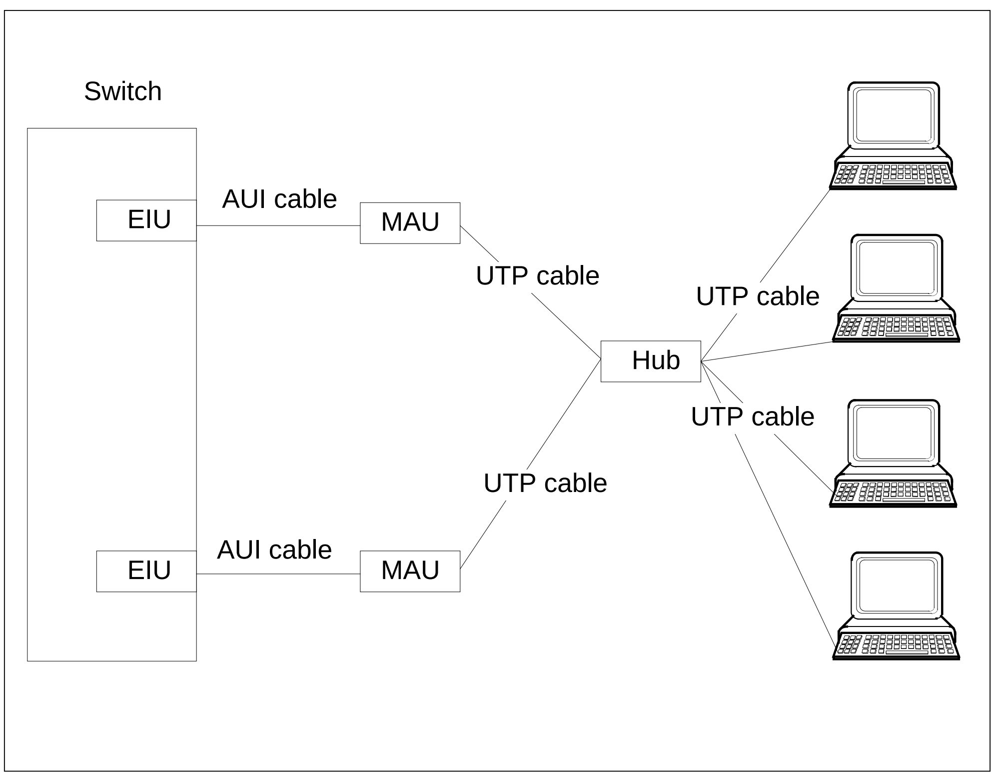
The EIU carries the full traffic load. If the EIU fails, the system shifts traffic to the standby EIU. The two EIUs carry traffic when load-sharing occurs. Each EIU can carry the traffic load if the mate EIU fails.

For the network, the EIU is a router, or a node that routes packets from one network to another network. The EIU examines packets for the EIU network. Other LAN interconnection nodes, like bridges, examine the packets on the LAN.

The EIU uses two generic components to connect to the LAN. These components are an attachment unit interface (AUI) cable and a media access unit (MAU). The AUI consists of four shielded twisted pair wires and has a 15 pin connection at each end. The MAU transfers packets from the medium that supports the Ethernet LAN to the AUI cable. Media that support the Ethernet LAN include thin wire, thick wire, thin coax, UTP and fiber optic cables. The AUI and the MAU units are LAN-based equipment. These units are available to the public.

Figure 36-15 describes a connection of a DMS SuperNode switch and an Ethernet LAN.

Figure 36-15 Path between DMS SuperNode switch and Ethernet LAN



The LAN-based equipment is ac-powered. The media access unit (MAU) is not ac-powered. The MAU is powered through a paddle board in the EIU.

EIU cards

The two-slot EIU single card EIU processing and provides two taps to the F-bus.

Table 36-9 lists the cards in the two-slot EIU.

Table 36-9 EIU cards (2-slot)

PEC	Card	Function
NT9X84AA	Ethernet interface card (EIC) card	Manages protocols and handshaking for Ethernet collision detection
NT9X85AA	Ethernet AUI paddleboard	Provides interface between EIC card and Ethernet LAN through an AUI cable.
NTEX22BB	Integrated processor and F-bus (IPF) card	Provides a Motorola processor and two F-bus taps.

Ethernet link interface unit

The Ethernet link interface unit (ELIU) uses Ethernet technology to provide a link between a DMS-100 SuperNode switch and a local area network (LAN). The ELIU combines the functions of the LIU7 and EIU ASUs. The ELIU uses current CM and EIU hardware. The ELIU:

- functions as the remote application end of a virtual CCS7 link.
- acts as server in the client-server relationship that transmission control protocol/internet protocol (TCP/IP) requires.
- sends CCS7 messages (without CCS7 layers 1 and 2) over TCP/IP to communicate with SCP.

A service switching point (SSP), signaling transfer point (STP), or SSP-STP group loads can incorporate the ELIU.

Frame relay interface unit

The frame relay interface unit (FRIU) supports DATASPAN Frame relay. frame relay packet switching offers faster access speeds and higher performance than X.25-based packet switching. The DATASPAN allows LANs from different locations to connect in a single data network. When the user enters data, DATASPAN loads to each APU.

FRIU operations

Under DATASPAN, the system transmits data in frames. Each frame contains data and routing information. Flags that use high-level data-link control (HDLC) delimit the start and end of each frame. The HDLC is a bit-oriented synchronous data-link protocol. End users determine the maximum size of frames, to a maximum of 2106 bytes, that DATASPAN supports.

The DATASPAN uses T1 carriers to transmit data. The FRIU terminates the T1 carriers at the switch. The FRIU analyzes incoming frames and addresses the frames that the system must route to the LIM unit. The LIM unit matches the frame with a hardware address in the system.

Each FRIU supports a T1 carrier in one of the following modes:

- channelized mode (24 x 56 or 24 x 64 kbits/s)
- non-channelized mode (1 x 1.544 or 1 x 1.344 Mbits/s)
- fractional mode (4 x 384 kbits/s)

FRIU cards

Table 36-10 lists and describes the cards in any FRIU.

Table 36-10 FRIU cards

PEC	Card	Function
NTEX22AA	Integrated processor and F-bus (IPF) card	Provides one tap to each F-bus.
NTEX30AA	T1 access paddle board	Provides basic framing and synchronization, alarm monitoring and generation, and signaling bit insertion and removal.
NTEX31BA	Frame relay access processor (FRAP) card	Interfaces with the T1 access paddle board for transmission and reception of PCM data in the shape of frames. Acts as an ISDN and direct memory interface link-layer controller.

> ***Note:*** The first generation FRIU was a three-slot PM. This FRIU consisted of a link general processor card, P-bus and F-bus interface card, a frame relay access processor card, and T1 interface paddle board. This FRIU does not support DATASPAN.

The slot number of the IPF card identifies the FRIU.

Network interface unit

The network interface unit (NIU) is a duplicate unit that provides channelized access between ASUs in an LPP and the switching network. The NIU does not support specified applications or services. The NIU supports ASUs that require channelized access to the network to support specified applications or service.

Channelized access and the channel bus

The ASUs that do not have channelized access do not have a direct links with the network. These ASUs use LIM units to communicate with the DMS-Bus. The use of LIM units creates a direct link to the DMS-Bus and distributes processing from the DMS-Core.

Some applications and services require a direct connection to the network. Call processing services like ADAS must have a direct link between the network and the ASU that provides voice services.

Channelized access provides a direct connection. A channel bus (C-bus) and an NIU on each LIS create channelized access. The C-bus in the backplane is a duplicate time-division multiplexed bus that operates at 4.096 MHz. A C-bus layout consists of 512 channels of 10 bits. Two buses, C-bus 0 and C-bus 1, support each LIS.

The ASUs that require channel access have a CBI card (NTEX26AA) and do not have an application interface paddle board.

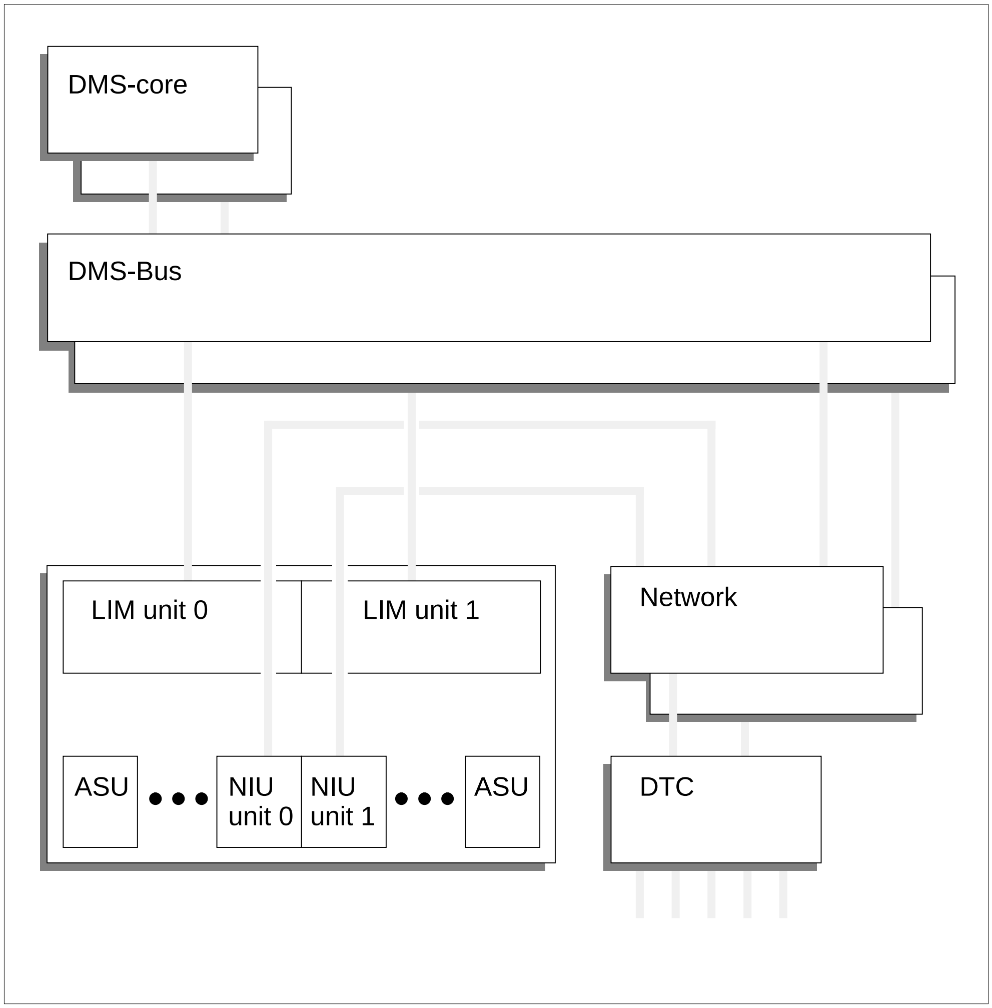
NIU configuration

The NIU consists of two units. Unit 0 supports C-bus 0, and unit 1 supports C-bus 1. The NIU units and the C-buses operate in hot-standby mode. The NIU unit 0 and C-bus 0 can be active for an LIS, while NIU unit 1 and C-bus 1 can be not active.

The NIU has duplicate DS30 links to each network plane. The NIU acts as a switch. The NIU provides a maximum of 10 connection paths between the 512 C-bus channels and the 120 DS30 link channels. In a single-shelf LPP, the NIU has fiber optic links to each network plane.

Figure 36-16 shows the operating structure of an NIU-supported LPP.

Figure 36-16 Functional architecture of NIU-supported LPP



Note: The F-bus and the C-bus support communications between ASUs. The F-bus and the C-bus are separate. The F-bus supports an LIM. The C-bus supports one LIS. The NIU uses the F-bus for maintenance messaging.

NIU communications paths

Each NIU supports four types of communication. A description of each type of communication follows.

- The F-bus provides communications between the DMS-Core and the NIU communications. Each NIU unit has two F-bus taps. The NIU resets and reloads occur through the F-bus. The NIU transmit receives manually transmitted messages through the F-bus.

- Duplicate DS30 links connect each NIU unit to each network plane. The links transmit identical data streams to prevent data corruption.
- Each C-bus has a direct connection to an NIU. The NIU unit 0 controls C-bus 0, and the NIU unit 1 controls C-bus 1.
- A cable between CBCs connects each NIU unit. Access to the data stream for the other network plane occurs through this cable. Control signals allow the CBCs to coordinate actions. Cross-link of data does not occur between the two planes.

NIU cards

Table 36-11 lists and describes the cards in a single NIU unit.

Table 36-11 NIU cards

PEC	Card	Function
NTEX22BB	Integrated processor and F-bus (IPF) card	Provides one tap to each F-bus.
NTEX25AA/BA	Channel bus controller (CBC) card	Provides the interface for data transmission from the C-bus to DS30 links.
NTEX28AA	NIU link interface paddle board	Supports four DS30 links to network modules. Includes inter-CBC cable connections.
Note: Each NIU unit has a different channel bus controller. The NTEX25AA supports unit 0, and NTEX25BA supports unit 1.		

Note: The ASUs that require channel access can be provided on the same LIS with ASUs that do not require channel access.

Voice processing unit

The voice processing unit (VPU) provides voice services for call processing applications that interact with subscribers over network voice channels. These call processing applications include ADAS and DMS-100 Mail. The VPU terminates subscriber network channels and can perform the following functions:

- record and play of the subscriber's speech
- play recorded audio prompts, tones, and announcements
- detect and generate dual-tone multi-frequency (DTMF) tones.

The VPUs do not contain application software. The VPUs support different call processing applications. The VPUs are data-driven hardware components that the audio load configures to provide functionality for specified applications. The audio load contains prompts for specified applications and announcements for the subscriber.

The VPU table control assigns one service to each VPU. A VPU can support one service for one application. The VPU resource manager allocates service circuits. Service circuits are network channels that a VPU terminates. These VPUs support correct services and a cross-section of call processing resources. Service circuits divide by functionality into pools.

VPU cards

Table 36-12 lists and describes the cards in a single VPU.

Table 36-12 VPU cards

PEC	Card	Function
NTEX22 BB	Integrated processor and F-bus (IPF) card	Provides one tap to each F-bus.
NTMX97 AA	Recording and announcement processor (RAP) paddle board	Terminates network channels and controls devices that provide voice services. Contains four digital signal processing cells, message interfaces, a speech memory array, and a ROM block.
NTMX99 AA	Channel-bus interface - 512 channels (CBI-512) paddle board	Provides the C-bus interface for the VPU.

The VPUs require channelized access to the network. Channelized access requires a network interface unit (NIU). Every LIS that contains a VPU must have one NIU that contains duplicate units 0 and 1. A DMS-100 SuperNode switch can support a maximum of 180 VPUs.

Communications paths

The VPU supports voice communications and requires direct access to the network. The NIU and the channel bus (C-bus) in each LIS provide this access. The VPU transmits signals over the C-bus to the NIU. The NIU forwards the signals over DS30 links to the network. A description of the NIU and channelized access are in this chapter.

Like other LPP PMs, the VPU has two taps to the F-bus. The VPU uses the F-bus for data communication to the LIM unit. The LIM unit forwards messages over DS30 links through the DMS-Bus to the DMS-Core. The VPU uses the F-bus to receive control signals from the APU.

X.25/X.75/X.75' link interface unit

The X.25/X.75/X.75' link interface unit (XLIU) supports protocol processing for DMS Packet Handler. The DMS Packet Handler provides integrated services digital network (ISDN) packet service as an integrated peripheral of the DMS-100 SuperNode system.

The DMS Packet Handler processes X.25 and X.75/X.75' protocols. The DMS Packet Handler provides call routing and translation functions for packet calls. The system transmits these packet calls over the B channel or D channel of an ISDN Basic Rate Interface (BRI) loop. The system uses DS30 channelized access through NIUs to transport B- and D- channel packets.

Note: The DMS Packet Handler requires a minimum of one NIU. A functional description of the NIU appears in this chapter.

The XLIU provides the X.25 and X.75 protocol processing for DMS Packet Handler. Protocol processing requires the XLIU to handle the first three layers of the Open Systems Interconnection (OSI) layered protocol model.

Table 36-13 lists these layers and the XLIU support for each layer.

Table 36-13 XLIU support of OSI protocol layers

Layer	Description	XLIU support
1	Physical Layer	Data bit stream synchronization
2	Data Link Layer	High-level data link control (HDLC) processing. The HDLC processing controls link access procedures that handle data exchange between terminal or network equipment and the DMS SuperNode.
3	Network Layer	X.25/X.75 packet format and control procedures

The XLIU terminates the link access protocol for D-channel (LAPD) and link access protocol balanced (LAPB) X.25 protocols. The XLIU terminates X.75 protocols between the ISDN signaling pre-processor (ISP) and the public packet switching network (PPSN) or other ISDN nodes.

Table 36-14 lists and describes the cards in a XLIU. A minimum of two XLIUs must support DMS Packet Handler. One XLIU must support X.25 and the second must support X.75/X.75'.

Table 36-14 XLIU cards

PEC	Card	Function
NTEX22BB	Integrated processor and F-bus (IPF) card	Provides one tap to each F-bus. Also provides layer 3 processing.
NTFX09AA	C-bus access interface paddle board (CIP)	Provides C-bus access to the high-density line controller (HDLC) ports on the HDLC frame processor.
NTFX10AA	HDLC frame processor (HFP) card	Provides layer 2 processing. Communicates with the IPF through common memory.

A single LIS can hold a maximum of 10 XLIUs.

LPP-supported applications and services

The LPP offers network providers a single platform from which to launch several advanced applications and services. The modular design of LPP and LPP components allow providers to add applications and services.

Descriptions of each of the applications and services that LPP supports appear in the following paragraphs.

Automated Directory Assistance Service

The Automated Directory Assistance Service (ADAS) uses advanced voice processing technologies to automate the requests section of directory assistance (DA) calls. With ADAS, network providers can implement a wide range of services. These services include: wake-up calls, stock quotes, operator-assisted yellow pages, local directions, restaurant and entertainment information, and worldwide weather conditions.

The ADAS is provided with VPUs and APUs in a DMS-200 SuperNode system configured for Traffic Operator Position System (TOPS) applications. An NIU is required for ADAS.

For additional information on ADAS, refer to *TOPS MP Product Guide*, 297-2281-010, or *TOPS MPX Product Guide*, 297-2291-010.

Common Channel Signaling 7

Common Channel Signaling 7 (CCS7) is a digital message-based network signaling standard. A CCS7 network separates call signaling information from voice channels so that interoffice signaling transmits over a separate signaling link. A CCS7 network provides Custom Local Area Signaling Services (CLASS) and other CCS7-based services. A CCS7 network provides access to several databases. These databases support calling-card validation, 800 Service, Global Title Translations (GTT), and other translations-based capabilities. The CCS7 uses CCS7 link interface units (LIU7).

For additional information on CCS7, refer to *DMS SuperNode Common Channel Signaling 7 Product Guide*, 297-5151-010.

DATASPAN

Frame relay packet switching offers faster access speeds and higher performance than X.25-based packet switching. The DATASPAN allows local area networks (LAN) from different locations to connect in a single data network.

Access to the DATASPAN is available through fractional, channelized, or non-channelized mode for high-speed, LAN and connections between host and computer. The DATASPAN contains an FRIU. The FRIU receives the data frame and verifies if the data frame is valid. The FRIU sends the frame to the F-bus Processor card.

For additional information on DATASPAN, refer to *DMS SuperNode DataSPAN Frame Relay Service Product Guide*, 297-5111-010.

DMS-100 Mail

Through the LPP, DMS-100 Mail can generate voice and facsimile services. These voice and facsimile services form a central platform for voice messaging and retrieval services. The CCS7 capabilities in the LPP transport call-control information to the DMS-Core to select the correct Service Peripheral Module (SPM). The EIUs provide connections through a duplicate Ethernet LAN for the SPMs. The EIUs allow performance of OAM functions from a central location.

For additional information on DMS-100 Mail, refer to *DMS-100 Mail Product Guide*, 297-7001-010.

DMS Packet Handler

The DMS Packet Handler provides ISDN X.25 packet service as an integrated peripheral of the DMS-100 SuperNode system. The DMS Packet Handler processes X.25 and X.75/X.75' protocols. The DMS Packet Handler provides call routing and translations functions for packet calls. These packet calls transmit over the B channel or D channel of an ISDN Basic Rate Interface (BRI) loop.

For additional information on DMS Packet Handler, refer to *Integrated Services Digital Network Product Guide*, 297-2401-010.

Fault conditions

This section describes faults that can occur in LPP PMs. The next section, "Automatic maintenance", describes steps the system takes to diagnose and correct these faults.

Fault conditions for the link interface module

Several fault conditions affect the operations of the link interface module (LIM). These conditions include:

- faults in the LIM, like
  - card-level faults in an LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- external power faults
- card-level faults in a connected LIM

The LIM has several cards that are system components. The failure of one of these cards causes the LIM unit to go out of service. These cards include:

- DMS SuperNode processor card (NT9X13DB)
- T-bus access card (NT9X52AA)
- P-bus terminator card (NT9X49CA)
- system clock card (NT9X53AA)
- remote terminal interface paddle board (NT9X26AA)
- mapper card (NT9X15AA)
- +5 volt power converter (NT9X30AA)

The failure of a DMS-Bus plane does not affect the operation of an LIM. The LIM continues to operate and buffer messages until the DMS-Bus returns to service.

Faults in a single F-bus or LIM unit do not affect the operation of the LIM. Traffic shifts to the mate unit. Faults in a F-bus or LIM cause the LIM to lose redundancy. This loss of redundancy affects the reliability of the LIM.

Faults in the ASUs or ASU applications do not affect the operation of the LIM. The system isolates the ASU node. Operations continue for the rest of the LIM.

The failure of port controller interface causes the loss of the link(s) that the port controller interface supports. The failure of a link causes the loss of all messages in the buffer, to a maximum of 2 kilobytes.

Maintenance software in the switch can diagnose and correct faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on fault clearing procedures for LPP PMs, refer to LPP trouble isolation and correction. Refer to page 43-1 of this guide.

Fault conditions for the frame transport bus

Several fault conditions affect the operation of the frame transport bus (F-bus). These conditions include:

- faults in the LIM, that include
  - — card-level faults in an LIM unit
  - — communications faults between the LIM units
  - — communications faults between the LIM and the DMS-Bus
  - — card-level faults in the F-bus
- external power faults

The F-bus has three cards that are system components. Each card can fail separately from the F-bus. The failure of a card can cause the F-bus to fail. These system components include:

- F-bus rate adapter card (NT9X73AA)
- F-bus/C-bus termination card (NTEX20AA/BA)
- F-bus repeater card (NT9X74AA)

Faults in a single F-bus do not affect the operations of the LIM. Traffic shifts to the mate unit. Faults in a single F-bus or LIM cause the LIM to lose redundancy. This loss of redundancy affects the reliability of the LIM.

Faults in the ASUs or ASU applications do not affect the operations of the F-bus. The system isolates the ASU node. Operations continue for the rest of the LIM.

> ***Note:*** A failed rate adapter card can prevent the transfer of messages by the LIM unit between ASUs. These ASUs are on the lower shelves of the LPP.

Maintenance software in the switch diagnoses and corrects these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on problem clearing procedures for LPP PMs, refer to LPP trouble isolation and clearing. Refer to page 43-1 in this guide.

Fault conditions for the application processor unit

Several fault conditions affect the operation of the application processor unit (APU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the voice processing platform (VPP):
  - card-level faults in the network interface unit (NIU)
  - card-level faults in the voice processing unit (VPU)
  - communication faults between the ASUs in the VPP
- faults in the APU:
  - card-level faults
  - system errors in the support operating system (SOS) or UNIX
- faults for the call processing application:
  - software errors in the application
  - transmission faults in the carriers

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on problem clearing procedures for LPP PMs, refer to "LPP problem isolation and clearing". Refer to page 43-1 of this guide.

Fault conditions for the CCS7 link interface unit

Several fault conditions affect the operations of the CCS7 link interface unit (LIU7). These fault conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the LIU7:
  - card-level LIU7 faults
  - communications faults between the LIU7 and the CCS7 network
- faults in an ASU that relates to the LIU7:
  - card-level faults in an application processor unit (APU), Ethernet interface unit (EIU), or network interface unit (NIU)
  - communications faults on the channel bus (C-bus) between an LIU7 and an ASU that relates to the LIU7.
- faults in the CCS7 application

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to Automatic maintenance in this chapter

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on fault clearing procedures for LPP PMs, refer to "LPP problem isolation and clearing. Refer to page 43-1 of this guide.

Fault conditions for the Ethernet interface unit

Several fault conditions affect the operation of the Ethernet interface unit (EIU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the EIU:
  - card-level faults
  - data integrity faults in the protocol conversion process
- faults in the local area network (LAN):
  - faults in the LAN media
  - hardware faults in a minimum of one LAN node
  - system faults in the LAN operating system
- faults in an ASU that relates to the EIU:
  - card-level faults in a application processor unit (APU), CCS7 link interface unit (LIU7), or network interface unit (NIU)
  - communications faults on the channel bus (C-bus) between an EIU and an ASU that relates to the EIU

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to Automatic maintenance in this chapter.

> ***Note:*** The DMS-100 maintenance software cannot diagnose faults in LAN, the media access unit (MAU), or the attachment unit interface (AUI). The AUI and the MAU are the two media that connect a DMS-100 switch to an Ethernet-based LAN. The DMS-100 maintenance software can monitor the communications path between the switch and the LAN. Additional information appears in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on fault clearing procedures for LPP PMs, refer to "LPP problem isolation and solving". Refer to page 43-1 of this guide.

Fault conditions for the Ethernet link interface unit

Several fault conditions affect the operations of the Ethernet link interface unit (ELIU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the ELIU:
  - card-level faults
  - data integrity faults in the protocol conversion process
- faults in the local area network (LAN):
  - faults in the LAN media
  - hardware faults in a minimum of one LAN nodes
  - system faults in the LAN operating system
- faults in an ASU that relates to the ELIU:
  - card-level faults in an application processor unit (APU), CCS7 link interface unit (LIU7), or network interface unit (NIU)
  - communications faults on the channel bus (C-bus) between an EIU and an ASU that relates to the ELIU

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to Automatic maintenance in this chapter.

> ***Note:*** The DMS-100 maintenance software cannot diagnose faults in the LAN, in the media access unit (MAU), or the attachment unit interface (AUI). The AUI and the MAU are the two media that connect a DMS-100 switch to an Ethernet-based LAN. DMS-100 maintenance software can monitor the communications path between the switch and the LAN. Additional information appears in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a problem. For additional information on problem clearing procedures for LPP PMs, refer to LPP trouble isolation and clearing. Refer to page 43-1 of this guide.

Fault conditions for the frame relay interface unit

Several fault conditions affect the operations of the frame relay interface unit (FRIU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the voice processing platform (VPP)
- faults in the FRIU, that include card-level faults
- communications faults on the T1 carrier:
  - congestion errors
  - transmission errors
  - losses of signals and frames
  - bit errors
- faults in DATASPAN

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a problem. For additional information on fault clearing procedures for LPP PMs, refer to LPP problem isolation and clearing. Refer to page 43-1 of this guide.

Fault conditions for the network interface unit

Several fault conditions affect the operation of the network interface unit (NIU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the NIU:
  - card-level faults in one or both NIU units
  - communications faults between the NIU units
- faults in an ASU that relates to the NIU:
  - card-level faults in an application processor unit (APU), Ethernet interface unit (EIU), or CCS7 link interface unit (LIU7)
  - communications faults on the channel bus (C-bus) between an NIU and an ASU that relates to the NIU

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on problem clearing procedures for LPP PMs, refer to LPP problem isolation and clearing. Refer to page 43-1 of this guide.

Fault conditions for the voice processing unit

Several fault conditions affect the operations of the voice processing unit (VPU). These conditions include:

- faults in the LIM:
  - — card-level faults in each LIM unit
  - — communications faults between the LIM units
  - — communications faults between the LIM and the DMS-Bus
  - — card-level faults in the F-bus
- faults in the voice processing platform (VPP):
  - — card-level faults in the network interface unit (NIU)
  - — card-level faults in the application processing unit (APU)
  - — communication faults between the ASUs in the VPP
- faults in the VPU:
  - — card-level faults
  - — faults in the audio data that the VPU supports
- faults in the call processing application:
  - — software errors in the application
  - — transmission faults in the carriers

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to "Automatic maintenance" in this chapter

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on problem clearing procedures for LPP PMs, refer to "LPP problem isolation and clearing". Refer to page NO TAG43-1 of this guide.

Fault conditions for the X.25/X.75/X.75' link interface unit

Several faults conditions affect the operation of the X.25/X.75/X.75' link interface unit (XLIU). These conditions include:

- faults in the LIM:
  - card-level faults in each LIM unit
  - communications faults between the LIM units
  - communications faults between the LIM and the DMS-Bus
  - card-level faults in the F-bus
- faults in the XLIU:
  - card-level faults
  - data integrity errors
- communications faults:
  - ISDN line errors
  - X.75 trunk faults
- faults in the DMS Packet Handler
- faults caused by congestion in the XLIU

Maintenance software in the switch can diagnose and correct these faults. For additional information on automatic maintenance activities that support LPP PMs, refer to Automatic maintenance in this chapter.

Maintenance personnel must intervene when automatic maintenance fails to correct a fault. For additional information on problem clearing procedures for LPP PMs, refer to "LPP problem isolation and clearing". Refer to page 43-1 of this guide.

Automatic maintenance

Automated processes in the DMS-100 system monitor LPP PMs for hardware, software, or communications faults. If a failure occurs, the system isolates the fault and recovers from the failure. The system can correct the fault and return the component to service. If the system cannot correct a fault, the system isolates the fault. The system notifies the MAP terminal of a change in status and notifies affected subsystems or services. A manual request can cause the system to generate a list of cards that have faults at the MAP display.

Several ordered layers of maintenance software support LPP PMs. Maintenance software at the CM level, for example, continuously monitors communications between the DMS-Bus and the LIM units. The LIM-level maintenance software monitors for LIM faults. The ASU-level maintenance monitors for application faults. This ordered approach isolates maintenance software from the faults the software attempts to detect. This isolation enhances switch accuracy and availability.

Automated DMS-100 Family system maintenance supports LPP PMs. System maintenance activities include:

- hardware accuracy checks, like parity or error detection and correction on memory arrays, cyclic redundancy checks (CRC) on data in transit, and state detection in error.
- periodic functional audits, that make sure that hardware can function and that static tables are not corrupted.
- hardware-driven sanity checks like watchdog timers, memory access protection

Integrated Bit Error Test

An integrated bit error rate test (IBERT) line card (NT6X99) in the DMS-100 Family switch adds IBERT ability to automatic maintenance plans. Loopback tests isolate faults that can occur in the loop. Loopbacks can be set at:

- different points along the line
- the switch
- the data line card (DLC)
- the loop
- the subscriber equipment.

The IBERT transmits a bit pattern through the network on the line under test. The IBERT receives the pattern from the point where the loopback is set, and compares the pattern received with the pattern transmitted.

The results of the loopback tests locate possible faults.

Automatic maintenance of the link interface module

Software in the DMS-Core monitors the link interface module (LIM). If a LIM or a LIM unit fails, this software remains in-service and can isolate the fault. The two LIM units poll each other continuously through the USART link.

The CM software detects LIM failure as a loss of communication, and starts to isolate the fault as a DS30 fault. When the DS30 links pass, the DMS-Core software starts to isolate the LIM unit. The system places an out-of-band reset on one of the links of the unit. The DMS-Core attempts to establish communications with the LIM and requests a restart. If communications fail, the DMS-Core software attempts to access the LIM to gain data on the fault. Access to the LIM occurs through the LIM through the USART link.

The DMS-Core audits the LIMs every 2 s. These audits detect isolated LIM units, or LIMs with lost DS30 links with the DMS-Bus. These audits are present in messaging paths. This distribution makes sure that a detected LIM is isolated and does not have transient messaging problems. When some communications are lost, because links go out of service, LIMs do not go out of service.

Card maintenance units (CMU) on the clock card detect synchronization errors and on-board hardware failures. A clock failure can cause the LIM to go out of service.

A LIM failure means all DS30 links fail or both LIM units fail. Applications and services that LIM supports are not available.

Load-sharing

Under normal conditions, the two LIM units operate in load-sharing mode. Each unit processes traffic for the LIM. If one unit fails, the system shifts traffic to the second LIM unit.

Maintenance software attempt to diagnose and correct the fault in the first unit. If the software cannot correct the fault, the system sets the unit to SysB. Maintenance personnel must intervene when automatic maintenance fails to correct a fault.

Types of LIM faults

System maintenance identifies two types of faults in the LIM: hard faults and soft faults. Hard faults affect the system and threaten the operation of the PM. Soft faults affect the system and do not threaten the operation of the PM.

Table 36-15 lists types of LIM cards, possible faults, and actions the system takes when the system detects a fault.

Table 36-15 LIM card faults and system actions

LIM card type	Possible faults	System actions
System cards	Hard faults	• Attempts to notify DMS-Core of fault • Sets node to SysB • Attempts to RTS card/node • Waits for OOB reset or message from mate
DS30 cards	Hard faults	• Sends message to DMS-Core • Switches clock sync • Sets card to SysB • Attempts to RTS card • Sets node to ISTb
All cards	Soft faults	• Sends message to DMS-Core • Sets node to ISTb

Automatic maintenance of DS30 links

The LIM and DMS-Bus audit and maintain DS30 links to the DMS-Bus. If the LIM detects a loss of communications, the LIM suspends messaging to the DMS-Core. The LIM continues operations not related to the DMS-Core. For the DMS-Core, the LIM is out-of-service until the system establishes communications again.

Eight DS30 links connect each LIM to the DMS-Bus. Two links connect each LIM unit or LMS to each DMS-Bus plane. The link pairs operate in load-sharing mode. Each link pair can handle the full processing load.

This redundancy helps to prevent critical DS30 link failures. If a single DS30 link fails, the system routes traffic to the second DS30 link. The loss of the redundant communications path of the LIM affects service, but the system maintains communication. A hard fault in the DS30 links system busies the affected LIM. A soft fault in the DS30 links causes the LIM to operate in-service trouble.

If an LIM is isolated from the DMS-Bus, a large number of messages from the DM-Bus to the LIM can be lost. An LIM can be isolated if DS30 links are not present between the MS and both LIM units. A loss of messages does not occur from the LIM to the DMS-Bus.

Routine exercise

A routine exercise (REx) is a series of tests that the switch performs as preventive maintenance. The switch runs these tests at regular intervals. These intervals are not frequent. Maintenance personnel can control REx tests to troubleshoot for faults.

A REx runs on a two-unit PM. Activity switches between the units before the test, so a REx always runs on the inactive unit. If a REx detects faults that affect service, the REx takes the unit out-of-service. The REx runs a set of diagnostics. These actions do not affect service from the PM.

In an LPP, this type of test is not necessary. In normal conditions, the two LIM units operate in load-sharing mode and carry traffic. An LIM that provides service is free of faults. Out-of-service tests like REx do not normally detect faults not detected during normal operations. When a LIM unit goes out-of-service, the LIM eliminates the redundancy of the LIM and the F-bus units. This loss of redundancy affects service.

The REX tests are important for maintenance of the LPP. The tests make sure that the fault detection circuits of the LIM function correctly. When the fault detection circuitry of the LIM does not function correctly, problems can occur. The unit can appear to function correctly when the unit does not function correctly and loses traffic. A unit that does not function correctly, and cannot detect this fault, can cause other system components to report faults. In this condition, problem solving becomes difficult.

Before a REx runs on a unit, the following conditions must occur:

- Each LMS unit of the LIM must be in-service or in-service trouble. A load name mismatch can cause the in-service trouble .
- Each LIM unit must have four open links to the message switch.
- The two cross links must be open.
- A node on the F-bus of the LIM cannot be isolated when the LIM unit goes out of service.

The REx for a LIM unit consists of the following four steps:

- The LIM maintenance system busies the unit.
- The unit is reset out-of-band.
- The unit is tested out-of-service.
- The unit is RTS.

A REx takes less than 15 min to run, if the test does not detect problems. When a REx runs the MAP terminal posts a minor alarm (LIMREx) for the LIM that the REx affects.

Maintenance personnel can control automatic REx tests for LIMs through the MAP terminal. Automatic tests can include or exclude specified LIMs. Maintenance personnel cannot include or exclude specified LIM units from automatic tests.

Maintenance personnel can run REx tests on specified LIMs and LIM units. For additional information on manual REX testing, refer to page 43-14 in this guide.

Automatic maintenance of the frame transport bus

The LIM and ASUs perform maintenance on the frame transport bus (F-bus). The LIM and ASUs detect faults and notify the DMS-Core of a change in status. The LIM and ASUs perform loopback tests to isolate faults in the F-bus.

When an F-bus fails, the system forces traffic on the mate F-bus. Service is maintained but messages can be lost if the ASUs cannot immediately detect the F-bus failure.

The system tests each F-bus before the system brings the F-bus into service to carry traffic. The TST command initiates the simulated traffic test. The system sends tap out-of-service messages through inter-LMS links and the mate F-bus that is in-service. Before the system sends these messages, the following conditions must be met:

- the mate LMS is in-service
- the inter-LMS links are open
- the F-bus of the mate LMS is in-service

The system attempts maintenance on all F-bus taps. The state of the ASU for that tap does bit determine if maintenance attempts occur. Integrated link maintenance (ILM) attempts to keep ASU-resident maintenance in sync with F-bus maintenance at all times.

Load-sharing

In normal conditions, each F-bus carries traffic for the LIM unit of that F-bus. Each F-bus taps into each LIM unit. If one F-bus fails, maintenance software shifts traffic to the mate F-bus. The two LIM units continue to operate normally. Maintenance personnel must intervene when maintenance software fails to correct a problem and the system raises an alarm through the MAP terminal.

Automatic maintenance of all application specific units

The DMS maintenance software performs generic audits of all application specific units (ASU). The type or application of ASU does not determine if audits occur. The generic audits are: slow audits and fast audits.

Slow audits

The system performs slow audits on manually busy ASUs on a 2 min audit cycle when the following conditions occur:

- reset sequence
  - a CI PMRESET command is issued
  - state changes from offline to manually busy
  - is part of a CI LOADPM command
- the ASO becomes accessible again
- state changes from in-service, in-service-trouble, or system busy to manually busy

Fast audits

Fast audits occur on ASUs that are in-service or in-service-trouble. The frequency of these audits is set at IPL. Audits can run more than one time each second and run every 1 - 4 s.

Fast audits run after the following conditions occur:

- return to service sequence
  - a CI-level return to service of a manually busy or system busy ASU
  - the autonomous recovery of a system busy ASU
- the ASU becomes accessible again

The initiation of fast audits is part of the return to service process. The ASU can go in service if LPP-resident maintenance confirms the initiation of the audit.

When the LPP is directed to initiate an audit, the LPP makes a maximum of two attempts to communicate with ASU. The LPP allows a 1 s timeout for the ASU to reply.

Audit failure

An audit can fail for one of the following reasons:

- the ASU fails to reply to attempts by the LIM to initiate the audit
- the ASU replies, but the system detects a state mismatch
  - the ASU is busy during a fast audit
  - the ASU is RTS during a slow audit

When an audit fails, the LIM informs the DMS-Core. The DMS-Core must know the condition of the ASU before problems occur in the ASU resident applications.

Maintenance software in ASU, F-bus, LIM, and DMS-Core continuously audits operations and communications of the application processor unit (APU). If the system detects a fault, the software attempts to isolate and correct the fault.

The DMS-Core-software collects state and load information on:

- dynamic load information for the application and specified ASUs
- ASU maintenance states
- ASU application process states
- data update status for each ASU

Automatic maintenance of the application processor unit

Maintenance software at the application processor unit (APU) level makes sure that DMS-Bus failure does not force APUs out of service. The APU-level maintenance performs the following functions:

- supports SOS reload restarts
- monitors the internal status of the APU and cards
- notifies affected subsystems of status changes in the APU
- performs maintenance requests that higher levels of maintenance or manual intervention initiate. These requests include requests to:
  - offline the APU
  - busy the APU
  - return the APU to service
  - perform diagnostics
  - receive and process configuration data

Maintenance software at the APU level interfaces with generic ASU maintenance, LIM-level maintenance, and DMS-Core-level maintenance.

Redundant APUs

A VPP requires only one APU for support. Many switches have two APUs for redundancy.

The two APUs operate in load-sharing mode or hot-standby mode. If an APU fails, the system shifts traffic to the second APU.

Maintenance software attempts to diagnose and correct the fault in the first APU. If the software cannot correct the fault, the system busies the APR. Maintenance personnel must intervene when maintenance software fail to correct a problem.

Operating system maintenance

Maintenance audits do not attempt to diagnose and return to service faults in the operating system. The APUX does not provide UNIX maintenance functionality. Software on the APUX monitors distributed UNIX application processes.

Maintenance audits monitor internal transmission of OM data between card-level OM receivers on APUX and DMS operational measurement (OM) system. Faults can include register overloads, invalid messages, and failed communications between the two OM systems. Log reports OMX101, OMX102, UOAM300, UOAM301, UOAM302, and UOAM503 identify faults in the transmission process.

Fault prevention by datafill

Entries determine the functionality of each APU. The accuracy of entries and entry updates is critical to the accuracy of the APU. Software starts and monitors applications entered for each APU. As entries change, new applications start and old applications stop. This process provides the following benefits:

- Entry updates automatically update the process that runs on an APU. Updates adjust the two system abilities.
- Duplicate entries between the DMS-Core and APUs are eliminated.
- A central point of contact is present for information about the maintenance status of APUs.
- Processes restart automatically if a failure occurs.
- the system notifies processes of future shut-down.

Data update failures caused by timeouts or data manager process messages that indicate failure, do not cause circuit failures.

Application-level maintenance

Maintenance software in the call-processing application also monitors the APU. The ADAS allows maintenance personnel to use a UNIX-based work station that connects to an Ethernet LAN to problem solve for APUs.

Applications-based audits continuously monitor the performance of each application. If an application goes out-of-service, each channel on that APU fails.

Automatic maintenance of the CCS7 link interface unit

Maintenance software monitors the CCS7 link interface unit (LIU7) for hardware and software faults. These tests check the following:

- accuracy of the C-bus channel number
- signaling terminal (ST) sanity
- too many DS-0A control codes
- too many DS-0A data bipolar violations
- interface paddle board/processor interface
- power supply operations
- port accuracy
- processor memory
- fault detection circuitry

The CCS7 application audits also monitor the operation of the LIU7.

CCS7 signal audits

Part of the protocol support in the CCS7 network includes audits of incoming and outgoing signals. These audits include the following activities:

- signal unit alignment and delimitation
- signal link (SL) alignment
- SL error monitoring
- flow control

CCS7 bit error rate testing

The CCS7 bit error rate testing (C7BERT) measures the quality of digital transmission paths for fault isolation on signaling links (SL). A C7BERT test repeatedly transmits a 2047-bit pseudo-random pattern that complies with the CCITT 0.152 requirement. The C7BERT checks the returned pattern against the original transmission to make sure that bit errors do not occur. The C7BERT can occur during the first installation of a new CCS7 link,to isolate faults.

For DMS-100 switch-based CCS7 node, the test path includes the message switch, network, interface peripheral, and associated transmission facility. For the SuperNode switch-based CCS7 node, the test path includes the link termination paddle board and the associated transmission facility. The transmission facility can be DS-O or V,35.

Automatic maintenance of Ethernet interface units

The ASU maintenance software audits Ethernet interface units (EIU) and Ethernet link interface units (ELIU) for hardware faults every 5 min. Basic checks include:

- card parity for both the P-bus and the shared bus
- problems with descriptor blocks
- missing transmit interrupts
- bus error traps
- accuracy of functional blocks of the EIC

Dual-unit provisioning

One EIU or ELIU, which uses EIU hardware, is required for each Ethernet LAN that connects to a switch. Two EIUs provide fault redundancy and can operate in load-sharing or hot-standby mode. A group of EIUs that connect to a single LAN is a "set". Entries define the set of EIUs for a given LAN. If the primary EIU fails, information in routing tables shifts traffic to the second EIU.

LAN faults

The EIU maintenance software does not detect LAN hardware or software faults. The LANs use a variety of commercial equipment in a certain configuration. This configuration does not always meet Northern Telecom requirements for problem isolation and problem solving. Most LANs include software, on a central work station or server, that monitors and isolates problems.

The LEDs on the hub and media access unit indicate traffic activity, port segmentation, collision, and power. Self-tests and link accuracy tests on the hub and media access unit detect and isolate faults on these units.

The DMS maintenance software verifies connections to devices that the switch identifies through entries. The DMS maintenance software does not keep alarms, logs, or operational measurements normally kept for LAN equipment.

The DMS-core maintenance thresholds LAN fault errors. When error thresholds are exceeded, the DMS-core notifies local maintenance. The LAN faults that DMS-core maintenance thresholds include:

- errors in received packet (framing, overflow, CRC, and buffer)
- loss of carrier
- late collisions
- retries exceeded
- missing heartbeat

Data faults

The system performs data integrity audits at every protocol level to make sure that the protocol conversion process is accurate. Logs and OMs are kept at each protocol level to determine the source and path of faults.

Data integrity audits perform the following tasks:

- audit communication paths
- check protocol headers at all levels
- audit queues and buffers to check basic sanity
- verify header checksums at upper protocol levels

The system performs data integrity audits in the transmission control protocol/internet protocol (TCP/IP) stack. The TCP attempts to recover data that has faults, lost, duplicated, or delivered out-of-order by the IP. The TCP assigns a sequence number to each transmitted packet that requires a positive response from the receiving TCP.

The TCP governs the amount of data sent. The TCP returns a window. This window indicates the number of packets the sender can transmit before the sender receives additional permission.

The IP screens packets that pass between the switch and the LAN to protect the DMS-Bus. Screening discards IP packets from external nodes on the LAN that are not entered or are offline. Screening discards any IP packets sent to any external nodes on the LAN that do not have entries or are offlined. The IP also validates source, destination, and host addresses.

The internet control message protocol (ICMP) in IP alerts local maintenance to the following conditions:

- when a datagram cannot reach objective
- when the time-to-live field of the IP header expires before the datagram reaches objective
- when the datagram header not valid
- when a test of the communication between two items in the network must occur
- when the system samples the delay characteristics of the internet to get a timestamp.

Data integrity is a characteristic of Ethernet. Data integrity continuously monitors Ethernet links for possible collisions. A collision occurs when two network nodes transmit on the same channel at the same time. Ethernet contains carrier sense multiple access (CSMA) with collision detection (CD).

If a node detects another node signal during transmission, the node aborts transmission and tries again at a later time.

Communication faults

Communication faults can occur in transmission or reception. The descriptor blocks for both transmit and receive contain status bits that indicate the successful completion or failure of the operation. The system checks these bits at each transmit or receive interrupt. A register maintains additional network error bits.

The EIU maintenance supports an overload control process that discards packets at the interrupt level and not the process level. When resources in the EIU become critical, the system discards packets from the Ethernet interface or F-bus. Ethernet hardware provides 128 buffers for receive packets, and packets discards packets when all 128 buffers are full.

Automatic maintenance of the frame relay interface unit

Maintenance software continuously monitor the performance of frame relay interface units (FRIU) and associated T1 carriers. If the software detects a failure, the software attempts to correct the fault. If the software cannot correct the fault, the system raises an alarm.

DATASPAN faults

When the switch buffers that DATASPAN uses are full and cannot handle additional data, congestion occurs. When congestion occurs, the switch discards frames. When the destination device no longer receives sequential frames, the device determines that congestion occurs. The device requests that the originating device stop the transmission of frames until the condition returns to normal.

A frame check sequence (FCS) in every frame detects transmission errors. The network discards frames with errors.

Channel faults

When an FRIU connects to a switching network or T1 modem, the FRIU conducts two loopbacks at the same time on each channel. The system transmits received data back to the far end after the frame relay access processor (FRAP) processes T1 framing. The system loops back the transmitted HDLC frames to the FRIU. The FRIU also tests A/B signaling on each channel.

Carrier faults

The FRIU maintenance monitors T1 carriers for two fault detection parameters: loss of signal (LOS) and loss of frame (LOF). The LOS occurs when the hardware detects 175 +/- zeroes in the incoming signal. This condition terminates when the system detects a valid signal framing. When an out-of-frame situation lasts 2.5 s, the system declares LOF.

The FRIU maintenance monitors T1 carriers for two performance parameters: bit error ratio (BER) and out of frame (OOF) data. The BER determines the fraction of bits not received correctly during a certain time. The system uses bipolar violation (BPV) to approximate BER. The OOF represents the number of frame bit errors that occur on the T1 carrier.

The FRIU maintenance monitors T1 carriers for three service quality parameters: errored seconds (ES), severe errored seconds (SES), unavailable seconds (UAS). The ES is the number of seconds during which a BPV or OOF condition occurs. The SES is the number of seconds during which a standard BER occurs. The UAS is the number of unavailable seconds. After 10 s of SES, the service is not available.

Automatic maintenance of the network interface unit

The two network interface units (NIU) operate in a hot-standby mode. One unit is active. The other is not active. The two units connect through with an inter-CBC cable. On detection of service-affecting faults, the active unit signals the not active unit to become active. The not active unit performs audits on the active unit. If the software load in the active unit becomes insane, the not active unit can force a reset of the active unit. The not active unit can force a switch of activity.

The NIU maintenance is part of the channelized access. The NIU maintenance maintains the two unit NIU and controls allocation of C-bus channels to applications in the LPP. The NIU maintenance also maintains the accuracy of the DS30 connections from the network.

The design of NIU communications helps make sure that data transmits correctly. These design advantages include:

- ASUs only accept data from the C-bus of the active unit
- NIUs only transmit data from the active unit
- NIUs transmit equal data streams to the network module over duplicate DS30 links
- The DS30 paddle boards in each unit only respond to maintenance requests from the active unit. Response does not allow a potentially insane unit to corrupt a feature data stream.

The NIU maintenance audits attempt to diagnose and correct as many hardware faults as possible before the NIU unit enters service. In-service tests are actions that do not affect traffic. Out-of-service tests are thorough, and apply every circuit and data path on the CBC card.

C-bus faults

The NIU monitors the C-bus for parity errors on assigned and not assigned channels. Thresholding of these errors determines the severity of the failure.

The C7LKSET level of the CCS subsystem of the MAP terminal maintains the CCS7 links.

Automatic maintenance of the voice processor unit

The voice processor unit (VPU) is a single PM and does not have a redundant unit. The system takes the VPU out of service when the system detects a failure. The VPU-level maintenance performs in and out of-service diagnostics on the recording announcement processor and C-bus interface 512 channel (CBI-512) card. Out-of-service diagnostics detect and isolate faults at the card level before the system puts the VPU in service. In-service diagnostics perform tests while the VPU is in-service. These tests do not destroy components of the VPU.

If a single VPU goes out of service, the application supports remains in service. The change of state affects the voice-processing ability of the application.

If a VPU is configured to disable positive validity check, protocol violations lock the service circuit. All messages from the application, that follow, generate error messages. The service circuit remains locked until the application deallocates the service circuit or a maintenance audit reclaims the service circuit.

Out-of-service diagnostics

The system conducts basic out-of-service diagnostics on the following RAP and CBI-512 components:

- CBI-512 element ID PROM
- CBI-512 P-bus-addressable registers
- RAP element ID PROM
- RAP P-bus-addressable registers
- digital signal processing cell (DSPC) reset
- integrated processor and F-bus (IPF)/DSPC message interface
- DSPC ROM-based diagnostics

Extended out-of-service diagnostics make sure that CBI-512 and RAP shared hardware resources function correctly. Diagnostics test RAP speech memory, RAP speech memory write protection circuitry, RAP/CBI-512 global PCM loopbacks, and RAP/CB miscellaneous interrupts. These diagnostics include a destructive speech memory test. The audio load must not be loaded before these diagnostics are run.

Reset diagnostics

Correct reset of the DSPC causes DSPC ROM software to execute CPU initialization and self-tests. The DSPC ROM software also executes an IPF/DSPC message interface hardware verification process with the IPF. If these tests are successful, the VPU performs the following ROM-based diagnostics:

- standard local memory test that is not destructive
- destructive extended local memory test
- hardware sanity test
- extended out-of-service tests

In-service diagnostics

In-service diagnostics determine the accuracy of RAP and CBI-512 hardware while the VPU is in service. These tests include:

- speech memory test
- TDM loopback for each channel

Service circuit audits

The VPU maintenance audits attempt to reclaim allocated service circuits. If the system allocates a service circuit for a minimum of one audit interval, the VPU queries the application. The VPU queries the application to determine if the circuit is in use. If the circuit is not in use, the session terminates and the VPU reclaims the circuit. Maintenance audits also attempt to reclaim locked circuits.

When a service circuit fails, the VPU removes the circuit from the correct pool. The VPU signals the application procedure for each affected service circuit. When the service circuits become available, the VPU returns the circuits to the pool.

Automatic maintenance of the X.25/X.75/X.75' link interface unit

Maintenance software continuously monitors the performance of X.25/X.75/X.75' link interface units (XLIU) and the links that associate with the XLIU. If the system detects a failure, the software attempts to correct the fault. If the system cannot correct the fault, the system raises an alarm.

The XLIU self-monitors for congestion. Five congestion conditions can occur:

- When a large number of packets is present in the XLIU, new incoming packets to the XLIU are dropped. The XLIU changes to the ISTB state with the reason "Packet dropping threshold reached". The XLIU state returns to InSv when incoming packets are no longer dropped.
- The BMS free buffer pool can drop below the mild congestion level because of high traffic levels. If this drop occurs, the Dynamic Window

algorithm decreases the Layer 3 flow control window to limit the XLIU data traffic flow. The XLIU changes to the ISTb state with the reason "BMS free pool Dynamic Window congestion threshold reached". The BMS free buffer pool is in Layer 3. The XLIU state returns to InSv when the BMS free pool recovers above the mild congestion level.

- The HBM free buffer pool can drop below the mild congestion level because of high traffic levels. If this drop occurs, the Dynamic Window decreases the Layer 3 flow control window to limit XLIU data traffic flow. The XLIU changes to the ISTb state with the reason "HBM free pool Dynamic Window congestion threshold reached". The HBM free buffer pool is in Layer 2. The XLIU state returns to InSv when the HBM free pool recovers above the mild congestion level.
- The BMS free buffer pool can drop below the severe congestion level because of overload traffic levels. If this drop occurs, the RNR algorithm sends Layer 2 RNRs to the affected DTEs in order to stop input data traffic. The XLIU changes to the ISTb state with the reason "BMS free pool RNR at Layer 2 congestion threshold reached". The XLIU state returns to InSv when the BMS free pool recovers above the severe congestion level.
- The HBM free buffer pool can drop below the severe congestion level because of overload traffic levels. If this drop occurs, the RNR algorithm sends Layer 2 RNRs to the affected DTEs to stop input data traffic. The XLIU changes to the ISTb state with the reason "HBM free pool RNR at Layer 2 congestion threshold reached". The XLIU state returns to InSv when the HBM free pool recovers above the severe congestion level.

Return-to-service tests

When an XLIU RTS, the system runs the following tests:

- micro-controller subsystem test
- high-level data link control (HDLC) subsystem test
- HDLC frame processor (HFP) RAM test
- direct memory access (DMA) controller test
- P-bus address and data tests
- ID PROM verification
- connection memory tests
- continuity test support

The HFP is reset when an XLIU changes from a ManB state. This reset brings the HFP to ROM level.

Interrupt-driven errors

The IPF card receives interrupt-driven errors from the HFP and the C-bus access interface processor (CIP). The interrupt-driven errors indicate a fault with the XLIU. Interrupt errors include:

- parity error
- P-bus error
- autonomous reset
- connection memory

If the XLIU detects an interrupt error, the XLIU changes state to SysB.

In-service tests

The system sends an audit probe to the HFP card every 10 s. If the HFP fails to respond with a probe interval, the XLIU changes state to SysB. The HDLC frame processor (HFP) is started again.

Quick Reference to manual maintenance

Automatic maintenance activities, like audits and tests, can diagnose and repair the faults that occur in the LPP. When manual maintenance is required, the required activities are specified by MAP displays, log reports, and OMs that maintenance personnel receive and that this guide identifies.

37 LPP preventive maintenance methods

This chapter describes the preventive maintenance methods for link peripheral processor (LPP) peripheral modules (PM). This chapter provides general information to help maintenance employees with experience to troubleshoot and maintain LPP PMs.

Description of routine maintenance procedures

The establishment and implementation of routine maintenance procedures is a necessary step in preventive maintenance of all DMS SuperNode equipment. *Routine Maintenance Procedures* describes these procedures.

The following chapter lists some of the routine maintenance procedures for LPP PMs. Use these procedures in addition to, and not to replace, procedures established by your local switching office.

Routine maintenance schedules

Table 37-1 lists routine maintenance procedures for LPP PMs, and frequency of performance for each procedure.

Table 37-1 Schedule of routine maintenance tasks for the LPP (Sheet 1 of 2)

Performance interval	Maintenance task
Daily	Perform a manual REX test on an NIU.
Daily	Perform a manual REX test on an LIM unit.
Daily	Test the F-bus taps on one F-bus.
Two weeks	Inspect the cooling unit filters and replace the filters when necessary
One month	Test the wrist strap grounding cords.

Note: To minimize service interruptions, perform daily maintenance tasks during periods of light traffic.

Table 37-1 Schedule of routine maintenance tasks for the LPP (Sheet 2 of 2)

Performance interval	Maintenance task
One month	Test the dead system alarm.
Three months	Inspect and replace any burnt out lamps in frame supervisory panels.
Three months	Replace cooling unit filters P0558302 and A0344437.
Three months	Test power converter voltages.
As required	Return cards or assemblies for replacement or repair.
As required	Test an LIM unit.
As required	Test an ASU.
As required	Test the F-bus taps on one LIM.
As required	Conduct a carrier loopback test.
As required	Perform a manual line test.
As required	Perform a manual trunk test.

Note: To minimize service interruptions, perform daily maintenance tasks during periods of light traffic.

38 LPP related logs

This chapter identifies logs for maintenance of link peripheral processor (LPP) peripheral modules (PM). This chapter identifies these logs as background information to help maintenance employees with experience to troubleshoot and maintain LPP PMs.

The DMS-100 switch generates logs to record important operation events. Important operation events include equipment faults, equipment state changes, and the failure or completion of tests. Subsystem buffers store these logs. Maintenance employees can access subsystem buffers from the MAP terminal. Maintenance employees can review the logs in these buffers to identify and correct faults or possible faults.

Table 1 lists some of the logs that LPP-related faults can generate. This table identifies the possible cause of the log and describes the correct response for maintenance employees.

For more information on these and other logs, refer to ***Log Report Reference Manual***.

Table 38-1 LPP Related logs

Log name	Causes	Response
AUDT401	A system audit detects a mismatch between the computing module and an LIU7	There is no response. The audit corrects the mismatch.
AUDT612	A CCS audit detects a mismatch in link availability between the computing module and an LIU7 or other PM.	There is no response. The audit corrects the mismatch.
AUDT616	A system audit detects a synchronization mismatch between the computing module and a signaling terminal.	There is no response. The audit corrects the mismatch.

Table 38-1 LPP Related logs

Log name	Causes	Response
AUDT620	A system audit detects a mismatch in link discard levels between the common channel and a signaling terminal.	There is no response. The audit corrects the mismatch.
AUDT621	A system audit detects a mismatch in congestion levels between the computing module and an LIU7.	The audit corrects the mismatch. Contact the next level of support for analysis of the audit fault detection.
AUDT622	A CCS audit detects a mismatch in link discard levels between the computing module and an LIU7 or other PM.	The audit corrects the mismatch. Contact the next level of support for analysis of the audit fault detection.
AUDT626	A signaling control point audit detects an accuracy mismatch between the static data of the computing module and of LIU7 or MSB7.	There is no response. An information report.
CCS101	A CCS link fails.	Refer to ***Log Report Reference Manual***.
CCS102	A CCS link reaches sync, or aligns, and is ready to carry traffic.	There is no response. An information report.
CCS103	A CCS link times-out after the link attempts alignment and fails to achieve sync.	Refer to ***Alarm and Performance Monitoring Procedures***.
CCS104	The far end of CCS link has processor power failure. This remote processor power failure can result when a CCS link is manual busy or inhibited at the far end.	Contact the far-end office to verify remote processor power failure or manual busy condition.
CCS105	A CCS link recovers from remote processor power failure.	There is no response. An information report.
CCS106	You manually deactivate a CCS link.	There is no response. An information report.
CCS107	A CCS7 link test fails.	Refer to ***Alarm and Performance Monitoring Procedures***.
CCS108	A CCS7 link reaches sync but cannot reserve the link.	There is no response. An information report.
CCS156	A CCS link becomes offline.	There is no response. An information report.
CCS157	A CCS link is manual busy.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
CCS158	A CCS link is system busy after a return-to-service fails.	Refer to ***Alarm and Performance Monitoring Procedures***.
CCS159	The system performs a local inhibit on a CCS link.	There is no response. An information report.
CCS160	The system performs a remote inhibit on a CCS link.	There is no response. An information report.
CCS161	The system removes a local inhibit from a CCS link.	There is no response. An information report.
CCS162	The system removes a remote inhibit from a CCS link.	There is no response. An information report.
CCS163	A CCS link is available for signaling traffic.	There is no response. An information report.
CCS164	A CCS link is not available for signaling traffic.	Refer to ***Alarm and Performance Monitoring Procedures***.
CCS165	The switching far-end office at the far end of a CCS7 link did not follow CCS7 protocol.	Contact the next level of support.
CCS173	Congestion is present in the transmission buffer of a CCS link.	Reduce traffic on the link. If congestion continues, troubleshoot the transmission link or create more CCS7 links for this LINKSET.
CCS176	The remote service module detects differences in link data.	There is no response. The audit corrects the problem.
CCS241	A signaling-connection control part fails to route a message to an LIU7.	There is no response An information report. CCS241 is subject to thresholding. If (n) CCS241 logs generate in a 1 min period, a CCS243 log generates.
CCS243	The number of CCS241 logs exceeds the threshold for CCS241 logs. A signaling-connection control part fails to route a message to an LIU7 (n) times in 1 min.	Correct the reason for the routing failure.
CCS296	The system enables a signaling connection control point in an LIU7.	To disable signaling connection control point message tracing on the LIU7, use remote login.

Table 38-1 LPP Related logs

Log name	Causes	Response
CCS400	The path through a signaling transfer point from one LIU7 to another has faults.	There is no response. An information report. System action corrects the problem.
CCS401	The path through a signaling transfer point from one LIU7 to another returns to service.	There is no response. An information report.
CCS500	The number of message signaling units (MSUs) discarded by gateway screening exceeds the threshold value.	Several CCS502 log reports normally follow this report. Contact the next level of support.
CCS501	The number of MSUs received from other networks exceeds threshold values.	Contact the next level of support.
CCS502	A gateway screening function discards a message.	Contact the next level of support.
CCS503	An error prevents performance of a gateway screening function.	Determine the reason screening errors occur and correct the screening function involved.
CCS504	Gateway screening function table operations fails. Some form of data corruption occurs between computing module gateway screening tables and gateway screening functions in the specified link.	Refer to ***Log Report Reference Manual***.
CCS505	A gateway screening function stops, The cause can be a hardware error.	Refer the log to Nortel personnel.
CCS701	A static data audit detects a problem with a PM table and takes action.	Refer to ***Log Report Reference Manual***.
C7TU101	A C7TU link receives a message. The system makes a request to intercept or monitor this message type with C7TU.	There is no response. An information report.
C7TU102	A C7TU intercepts a message sent to a link from an MSB.	There is no response. An information report.
C7TU103	A message transmitted correctly through a CCS7 link.	There is no response. An information report.
C7TU104	The system uses C7TU to insert a message on a CCS7 link.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
C7TU105	The system cannot insert a message on a CCS7 link with the SEND command from the CCS7 test utility link.	Try the SEND command again to send the message again.
C7TU106	A C7TU receives a message that is not known.	Determine the message type and origin.
C7TU108	The destination point code status reporting status turns on in C7TU. The status of a ROUTESET changes.	There is no response. An information report.
C7TU109	The system enables message monitoring or intercept in the PM.	There is no response. An information report.
C7TU110	The system disables message monitoring or intercept in the PM.	There is no response. An information report.
DDM100	Data transfers correctly to a PM.	There is no response. An information report.
DDM101	Distributed data fails to download to a PM.	Contact the next level of support. Failure to download a table causes the RTS to fail.
DDM102	A distributed data update fails to download to a PM.	When possible, take the PM out of service and attempt an RTS. The loss of a data update can cause the PM to become SysB.
DDM106	An audit of distributed data fails.	Problem can require PM maintenance. Contact the next level of support.
DDM107	An attempt to retrieve operational measurement data fails.	Problem can require PM maintenance. Contact the next level of support.
ENET114	An ENET parallel system recovery occurs.	Refer to ***Log Report Reference Manual***.
FRS101	A T1 trunk changes status from busy to in-service, or from in-service to busy.	To raise the trunk, return to service channel 1 of the correct FRIU.
FRS110	No recording unit is available when the system generates a frame relay billing record.	Refer to the customer office billing document.
FRS111	The counter for frame relay billing reaches 90% of threshold.	There is no response. If the system generates the log often, change the aggravation interval to a smaller value in the table.

Table 38-1 LPP Related logs

Log name	Causes	Response
FRS301	The terminating office rejects a frame relay connection request.	Refer to ***Log Report Reference Manual***.
ISDN100	The D-channel handler detects that a terminal is not available for traffic.	Determine the reason that the terminal is not available. Contact the next level of support.
ISDN101	The D-channel handler that associates with the loop cannot enter traffic level. The loop is not available for messaging traffic.	Check tables LTDEF and LTMAP for entries that relate to signaling terminal controller (STC) and line equipment number (LEN) in log output. Make sure that the STC has the correct load. Load the STC again when necessary. Busy and return to service the STC. If these actions do not solve the problem, contact the next level of support.
ISDN102	The D-channel handler detects a duplicate terminal endpoint identifier (TEI) on the same loop and removes the TEI from service.	Use the TEI command at the LTPDATA level of the MAP display to restore the TEI.
ISDN103	A manual action changes the state of the Bd channel.	There is no response. An information report.
ISDN104	The Bd channel loses sync. The system removes the Bd channel from service. A problem is present in the connection between the DMS switch and the packet handler.	Use the CONT command at the DCH level of the MAP display to determine where the problem is on the loop. Attempt to correct any problems. RTS the carriers. RTS the Bd channel. If the Bd channel continues to fail, contact the next level of support.
ISDN105	The primary rate access (PRA) STC/B-channel loses sync. The system removes the PRA STC/B channel from service. A problem exits with the PRA interface.	Determine if the STC or DS1 are in or out of service. If out of service, RTS the STC or DS1. If the problem continues, contact the next level of support.
ISDN106	Layer 1 of the specified D-channel fails separately.	Determine the reason for the failure. Contact the next level of support.
ISDN107	The system fails to restore a terminal endpoint identifier (TEI).	Determine the reason for the failure. Contact the next level of support.
ISDN108	The system restores a TEI.	Run a SUSTATE test to make sure that the system restores communication with the restored TEI.

Table 38-1 LPP Related logs

Log name	Causes	Response
ISDN109	The system restores a D-channel to service.	Run a SUSTATE test to make sure that the system establishes communication with the restored D-channel.
ISDN110	One D-channel is in-service and the other D-channel is in a standby state.	Determine if the D-channel carrier is out-of-service. If the D-channel carrier is out-of-service, RTS the D-channel carrier. If the problem continues, perform a continuity test or a loopback test to make sure the hardware functions correctly.
ISDN111	One D-channel is active, and the other D-channel is out-of-service.	Determine if the D-channel carrier is out-of-service. If the D-channel carrier is out-of-service, RTS the D-channel carrier. If the problem continues, perform a continuity test or a loopback test to make sure the hardware functions correctly.
ISDN112	Both D-channels are out-of-service.	Determine if the D-channel carrier is out-of-service. If the D-channel carrier is out-of-service, RTS the D-channel carrier. If the problem continues, perform a continuity test or a loopback test to make sure the hardware functions correctly.
ISDN113	You perform a D-channel switchover.	Determine if the D-channel carrier is out-of-service. If the D-channel carrier is out-of-service, RTS the D-channel carrier. If the problem continues, perform a continuity test or a loopback test to make sure the hardware functions correctly.
ISDN114	The system performs a D-channel switchover.	Determine if the D-channel carrier is out-of-service. If the D-channel carrier is out-of-service, RTS the D-channel carrier. If the problem continues, perform a continuity test or a loopback test to make sure the hardware functions correctly.
ISDN115	The attempted TEI alignment exceeds subscription counters that represent the maximum number of permitted links for a set of TEI values.	Perform the TEI audit.

Table 38-1 LPP Related logs

Log name	Causes	Response
ISDN116	The action identifier is a TEI value that is not assigned to a terminal on the loop.	Identify the denied transmitted message. The switch performs a TEI audit.
ISDN200	The system generates this report daily for a maximum of 10 ISDN lines for each generation. ISDN200 displays: • the total number of frames received and transmitted again. • the number of received and transmitted later frames where errors exceed the threshold value. • the percentage of the total frames that these errors represent.	Determine the reason for high transmission error rates.
ISDN201	This daily report shows the percentage of frames that have faults and frames transmitted again on an ISDN switch.	Determine the reason for high transmission error rates on bad ISDN lines reported by the ISDN200 logs that match.
ISDN203	This daily report shows the percentage of frames that have faults and frames transmitted again on the ISDN switch.	Determine the reason for high transmission error rates on bad ISDN lines reported by the ISDN200 logs that match.
ITN201	Transmission control protocol (TCP) sequence numbers or control bit segments are continuously wrong. The connection aborts.	There is no response. Note the source host addresses of the failed peer TCP users.
ITN202	A peer TCP sends a connection request for a port that is not present.	There is no response. Note the source host addresses of the failed peer TCP users.
ITN203	A peer TCP sends a connection reset request in the form of a RESET segment. The connection aborts.	There is no response. Note the source host addresses of the failed peer TCP users.
ITN204	TCP aborts the connection between peer TCP applications because of an error in the local implementation of TCP.	There is no response. Issue a Problem Resolution System that contains details of the software error.

Table 38-1 LPP Related logs

Log name	Causes	Response
ITN205	TCP aborts the connection because time to transmit again exceeds threshold without response from the peer TCP. The system assumes the remote is dead.	There is no response. Determine the status of the connection path between the peer TCPs. Check the status of the remote peer node.
ITN206	TCP record mark service fails to position the received start of the message delimiter. The connection aborts.	There is no response. Note the source host address of the failed TCP with record marking implementation.
ITN299	The number of TCP log reports for a given LOG number exceeds the threshold.	There is no response. An information report.
ITN300	The system cannot deliver an incoming local IP (Internet protocol) packet because the upper layer protocol is not active on this node.	There is no response. An information report.
ITN301	The system cannot deliver an incoming IP packet because the system does not know the route.	Check the entries in data tables IPNETWRK and IPROUTER. Make sure the entries are the same as network architecture and assigned IP addresses. Check if a LAN that connects to SuperNode requires an external router and a default EIU. A default EIU and external router route messages from SuperNode to hosts not on a LAN directly connected to DMS switch.
ITN302	The system cannot deliver an incoming IP packet because the route is not available. This condition occurs on an EIU when the file transfer address of the identification host within SuperNode is not available.	Busy and return to service the EIU. This response will refresh the ARP cache on the EIU. A warm restart of the whole system or the EIU does not help recover from this fault condition.
ITN304	The system cannot deliver an incoming IP packet because the TIME TO LIVE of the datagram expires. On the EIU, INT304 means the system cannot deliver expired datagram locally or forward datagram to another node on the route.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
ITN305	The system cannot deliver an incoming IP packet because of IP screening.	Check the screening flag in table IPNETWRK. If screening is ON, check for entry of the external node IP address in table EXNDINV. If any of the datafilled external nodes is OffL, the system will screen out IP packets.
ITN306	An incoming IP packet has an IP header that contains an error.	There is no response. An information report.
ITN310	The system cannot submit an outgoing IP packet because of IP screening.	Check the screening flag in table IPNETWRK. If screening is ON, check for entry of the external node IP address in table EXNDINV. If any of the entered external nodes is OffL, the system screens out IP packets.
ITN311	The system cannot submit an outgoing IP generated on this node.	There is no response. An information report. The datagram needs fragmentation that the upper layer protocol does not permit.
ITN312	A message does not transmit to a node because the system does not know the route.	Refer to ***Log Report Reference Manual***.
ITN313	A message does not transmit to a node because the system does not know the route.	Refer to ***Log Report Reference Manual***.
ITN315	An audit detects a mismatch between the TCP/IP connection data stored on series three nodes and on the computing module.	Refer to ***Log Report Reference Manual***.
ITN399	The number of logs exceeds the threshold. A summary report.	There is no response. An information report.
ITN400	The system cannot deliver an incoming IP because upper layer protocol is not active on this node.	There is no response. An information report.
ITN401	The system cannot forward an internet control message protocol packet to the destination network of the packet.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
ITN402	An internet control message protocol packet is not forwarded to the destination host of the packet.	There is no response. An information report.
ITN403	The system cannot deliver an internet control message protocol packet because of an error in fragmentation.	There is no response. An information report.
ITN404	The system cannot deliver an internet control message protocol packet because the Time To Live parameter of the packet expires.	There is no response. An information report.
ITN405	The system cannot deliver an internet control message protocol packet because of an error in the IP header.	There is no response. An information report.
ITN499	The number of logs exceeds the threshold.	There is no response. An information report.
LINE100	An ISDN loop passes a diagnostic test from the shower queue.	There is no response. An information report.
LINE101	An ISDN loop fails a diagnostic test from the shower queue or manual action.	Review the log to determine the cause of the failure. Refer to ***Log Report Reference Manual***.
LINE102	The system changes the line state from call processing busy (CPB) to lockout (LO).	Check the LINE log report buffer for line trouble reports for the same line equipment. Resolve the trouble reports.
LINE103	A line returns to service from a lockout state.	There is no response. An information report.
LINE104	The system encounters a problem during call processing. If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.

Table 38-1 LPP Related logs

Log name	Causes	Response
LINE105	The system encounters a problem during call processing. If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE106	The system encounters a problem during dial pulse reception on a line. This normally indicates signal distortion by a foreign electromagnetic force (FEMF). If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE107	The system requests a line insulation test. This report identifies the ringing differential offset for a line that causes ringing to fail.	Check facility.
LINE108	The system encounters a problem during digitone reception on a line. This normally indicates a hardware problem with the circuit pack or facility. If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE109	The system encounters a problem during call processing. If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE and TRKS buffers for diagnostic reports and problem reports for the same line or trunk equipment. If you find a failed diagnostic report or problem report, resolve the problem.
LINE110	The system detects FEMF on a line during a foreign potential test.	Perform line diagnostics on suspect line equipment from the LTPLTA level of the MAP terminal.
LINE112	The system detects a stuck coin during coin operation on a line connected to a coin box. The system fails to remove the coin.	To release the coin, use the coin box manufacturer maintenance manual for coin release procedures.
LINE113	The system encounters a problem during an attempt to apply ringing to a line.	Refer to ***Log Report Reference Manual***.

Table 38-1 LPP Related logs

Log name	Causes	Response
LINE114	A diagnostic test of line equipment detects the failure of one of the two digital-set interface chips (DSIC).	Replace the DPMC (8X55) card.
LINE115	A call from a line that connects to the DMS switch terminates. The call terminates to a line with the calling line identification (CLI) service order (SO) option.	Save this report for the department that requested the CLI SO option for the line.
LINE117	A call from a trunk that connects to the DMS switch terminates to a line with the CLI SO option.	Save this report for the department that requested the CLI SO option for the line.
LINE118	The system uses a metallic test access (MTA) to attempt the metal connection between the line circuit pack and test equipment. The MTA test does not complete. Either you or the system request a diagnostic test that requires the use of an MTA.	Repeat the action that generated the LINE118 log. If the system generates another log, post the MTA DRIVER number and test the MTA card. If the diagnostic test fails, replace the MTA card and RTS the card.
LINE119	A call from another line that connects to the DMS switch terminates. The call terminates to an emergency service bureau (ESB) line with the CLI SO option.	Save this report for the department that requested the CLI SO option for the line.
LINE120	The DMS switch fails to establish a three-way call because a hardware or software resource is not available.	There is no response when the system generates this report less than 10 times with the same message in 1 h. There is no response when the system generates this report less than 20 times with different messages in 1 h. If the system generates this report more than 10 times in 1 h with the same message, check table LENFEAT. Table LENFEAT shows if the line allows three-way calling. If the system generates this report more than 20 times in 1 h with the different messages, contact network planning employees.
LINE125	A call from a trunk that connects to DMS switch terminates a line with calling line identification with flash (CLF) SO option. The hookswitch flashes.	Save this report for the department that requested the CLF SO option.

Table 38-1 LPP Related logs

Log name	Causes	Response
LINE126	A malicious call originates from another line that connects to a DMS switch with the CLF option. The system activates the malicious call trace feature.	Save this log for the department that requested the CLF SO option.
LINE127	A line with the warm line update (WML) feature updates the tuple in table LENFEAT while the journal file is active. A line with the WML feature activates or deactivates WML while the journal file is active.	Make sure that table LENFEAT shows the changes for the specified tuple.
LINE128	A line with the warm line update (WML) feature updates the tuple in table LENFEAT while the journal file is active. A line with WML activates or deactivates WML while the journal file is not active.	Make sure that table LENFEAT shows the changes for the specified tuple.
LINE130	A call from a trunk that connects to the DMS switch terminates to a line with the CLF SO option. The hookswitch flashes.	Save this log for the department that requested the CLF SO option.
LINE131	This report provides the loop performance statistics for an ISDN loop.	There is no response. This log report is for information only, but can indicate service degradation. Operating company personnel can perform a diagnostic on the line or a SUSTATE to determine the reason for the service degradation.
LINE138	A call routes to a treatment after call processing busy. This report normally follows LINE101 and LINE102 reports.	Check the LINE log report buffer for trouble reports for the same line equipment. Resolve any problems.
LINE139	The hotel or motel message register pulsing application cannot find an entry in table CHARGTAB for a message billing index charge treatment pair.	Check the entries in tables CHARGTAB, MUMRBI, and TDSCHED and correct entry errors. If the message billing index is not correct, enter a correct index.
LINE145	A 2BIQ ISDN line card (ISLC) changes sync.	There is no response. An information report. Operating company personnel can diagnose the line reports to determine the cause of the sync loss.

Table 38-1 LPP Related logs

Log name	Causes	Response
LINE150	The system correctly performs a customer originated trace (COT).	There is no response. An information report.
LINE151	A subscriber with the COT feature dials the COT access code and initiates a trace of the last call received.	There is no response. An information report.
LINE160	The called party did not answer within a ringing timeout.	There is no response. An information report.
LINE161	The system generates this report with a TCM sync monitoring test. The system flags datapath line cards report sync losses equal to or in excess of the threshold are flagged.	Sync losses that indicate problems occur in sync between the data line card and the data unit. If diagnostics do not detect TCM sync problems, you must replace the line card.
LINE204	The system encounters a problem during call processing. If the problem interrupts a call in progress, the switch routes the call to a treatment and generates log report LINE138.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE205	The number of function key hits reaches or exceeds four in 2 s.	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system does not initiate diagnostic testing, isolate the fault. To isolate the fault, perform line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE209	The system generates log report LINE138 if: • the line exceeds the call processing error thresholds for the first time and is scheduled for system diagnostics. • the line fails the system diagnostics. • the line exceeds the thresholds again within 15 min of system diagnostics.	If system diagnostics do not solve the problem, contact the next level of support.
LINK100	An ILM-maintained resource changed state.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
LINK101	The system detects or clears a fault in an ILM-maintained resource.	There is no response. An information report.
MS267	No datafill is present for the identified LIS.	Datafill shelves in table SUSHELF.
MS400	The F-bus returns to service from manual busy or system busy.	There is no response. An information report.
MS401	The F-bus state changes from OK to manual busy.	There is no response. An information report.
MS402	The F-bus changes state from system busy, C-side busy, or offline to manual busy.	There is no response. An information report.
MS403	The F-bus returns to service.	There is no response. An information report.
MS404	The F-bus changes state from C-side busy to system busy.	Try to return to service the F-bus. If the diagnostic tests pass but the F-bus does not return to service, contact the next level of support. If the diagnostic tests fail, the system generates a card list. Replace cards and test the unit again until the test passes. If you exhaust the card list and F-bus remains out of service, contact the next level of support.
MS405	The F-bus changes state from system busy to C-side busy.	The card identified is out-of-service. Return the card to service.
MS406	The F-bus changes state from manual busy to offline.	There is no response. An information report.
MS407	A local message switch performed maintenance.	There is no response. An information report.

Table 38-1 LPP Related logs

Log name	Causes	Response
MS413	The F-bus is system busy.	The F-bus tap is out-of-service. Try to return to service the F-bus tap. If the diagnostic tests pass and the F-bus does not return to service, contact the next level of support. If the diagnostic tests fail, the system generates a card list. Replace cards and test the unit again until the tests pass. If you exhaust the card list and the F-bus remains out of service, contact the next level of support.
MS414	The F-bus tap changes state from C-side busy to system busy.	Refer to MS413.
MS415	The F-bus tap changes state from system busy to C-side busy.	The F-bus tap or card is out of service. Return to service the F-bus tap or card.
NET100	A receiving peripheral detects an accuracy mismatch. The system continues to define the network path, but cannot run a diagnostic with the available resources.	Collect and compare accuracy messages that follow to determine the cause of the accuracy failures. Use the NETINTG level of the MAP display.
NET101	A receiving peripheral detects an accuracy mismatch. The system cannot recover path data because the call disconnected before the network froze the connection for analysis.	Collect and compare accuracy messages that follow to determine the cause of the accuracy failures. Use the NETINTG level of the MAP display.
NET102	A receiving peripheral detects an accuracy fault.	Collect and compare accuracy messages that follow to determine the cause of the accuracy failures. Use the NETINTG level of the MAP display.
NET103	This report summarizes the accuracy failures in the switch.	If a counter exceeds 80, refer to the NETINTG level of the MAP display to investigate the problem.
NET104	The NETPATH diagnostics detect damaged cards.	Replace the cards and run NETPATH again to check for correct replacement.
NET105	The AUTO NETPATH test passes or aborts.	If the test aborts, refer to ***Log Report Reference Manual***.

Table 38-1 LPP Related logs

Log name	Causes	Response
NET106	The system generates this report each day before 1200 h. The NET106 reports the status of the scheduled NETPATH tests.	Test the paths manually.
NET130	The system cannot find a network path.	There is no response. An information report.
NET131	The system writes over a connection.	There is no response. An information report.
NET132	The system attempts to connect to a network path end that already has an allocated path. The system holds the original path for diagnostics.	There is no response. An information report.
NET133	The network attempts to make a connection that is not reserved.	If this log continues, contact the next level of support.
NET134	This report signals a call processing sequence that the system does not permit.	Contact the next level of support.
NET135	The system generates a log report NET135 if: • attempts to reverse a reversed path. • no path exists. • the path is not two way. • the system cannot find the other end of the path. • the number of connections is not exactly one.	Contact the next level of support.
NET136	The system attempts to connect two ports that do not have in-service planes available.	Return to service the correct network, plane, or junction.
NET155	The network clock audit detects that a network plane pair uses the wrong MS as a clock source.	If the log continues, contact the next level of support.

Table 38-1 LPP Related logs

Log name	Causes	Response
OMX101	The UNIX OM transfer process receives an OM data message from a central OM receiver that contains corrupt data.	If the problem continues, contact the next level of support.
OMX102	The UNIX OM transfer process fails to allocate memory to store OM group data.	Contact the next level of support.
PCH107	The system finds a discrepancy in patch audit.	Check the patch of the problem unit to determine if a failure is present. If the problem cannot be quickly corrected, contact Nortel TAS.
PM102	A PM is system busy.	Refer to ***Log Report Reference Manual***.
PM103	A PM is offline.	There is no response. An information report.
PM104	A PM is not equipped.	There is no response. An information report.
PM105	A PM is manual busy.	There is no response. An information report.
PM106	A PM returns to service.	There is no response. An information report.
PM109	A T1 carrier line is system busy.	If the system generates PM109 for less than 2 min, there is no response. If the system generates PM109 in excess of 2 min, perform maintenance on the T1 carrier. If the affected PM is an FRIU, the Carrier Number is 1.

Table 38-1 LPP Related logs

Log name	Causes	Response
PM110	A change occurs in the carrier service count.	If the limit clears, there is no response. If the maintenance limit is set, perform facility maintenance. ***Note:*** Frame loss Maintenance Limit (ML) and slip loss ML do not clear automatically, thus no PM110 Clear message is output. They are cleared at 2400 hours each day by an audit. This is confirmed when a log PM186 Audit Clear message is output. They are also cleared whenever a link is RTS'd. The frame loss ML and slip ML conditions are meant to be an early warning of a potential problem. Generally, you will want this to be reported a couple of times before taking any action. A single report requires only noting and no action. If the out-of-service limit is set, deload trunks and perform facility maintenance. If the affected PM is an FRIU, the Carrier Number is 1.
PM111	A T1 carrier returns to service.	There is no response. An information report.
PM128	A PM encounters a problem during normal operation and is now in-service-trouble.	If system action resolves the problem, there is no response. If the system cannot resolve the problem, the system generates a PM102 report. Refer to ***Log Report Reference Manual***.
PM179	A hardware condition affects normal PM operations.	Refer to ***Log Report Reference Manual***.
PM180	PM software is not correctly executed.	There is no response. Forward the log report to software employees for analysis.

Table 38-1 LPP Related logs

Log name	Causes	Response
PM181	The system detects a fault during a routine exercise.	Look for an occurrence of the same state change log for that PM. If no occurrences of the same state change log are present, wait for more PM181 logs. If the system does not generate more PM181 logs, a temporary event generated the original log. If occurrences of the same state change log or repeated PM181 log are present, refer to the card lists the PM181 logs generated. Replace and test cards again until the fault clears. Note: If the unit is an EIU, refer to the ***Log Report Reference Manual***.
PM182	An F-bus is manual busy.	There is no response. An information report.
PM183	An F-bus is system busy.	Try to return to service the PM. If the diagnostic tests fail, the system generates a card list and a PM182 log. If the diagnostic tests pass, but the F-bus does not return to service, contact the next level of support.
PM184	An F-bus returns to service.	There is no response. An information report.
SWNR100	This log provides CC Warm SWACT information after a SWACT transferral of DSM control to alternate central control.	There is no response. Refer to BCS application documentation.
UADA300	ADAS receives a message that is not correct.	Check for a pattern of logs that repeats. The pattern can indicate an APU or VPU that has faults.
UADA301	The call timer expires.	After a restart, a number of these logs is normal. There is no response. If no restart occurred, check for a pattern of logs that repeats. The pattern can indicate an APU or VPU that has faults.

Table 38-1 LPP Related logs

Log name	Causes	Response
UADA302	ADAS cannot register with local OM collector.	There is no response. The APU attempts to recover from the fault. If the APU cannot recover, the APU becomes SysB.
UADA303	ADAS cannot send a message to the DMS-Core or VPU.	Check for a pattern of logs that repeats. The pattern can indicate a fault in the APU.
UADA304	The APU detects an error in the APU/VPU protocol.	Check for a pattern of logs that repeats. The pattern can indicate a damaged APU or VPU.
UADA305	The VPU reports a critical fault in the APU.	Check for a pattern of logs that repeats. The pattern can indicate a VPU that has faults. Logs of this type can occur from time to time.
UADA306	A command in a message to a VPU fails, and the APU cannot recover.	Check for a repeated pattern of logs. The pattern can indicate a VPU that has faults. Logs of this type can occur. from time to time.
UAPM300	An application error that the system cannot recover from occurs.	Busy and return to service the affected APU.
UAPM301	A critical process fails.	There is no response, unless the system generates other logs. The system attempts to start the process again.
UAPM302	A process that is not critical fails.	There is no response, unless the system generates other logs. The system attempts to start the process again.
UCDM300	Current calls require both sides of shared memory (old and new service data).	Wait for calls that use old service data to empty. Commit service data changes again.

Table 38-1 LPP Related logs

Log name	Causes	Response
UCDM301	The system generates log report UCDM301 if: • file server is not available • the service data files on the file server are not available • the system cannot open the service data files on the file server	Check the status of the file server. Commit service data changes again.
UCDM302	Data manager cannot initialize because shared memory is not available or the system cannot access service data files.	Check the status of the file server. Check the status of the call processing machine.
UOAM300	The central OM receiver cannot send a connection message to the DMS-Core.	If the problem continues, contact the next level of support.
UOAM301	The central OM receiver cannot send OMs to the DMS-Core. The receiver will try to send the OMs again.	There is no response.
UOAM302	The APU cannot send either a data message or a connection message again to the DMS-Core.	If the problem continues, contact the next level of support.
UOAM503	The central OM receiver correctly established communications with the DMS-Core.	There is no response. An information report.

39 LPP related operational measurements

This chapter describes the operational measurement (OM) groups that associate with the link peripheral processor (LPP) and LPP peripheral modules (PM). This chapter provides background information to assist maintenance employees with experience to problem solve and maintain LPP PMs.

Operational measurements are data that contains records of events that occur during a given time period. Three main types of measurements are present. These three types are: peg counts, use, and overflow. Operational measurements are used as service-level indicators, and as input for maintenance, hardware and software assignment, accounting, and equipment decisions. Print selected OMs on a periodic base.

Table 39-1 lists the and describes the OM groups that associate with LPP PMs. For more information, refer to *Operational Measurements Reference Manual*, *Basic Administration Procedures*, 297-1001-300, and *Service Problem Analysis Administration*, 297-1001-318.

Table 39-1 LPP operational measurements (Sheet 1 of 3)

Group	Information
AASV	**Description:** This OM group monitors advanced APU services like ADAS. The registers in this group gather information on service circuit availability and usage for each APU. **Associated logs:** There are no associated logs.
ADASAPU	**Description:** This OM group records different call processing statistics for the ADAS application that runs on the APU. **Associated logs:** There are no associated logs.
ASUFBUS	**Description:** This OM group records the number of octets transmitted and received on each F-bus port. **Associated logs:** There are no associated logs.

Table 39-1 LPP operational measurements (Sheet 2 of 3)

Group	Information
ASUMEMUT	**Description:** This OM group records data and program store information for an application specific unit (ASU). **Associated logs:** There are no associated logs.
C7LINK1	**Description:** This OM group provides information about failures and recoveries of a CCS7 link. **Associated logs:** CCS101, CCS102, CCS107, CCS108, CCS157, CCS159, CCS160, CCS161, CCS162, CCS163, CCS164, and CCS193.
C7LINK2	**Description:** This OM group provides information on calls and congestion on CCS7 links. **Associated logs:** CCS173 and CCS400
DS1CARR	**Description:** This OM group provides information on thresholds and out-of-service (OOS) thresholds for digital trunks for PMs. **Associated logs:** PM107, PM109, PM110, PM112, PM183, TRK109, TRK182,
EIUETHER	**Description:** This OM group provides information about traffic at the Ethernet protocol level. **Associated logs:** There are no associated logs.
FRSAGENT	**Description:** This OM group monitors traffic and faults that affect service on logical channels an FRS device uses. **Associated logs:** There are no associated logs.
FRSPM	**Description:** This OM group monitors traffic and faults that affect devices that run a frame relay service. This group activates for an FRIU if table PVDNCHAN receives datafill for the device. **Associated logs:** There are no associated logs.
ILMLINKS	**Description:** This OM group contains counters to track the performance of ILM maintained-links. **Associated logs:** There are no associated logs.
ILMMCHS	**Description:** This OM group contains counters to track the performance of ILM message channels. **Associated logs:** None
ISGBD	**Description:** This OM group monitors traffic handling on Bd channels. ISGBD monitors in offices with ISDN-line group controllers (LGCI), ISDN line trunk controllers (LTCI), and ISDN-remote cluster controllers (RCCI). **Associated logs:**

Table 39-1 LPP operational measurements (Sheet 3 of 3)

Group	Information
ISGBRA	**Description:** This OM group monitors traffic on basic rate access (BRA) D-channels. ISGBRA monitors in offices that have ISDN-line group controllers (LGCI), ISDN line trunk controllers (LTCI), and ISDN-remote cluster controllers (RCCI). **Associated logs:**
LIUFBUS	**Description:** This OM group monitors traffic at the F-bus level. This group zeroes as of CSP03. Group ASUFBUS now includes the associated monitoring ability. **Associated logs:** There are no associated logs.
MSFBUS	**Description:** This OM group monitors the performance of the F-bus. **Associated logs:** There are no associated logs.
MSFBUSTP	**Description:** This OM group monitors the performance of F-bus taps. **Associated logs:** There are no associated logs.
NCMPUST	**Description:** This OM group allows access to CPU occupancy measurements on an ASU. CPU occupancy measurements represent accumulated occupancies during the OM transfer period. **Associated logs:** There are no associated logs.
PM	**Description:** This OM group measures error, fault, and usage counts on the link interface module (LIM) and F-bus. **Associated logs:** PM102, PM103, PM104, PM105, PM106, PM128, PM181, PM183
PM1	**Description:** This OM group measures error, fault, and usage counts on single-unit modules. PM1 measures single-unit counts on modules like LIU7, FRIU, EIU, ELIU, APU, XLIU, and VPU. **Associated logs:** PM102, PM104, PM105, PM128, PM181

40 LPP related data structures

Data structures are not necessary for operating company personnel with experience to perform problem solving and maintenance on the link peripheral processor (LPP).

41 LPP related user interface commands

This chapter describes how maintenance employees can use the MAP terminal to support the link peripheral processor (LPP). This chapter describes correct MAP levels, system status displays, menu commands, and non-menu commands.

LPP PMs use common MAP displays and commands. LPP PMs also use different display fields, menu commands, and non-menu commands to support different features, applications, and services. The section MAP user interface introduces the MAP system, common MAP displays, menu commands, and non-menu commands. Detailed information on the MAP levels, system status displays, menu commands, and non-menu commands for each LPP PM follow this introduction.

This chapter provides general information to help maintenance employees with experience to problem solve and maintain the LPP and LPP components. For additional information, refer to *DMS-100 Family Commands Reference Manual*, 297-1001-822.

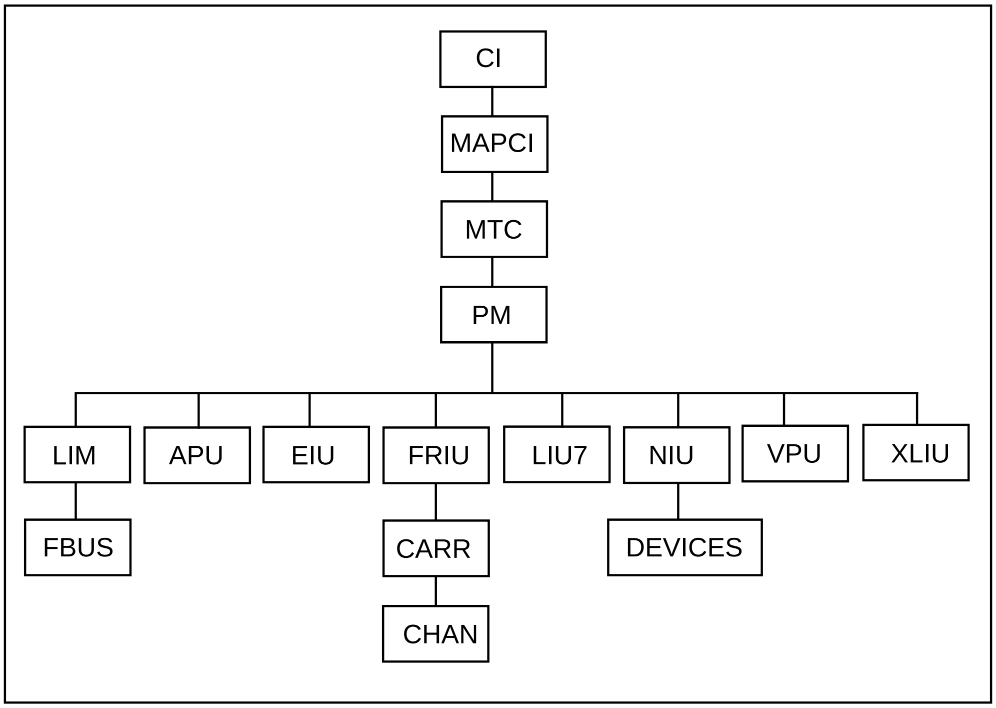
MAP user interface

Information at the MAP terminal organizes into an ordered series of display levels, that start at the command interpreter (CI) level. You access the CI level when you log on at a MAP terminal. At the CI level, the MAPCI command accesses the next highest level. From the MAPCI level, you can string commands to telescope into other levels.

Each level of the MAP system has a different set of commands and system status displays. Each level can display and access information from a previous level. For example, you can use menu commands available at the peripheral module (PM) level as non-menu commands at the link interface module (LIM) level. Status information displayed at the PM level remains on display when you access lower levels.

There is no LPP level. The LPP is an equipment package and not hardware. You access LPP PMs through the PM level of the MAP terminal. Figure 41-1 shows the LPP-related levels under the PM level.

Figure 41-1 LPP related levels of the MAP system



Other MAP levels, support LPP PMs. This chapter describes these levels and the LPP PMs that associate with these levels. These levels are discussed in this chapter with the corresponding LPP PM.

System status display

Each level of the MAP system provides a system status display at the MAP terminal. Each display builds on the display from the earlier level.

The first three lines of the system status display are common for all levels of the MAP terminal. These lines identify the number and type of PMs that have faults and the alarm codes. In the event of multiple faults, the system status display identifies the most important fault condition. If the MAP system detects a critical LIM fault and minor NIU fault, the MAP terminal displays the critical LIM fault.

PM level

At the PM level, the system status display provides additional information on PM links and nodes. This information normally includes the maintenance states for the PM, PM units, PM taps, and PM cross links. For LPP PMs, codes you use at the PM level are the same as codes you use at the main level.

Table 41-1 lists and describes the possible maintenance states for LPP PMs.

Table 41-1 LPP maintenance states

Code	State	Description
InSv	In-service	The PM is free of faults that affect service and can support any process.
ISTb	In-service trouble	The PM is InSv, and has a minor fault that affects service.
ISTb (NA)	In-service trouble, resource(s) not available	The PM is ISTb and no messaging path is present between the PM and the DMS Bus.
ManB	Manually busy	The PM is busy. The switch operator issued the BSY command to test or hold the PM out of service (OOS) during a limited time.
ManB (NA)	Manually busy, resource(s) not available	The PM is ManB and no messaging path is present between the PM and the DMS Bus.
OFFL	Off line	The system removes the PM from service during a limited time.
SysB	System busy	System maintenance removes the PM from service because of faults.
SysB (NA)	System busy, resource(s) not available	The PM is SysB and no messaging path is present between the PM and the DMS Bus.
UNEQ	UNEQUIPPED	No entries are present to identify the PM.

Most application specific units (ASU) use a common system status display. Figure 41-2 shows a system status display for an application processor unit (APU).

Figure 41-2 ASU system status display

```
CM     MS     IOD     Net     PM     CCS     Lns     Trks     Ext     Appl
.      .      .       .      1APU     .       .       .        .        .
                               M
APU                  SysB     ManB       Offl    CBsy     ISTb  Insv
0  Quit      PM     0        1          0       0        0     123
2  Post      APU    0        1          0       0        0       5
3  ListSet
4
5            APU 12   ManB  (NA)      Mtce  /Loading  200k
6  Tst_
7  Bsy_
8  RTS_
9  OffL
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM_
15
16
17
18
         userid
   TIME   hh : mm>
```

Table 41-2 lists and describes some of the fields in Figure 41-2.

Table 41-2 ASU system status display fields

Field name	Contents	Description
Identifier	APU 12	Identifies the ASU by type and number
Maintenance state	ManB	Identifies the maintenance state for the posted ASU
Accessibility	(NA)	An (NA) after the maintenance state indicates that no messaging path is present between the ASU and the DMS-Bus. If the path is available, the field is blank.
Maintenance indicator	Mtce	The indicator “Mtce” appears whenever a maintenance operation is in progress.
Maintenance status	/Loading: 200 k	Messages next to the maintenance indicator show the status of manual and automatic maintenance actions.

Menu commands

Each level of the DMS-100 maintenance system supports a menu of commands. The menu of commands is on the left side of the system status display. You can enter commands in the following ways:

- type the number that comes before
- type the command in full, without regard for upper or lower case letters

> ***Note:*** When you respond to a command prompt, a space must come before the menu item number.

Parameters are available for some commands. An underscore that follows a menu command indicates that the command requires a parameter. An underscore that comes before a menu item indicates an optional parameter.

Using the online help

The MAP terminal has an online help facility that provides additional information about command syntax and parameters. To access online help, from a MAP terminal, type

>HELP command

and press the Enter key.

where

command
is the command for which you need additional syntax or parameter information.

Cancelling a command

The MAP terminal allows you to cancel a command. Use this function if you post the wrong PM, select the wrong command, or use the wrong parameters. To cancel a command, type

>ABORT command

and press the Enter key.

where

command
is the original command that you need to change

Correcting errors

If you make an error when you enter a command, the following message appears:

```
EITHER INCORRECT OPTIONAL PARAMETER(S) OR TOO MANY
PARAMETERS
```

A description of the error follows the message. Correct the error and enter the command again.

Non-menu commands

Non-menu commands are commands not listed at the menu of the current level of the MAP terminal. These non-menu commands can include:

- CI level commands
- menu and non-menu commands available at higher levels in the MAP terminal
- non-menu commands for the current level of the MAP terminal

To enter non-menu commands, type the command in full, without regard for upper or lower case letters. You cannot enter non-menu commands by the number that associates with the command at another level.

Link interface module

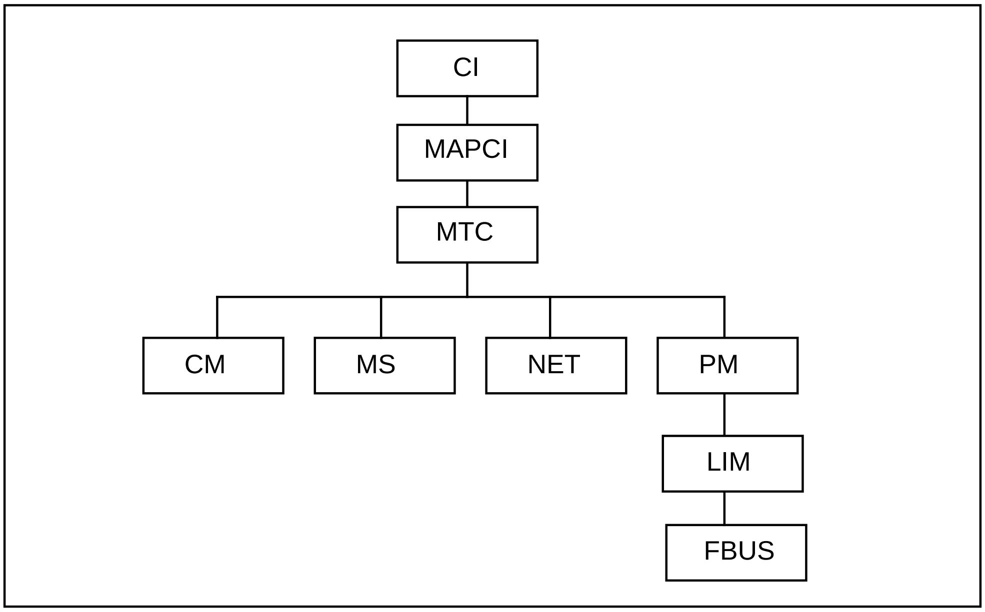
You can access the link interface module (LIM) level of the MAP terminal from the PM level. Maintenance activities at this level include the following:

- problem solve for LIM cards.
- access to the F-bus level to problem solve for the frame transport bus (F-bus).
- post a LIM to problem solve for the ASUs that associate with the LIM.

LIM MAP levels

Figure 41-3 shows the LIM related levels of the MAP terminal. You can access ASU levels from the PM level.

Figure 41-3 LIM related MAP levels



To access the LIM level from a MAP terminal, type

>MAPCI; MTC; PM; POST LIM lim_no

and press the Enter key.

where

lim_no
is the LIM you must post.

LIM system status display

Figure 41-4 shows a system status display at the LIM level for a posted LIM.

Figure 41-4 LIM-level system status display

```
CM    MS    IOD    Net    PM    CCS    Lns    Trks    Ext    Appl
.     .      .      .    1LIM    .      .       .       .      .
                           M
LIM               SysB    ManB      Offl   CBsy    ISTb  Insv
0  Quit     PM     0       1         0       0      0     123
2  Post     LIM    0       1         0       0      0       5
3  ListSet
4
5  Trnsl_   LIM 13   ManB
6  Tst_                    LINKS_00S Taps_00S
7  Bsy_     Unit 0   ManB    6          4   /Mtce
8  RTS_     Unit 1   ManB    2
9  OffL
10 LoadPM_
11 Disp_
12 Next
13 REx
14 QueryPM_
15
16
17
18 FBus
         userid
   TIME   hh : mm>
```

The LIM MAP display offers several fields that are not present in other PM MAP displays. Table 41-3 lists and describes fields for the LIM MAP display.

Table 41-3 LIM system status display fields

Field	Description
LIM status	Status of the posted LIM, identified by number.
LIM unit	Status of the posted LIM unit.
Links OOS	Total number of links out of service, including the two links between the two LIM units.
Taps OOS	Number of taps out of service for each F-Bus.
Progress indication	Describes current task or indicates the development of task for each unit.

LIM menu commands

LIM menu commands are like menu commands for other PMs. Table 41-4 lists and describes these commands.

Table 41-4 LIM-level menu commands (Sheet 1 of 2)

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
2	POST	Selects a set of LIMs or other PMs.
3	LISTSET	Lists the identification numbers of the posted LIMs.
5	TRNSL	Identifies the links and F-bus taps of the posted LIMs. Identifies the two end points and current state of the links and F-bus taps.
6	TST	Tests one or both units of a posted LIM. TST can test an link between units.
7	BSY	Manually busies one or both units of a posted LIM. Can busy a unit link between links.
8	RTS	Returns to service one or both units of a posted LIM. Can return to service an unit link between units.
9	OFFL	Sets an LIM to offline. You must first manually busy both units.
10	LOADPM	Loads one or both units of a posted LIM. You must first manually busy the units you will load.
11	DISP	Displays a list of all LIMs in a given state.
12	NEXT	Displays the next LIM in a posted set.
13	REX	Turns the REx test ability on or off. Applies one or both units, verifies inclusion of LIM in an application schedule, and verifies completion of last REx test.

Table 41-4 LIM-level menu commands (Sheet 2 of 2)

MAP #	Command	Description
14	QUERYPM	Displays information about a posted LIM that includes PM type, size of memory, node status, and REx schedules.
18	FBUS	Accesses the MAP FBUS level. Displays information about the F-buses of the posted LIM. Provides commands that execute maintenance and administrative actions on the F-buses.

LIM non-menu commands

Non-menu commands include:

- non-menu commands for the given LIM level
- menu and non-menu commands from higher levels that support the LIM level
- CI level commands that support the LIM level

LIM-level non-menu commands include a different WAIT command. Table 41-5 lists and describes LIM-level non-menu commands. Additional information on the WAIT command follows the table.

Table 41-5 LIM non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted LIM.
PMRESET	Resets one or both units of a posted LIM. If a unit is not loaded, the system performs a reload-restart. If a unit is not loaded or a command overrides the restart, the unit resets and runs at the firmware level.
WAIT	Turns wait mode on or off. WAIT is a command for the LIM level.

WAIT

Commands at the LIM MAP level execute in a different way from commands at other MAP levels. In normal operation, all commands at the LIM MAP level execute like you used a NOWAIT option. LIM-level commands return all responses to the MAP terminal, even when you exit the LIM MAP level.

Assume you entered the command LOADPM UNIT 0 on LIM 4 and exited the LIM MAP level to change table datafill. When you load the unit, the response

LIM 4 UNIT LOADPM PASSED appears on your screen while you enter the table. This feature allows you to perform several operations at the same time.

The command WAIT ON turns on the wait mode. When wait mode is on, commands at the LIM MAP level execute like commands at any other MAP level. The terminal holds until the command executes.

The command WAIT OFF turns off the wait mode. When wait mode is off, commands at the LIM MAP level execute in the background while you perform other operations.

Frame transport bus in full sized LPP

You can access the frame transport bus (F-bus) level of the MAP terminal from the LIM level. Maintenance actions at this level include the following:

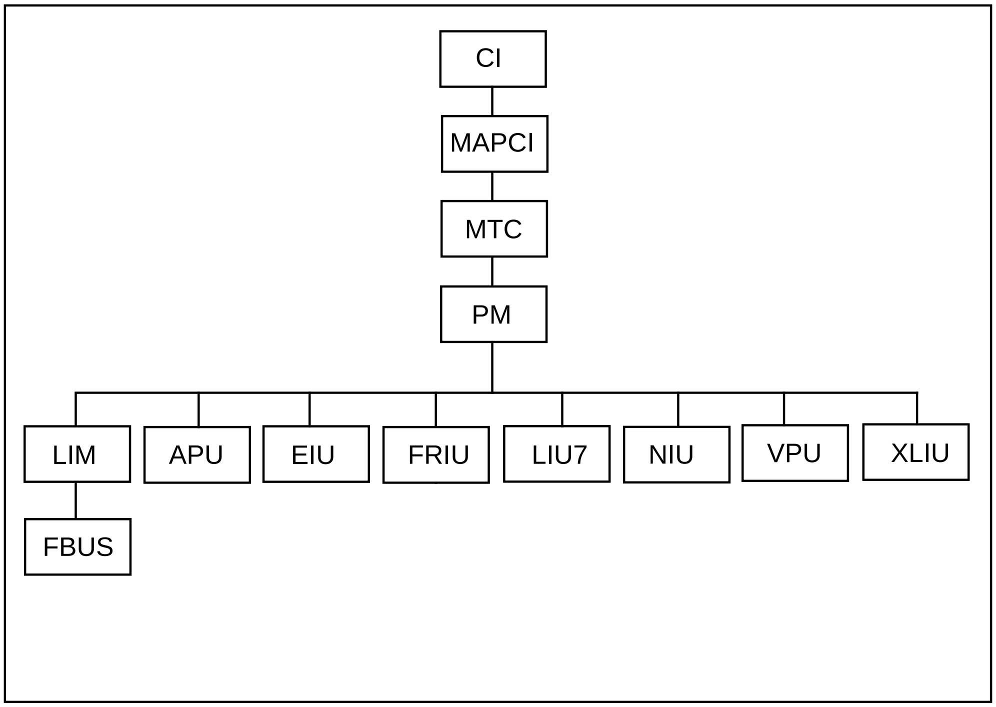
- problem solve for F-bus cards
- problem solve for F-bus taps
- busy the F-bus to problem solve for ASU cards

The MAP display identifies each ASU connection as a tap and each ASU as a subtending node.

F-bus MAP levels

Figure 41-5 shows the F-bus-related levels of the MAP terminal. You access each ASU level from the PM level.

Figure 41-5 F-bus-related MAP levels



F-bus system status display

Figure 41-6 shows a system status display at the F-bus level for a posted F-bus.

To access the F-bus level from a MAP terminal, type

>MAPCI; MTC; PM; POST LIM lim_no; POST FBUS fbus_no

and press the Enter key.

where

lim_no
is the LIM you must post

where

fbus_no
is the FBUS you must post.

Figure 41-6 FBUS-level system status display

```
CM    MS    IOD    Net    PM    CCS    Lns    Trks    Ext    Appl
.     .      .      .      .     .      .       .       .       .

FBus              SysB    ManB      Offl   CBsy    ISTb  Insv
0  Quit     PM     0       1         0      0       0     123
2           LIM    0       1         0      0       0       5
3
4
5  Trnsl_   LIM 13   InSv  LINKS_00S Taps_00S
6  Tst_
7  Bsy_     Unit 0   InSv
8  RTS_     Unit 1   InSv
9  OffL
10
11                                         1   1   2   2   2   3
12                     Tap:  0   4   8   2   6   0   4   8   2
13           FBus 0 InSv      -. .--------- . ----- . ---------
14           FBus 1 InSv      -. .--------- . ----- . ---------
15
16 QueryFB
17
18
         userid
   TIME   hh : mm>
```

F-bus menu commands

FBUS level menu commands are like the menu commands at other levels of the PM system. Table 41-6 lists and describes these commands.

Table 41-6 FBUS-level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP terminal.
5	TRNSL	Identifies the devices that attach to the bus or a given tap.
6	TST	Tests a bus or tap.
7	BSY	Manually busies a bus or tap.
8	RTS	Returns to service a bus or tap.
9	OFFL	Sets both F-bus units of a given LIM to offline.
16	QUERYFB	Displays information on the state of the F-bus and any current faults.

F-bus non-menu commands

The non-menu commands available at the FBUS level are like non-menu commands at other levels of the PM subsystem. Non-menu commands include:

- non-menu commands for the F-bus level
- menu and non-menu commands from higher levels that support the FBUS level
- CI level commands that support the FBUS level

Table 41-7 lists and describes these commands.

Table 41-7 F-bus non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted F-bus.
INFORMATION	Displays information about the posted bus.

Single shelf LPP

Maintenance for the single shelf LPP (SSLPP) takes place from the shelf level of the MS subsystem of the MAP system. Maintenance actions at this level include the following:

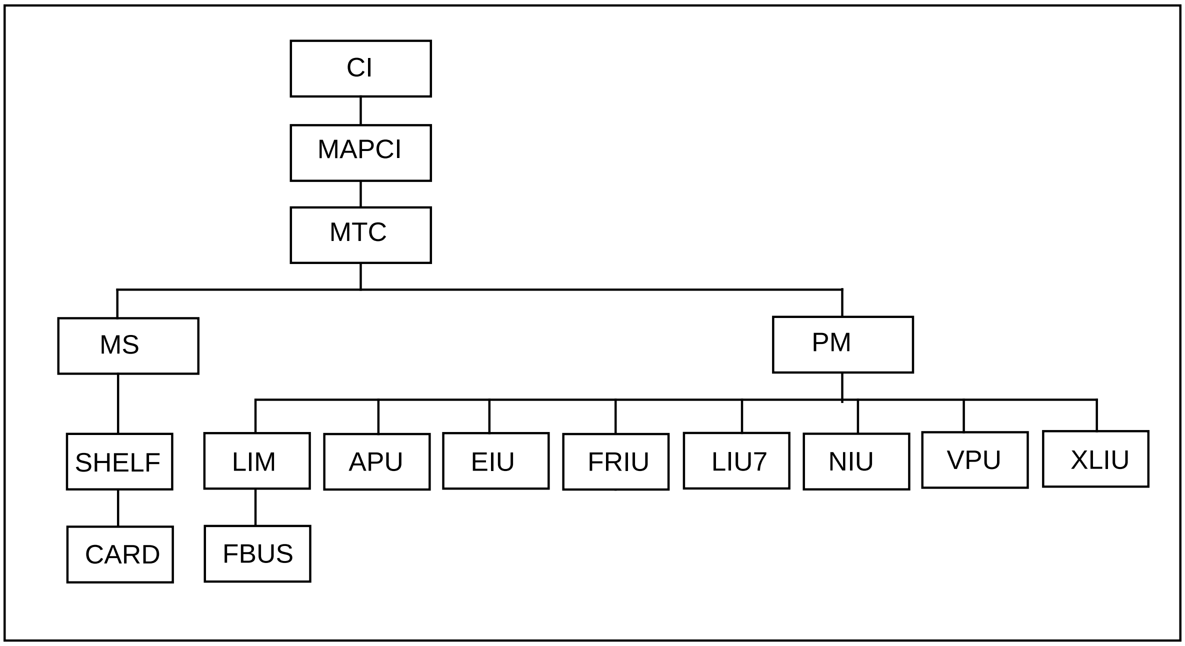
- troubleshoot F-bus cards
- troubleshoot F-bus taps
- busy the F-bus to troubleshoot ASU cards

The MAP display identifies each ASU connection as a tap and each ASU as a subtending node.

SSLPP MAP levels

Figure 41-7 shows the SSLPP related levels of the MAP terminal.

Figure 41-7 SSLPP related MAP levels



To access the CARD level from a MAP terminal, type

>MAPCI; MTC; MS; SHELF; card_no

and press the Enter key.

where

card_no
is the card you will post.

SSLPP menu commands

Table 41-8 lists and describes the menu commands that support the SSLPP available at the CARD level of the MAP system.

Table 41-8 CARD-level menu commands that support SSLPP (Sheet 1 of 2)

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
6	TST	Tests a bus or tap.
7	BSY	Manually busies a bus or tap.

Table 41-8 CARD-level menu commands that support SSLPP (Sheet 2 of 2)

MAP #	Command	Description
8	RTS	Returns to service a bus or tap.
9	OFFL	Sets an interface card or F-bus to offline.

Application processor unit

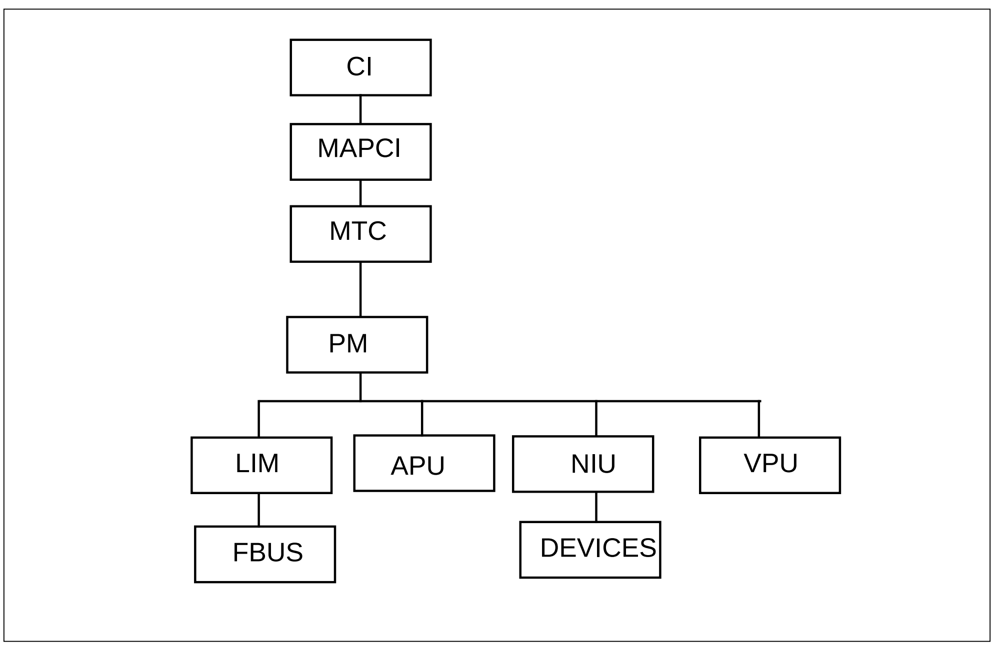
You access the application processor unit (APU) level of the MAP terminal from the PM level. The PM level supports both the APU and the APU with UNIX (APUX). Maintenance actions at this level include problem solving for APU cards.

APUs connect in tandem with network interface units (NIU) and voice processing units (VPU) to support many call processing applications. Maintenance of the APU can require you to access the NIU and VPU levels of the MAP terminal.

APU MAP levels

Figure 41-8 shows the APU related levels of the MAP terminal.

Figure 41-8 APU related levels of the MAP system



To access the APU level from a MAP terminal, type

>**MAPCI; MTC; PM; POST APU apu_no**

and press the Enter key.

where

apu_n
o is the APU you will post.

APU system status display

The APU uses the common ASU system status display. Refer to figure 41-2 for a diagram of this system status display.

APU menu commands

Table 41-9 lists and describes the menu commands available at the APU level of the MAP system.

Table 41-9 APU level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
2	POST	Displays an APU or a set of APUs.
3	LISTSET	Displays the devices in a list of specified APUs
6	TST	Tests an APU or set of APUs.
7	BSY	Manually busies an APU or set of APUs.
8	RTS	Returns to service an APU or a set of APUs.
9	OFFL	Sets an APU or set of APUs to offline.
10	LOADPM	Executes a load sequence on the posted APU or posted set of APUs.
11	DISP	Displays all APUs of a specified type.
12	NEXT	Displays the next APU in a posted set.
14	QUERYPM	Displays engineering and status information for the posted APU or posted set of APUs.

APU non-menu commands

Table 41-10 lists and describes some of the non-menu commands available at the APU level that supports APU maintenance activities. Non-menu commands include:

- non-menu commands for the given APU level.
- menu and non-menu commands from higher levels that support the APU level.

CI level commands that support the APU level.

Table 41-10 APU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted APU.
APPLY	PATCHER command that applies a patch
CHECK	PATCHER command that checks the syntax and agreement of a patch file.
DUMP	CI level command that creates a system image.
FINDDEV	CI level command that creates a directory that contains symbols. The symbols represent the devices of a given device type available on the specified node.
HELP	CI level command that provides command syntax.
INFORM	PATCHER command that displays patch information.
MATCH	PATCHER command that matches host and peripheral patches.
NODESET	PATCHER command that controls a node set.
PMRESET	CI level command that resets a specified APU.
RECLAIM	PATCHER command that retrieves program and data store that an SOS patch uses.
REMLOGIN	CI level command that allows you to login to a remote SOS processor.
REMOVE	PATCHER command that removes a software patch.
SET	PATCHER command that links a patch set to a objective.
UNSET	PATCHER command that cuts the links from a patch set to an objective.

CCS7 link interface unit

You access the CCS7 link interface unit (LIU7) level of the MAP terminal from the PM level. Maintenance actions at this level include problem solving for LIU7 cards.

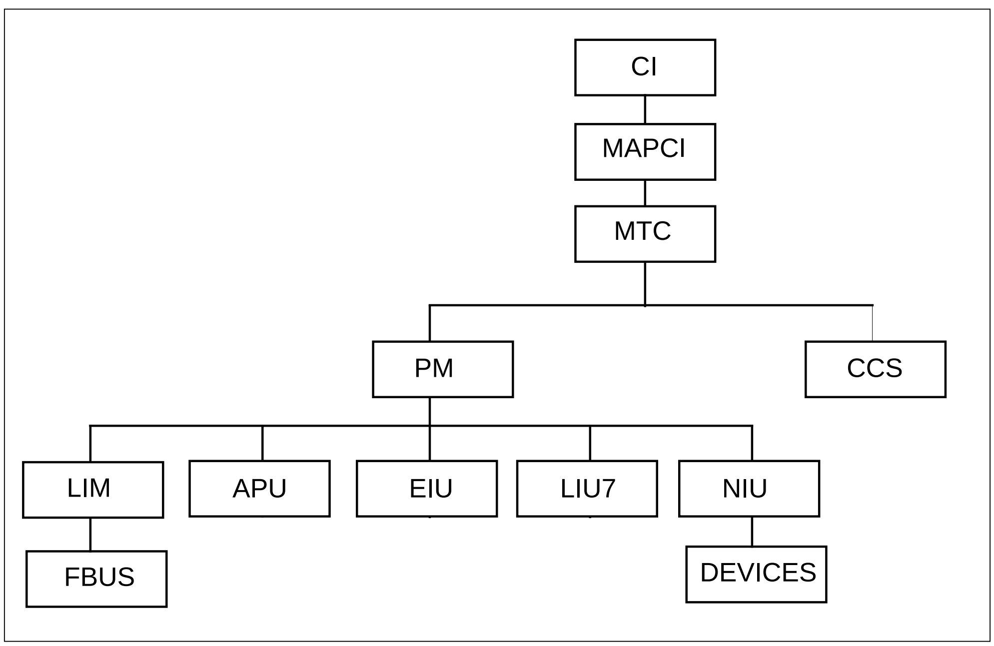
LIU7s work with application processing units (APU), Ethernet interface units (EIU), and network interface units (NIU) to support many call processing applications. Maintenance of the LIU7 can require you to access the APU, EIU, and NIU levels of the MAP system.

> ***Note:*** The LIU7 level supports maintenance of the LIU7 unit. CCS7 network maintenance is beyond the range of this guide. Refer to the maintenance guides for your CCS7 application.

LIU7 MAP levels

Figure 41-9 shows the LIU7-related levels of the MAP system.

Figure 41-9 LIU7-related MAP levels



To access the LIU7 level from a MAP terminal, type

>MAPCI; MTC; PM; POST LIU7 liu7_no

and press the Enter key.

where

liu7_no
is the LIU7 you must post.

LIU7 system status display
The LIU7 uses a common ASU system status display. Refer to figure 41-2 for a diagram of this system status display.

LIU7 menu commands
Most ASU level menu commands are like ASU level commands at other PM levels. A command normally initiates when you enter the given command. The MAP terminal cannot perform additional action during the maintenance activity.

Table 41-11 lists and describes the LIU7-level menu commands.

Table 41-11 LIU7-level menu commands (Sheet 1 of 2)

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP terminal.
2	POST	Selects a set of LIU7.
3	LISTSET	Lists the identification numbers of the posted LIU7s.
6	TST	Identifies the links of the posted LIU7s, and the two end points and current state of the posted LIU7s.
7	BSY	Tests one or both units of a posted LIU7. Can test an unit link between units.
8	RTS	Returns to service one or both units of a posted LIU7. Can return to service an unit link between units.
9	OFFL	Sets an LIU7 to offline. You must first manually busy both units.
10	LOADPM	Loads one or both units of a posted LIU7. You must first manually busy the units you need to load.
11	DISP	Displays a list of all LIU7s in a given state.
12	NEXT	Displays the next LIU7 in a posted set.

Table 41-11 LIU7-level menu commands (Sheet 2 of 2)

MAP #	Command	Description
14	QUERYPM	Displays information about a posted LIU7 that includes PM type, size of memory, node status, and REx schedules.
15	LOOPBK	Sets the LIU7 to loopback mode.

Command Description

The user uses the SCCPLoc MAP level to query or change the state of a minimum of one SCCP local subsystems.

Table 41-12 (Sheet 1 of 3)

Example of SCCPLoc MAP display

```
CM    MS    IOD    Net    PM    CCS    MTX    Trks    Ext    Appl
  .    .      .      .      .     .      .       .      .       .
 SCCPLoc            CCS7
 0 Quit
 2 Post_            C7 SCCP LOCAL            111111 11112222 22222222
 3                Subsystem State 01234567 89012345 67890123 45678901
 4                BSAP      Insv  O....D.- -------- -------- -------- 5
 6                  BSAP instance: 5
 7 Bsy_             Number of active connections: 16
 8 Rts_ 9 Offt_
 10 Next
 11
 12 Next
 13
 14 QueryCon
 15 TestSS_
 16 TranTst_
 17 Locate_
 18 QuerySS
```

MAP Responses for SCCPLoc Commands

Command 67Bsy `BSY Passed` `Deload of SSI is in progress. SSI will go ManB after deload complete.`

Table 41-12 (Sheet 2 of 3)

	Meaning: After call completion or early termination of deload release all connections, the SSI state changes from “D” to “M”. Failure or Bsy Force of an LIU7 causes early termination of deload.
	Meaning: If no Insv or ISTB SSIs are present, and at least one SSI in deload is present, the local subsystem goes into deload. The state of the SSI changes to Dld. The CCS banner displays M. M indicates a major alarm.
	Action: To prevent loss of service, RTS any SSI in the ManB state.
`BSY FailedDeload of SSI in progress. SSI will go ManB after deload is complete.`	
	Meaning: BSY command fails because the SSI is in the deload state.
	Action: None. SSI is already ManB.
`BSY FailedWARNING Service will be affected if the local service is put in the ManB state.`	
	Meaning: BSY command fails because the SSI cannot currently be taken out of service.
	Action: Use the Offl command to put the SSI offline.
Command 8 Rts	`RTS Failed Failed, not in MANB state.`
	Meaning: The SSI is in deload state and cannot return to service until deload is complete. When deload is complete, the SSI state changes to ManB.
	Action: Wait until the SSI state changes to ManB, then RTS the SSI.
Command 9 Offl	`Offl FailedFailed, not in MANB state.`
	Meaning: The SSI is in deload state. You cannot change the SSI to Offl until the deload is complete. When deload is complete, the SSI state changes to ManB.
	Action: Wait until the SSI state changes to ManB, then issue the Offl command to put the SSI offline.
Command 14 QueryCon	`BSAP INSTANCE: 5Number of active connections:16`
	Meaning: For BSAP Instance 5, 16 active connections are present.
	Action: None.
`BSAP INSTANCE: 5Instance not in service.`	

Table 41-12 (Sheet 3 of 3)

	Meaning: The SSI is not in the required state. You can use the QueryCon command only when the SSI is in the Insv or Deload or ISTB state. **Action:** None
`Query connection facility not available for subsystem.`	
	Meaning: Subsystem instance uses messaging without connections, or the subsystem does not support the QueryCon command. **Action:** None.
`No such subsystem`	
	Meaning: You entered a subsystem name that is not correct. **Action:** Re-enter the QueryCon command.
`Subsystem is not in the posted set.`	
	Meaning: The subsystem must be in the posted set for the system to accept the QueryCon command. **Action:** Post the SSI, and then re-enter the QueryCon command.
`Instance : QueryCon failed. Instance not datafilled.`	
	Meaning: You must enter the instance for the system to accept the QueryCon command. **Action:** Re-enter the QueryCon command.
`Instance : QueryCon failed.`	
	Meaning: Query on the instance failed because the LIU7 is not in service. **Action:** None.
`Instance : QueryCon failed. Inter-node messaging failed.`	
	Meaning: Communication with the LIU7 fails. The system cannot complete the query. **Action:** Wait for active connections, and then re-enter the QueryCon command.
`Instance number failed. Instance number out of range 0 - 31.`	
	Meaning: The instance number entered is not in the accepted range of 0-31. **Action:** Re-enter the QueryCon command.

LIU7 non-menu commands

Table 41-13 lists and describes the non-menu commands available at the LIU7 level. Non-menu commands include:

- non-menu commands for the LIU7 level
- menu and non-menu commands from higher levels that support the LIU7 level
- CI level commands that support the LIU7 level

Table 41-13 LIU7 non-menu commands

Command	Description
ABTK	Aborts all maintenance activity on the posted LIU7.
PMRESET	Performs a reload-restart to initialize the LIU7 again.

Ethernet interface unit

Access the Ethernet interface unit (EIU) level of the MAP terminal from the PM level. Maintenance activities at this level include problem solving for EIU cards

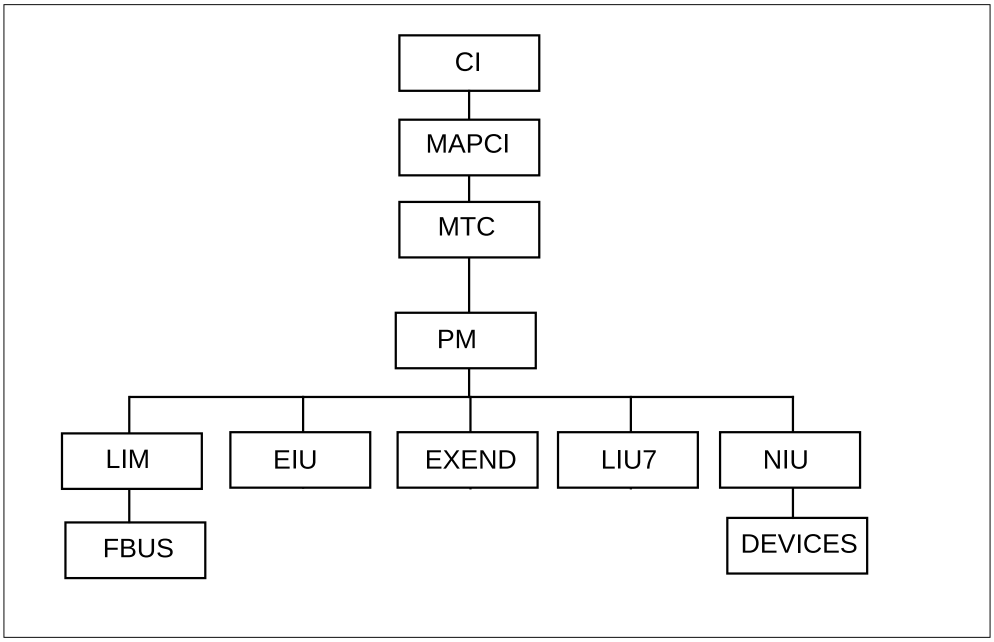
> ***Note:*** The EXEND level of the PM level allows maintenance employees to manage an Ethernet base local area network (LAN). Maintenance of a LAN and EXEND base commands are beyond the range of this guide.

APUs work with network interface units (NIU) and CCS7 link interface units (LIU7) to support several applications. Maintenance of EIUs can require you to access the NIU or LIU7 levels of the MAP terminal.

EIU MAP levels

Figure 41-10 shows the EIU-related levels of the MAP system.

Figure 41-10 EIU-related MAP levels



To access the EIU level from a MAP terminal, type

>MAPCI; MTC; PM; POST EIU eiu_no

and press the Enter key.

where

eiu_no
is the EIU you must post.

EIU system status display

The EIU uses a common ASU system status display. Refer to Figure 41-2 for a diagram of this system status display.

EIU menu commands

Table 41-14 lists and describes the menu commands available at the EIU level of the MAP terminal.

Table 41-14 EIU-level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP terminal.
2	POST	Displays an EIU or set of EIUs.
3	LISTSET	Displays the devices in a list of specified EIUs.
6	TST	Tests an EIU or set of EIUs.
7	BSY	Manually busies an EIU or set of EIUs.
8	RTS	Returns to service an EIU or set of EIUs.
9	OFFL	Sets an EIU or set of EIUs to offline.
10	LOADPM	Executes a load sequence on the posted EIU or posted set of EIUs.
11	DISP	Displays all EIUs of a specified type.
12	NEXT	Displays the next EIU in a posted set.
14	QUERYPM	Displays engineering and status information for the posted EIU.

EIU non-menu commands

Table 41-15 lists and describes some of the non-menu commands that support EIU maintenance activity available at the EIU level. Non-menu commands include:

- non-menu commands for the EIU level
- menu and non-menu commands from higher levels that support the EIU level
- CI level commands that support the EIU level

Table 41-15 EIU non-menu commands (Sheet 1 of 2)

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted EIU.
DUMP	CI level command that creates a system image of the EIU.

Table 41-15 EIU non-menu commands (Sheet 2 of 2)

Command	Description
FINDEV	CI level creates a directory that contains symbols. The symbols represent the devices of a given device type available to a specified EIU.
HELP	CI level command that provides command syntax.
REMLOGIN	CI level command that allows you to login to an EIU from another computer.

Ethernet link interface unit

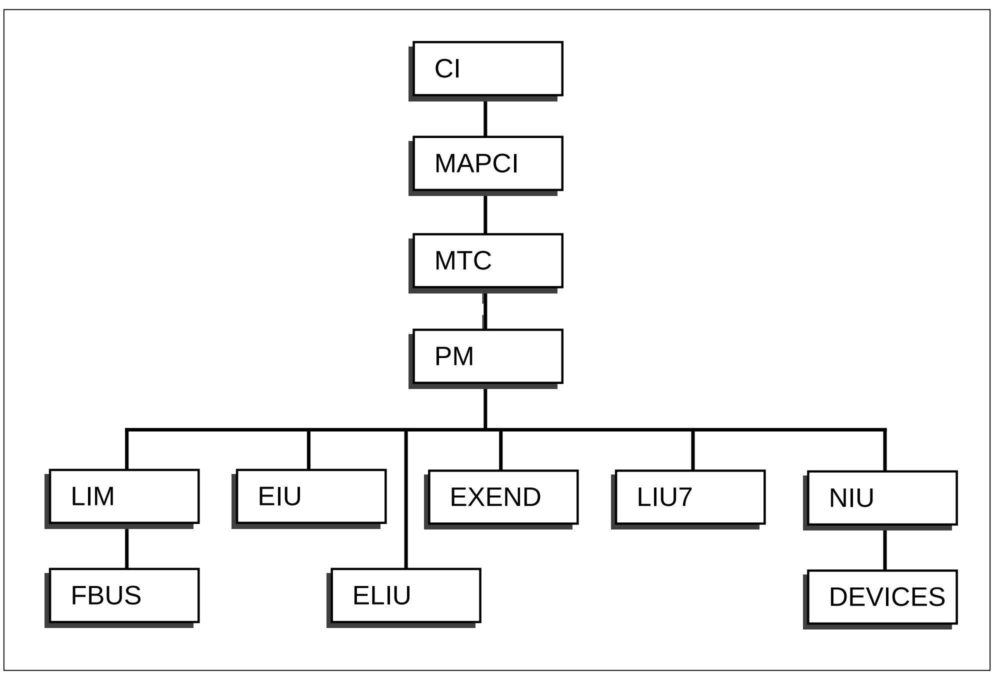
Access the Ethernet link interface unit (ELIU) level of the MAP system from the PM level. The ELIU level of the MAP display provides access to commands to perform maintenance activities on ELIU.

> ***Note:*** The EXEND level of the PM level allows maintenance employees to manage an Ethernet base local area network (LAN). Maintenance of a LAN and EXEND base commands are beyond the range of this guide.

ELIU MAP levels

Figure 41-11 shows the ELIU-related levels of the MAP system.

Figure 41-11 ELIU-related MAP levels



To access the ELIU level from a MAP terminal, type

>MAPCI; MTC; PM; POST ELIU eliu_no

and press the Enter key.

where

eliu_no
is the number of the ELIU you must post.

ELIU system status display

The ELIU uses a common ASU system status display. Refer to Figure 41-2 for a diagram of this system status display.

ELIU menu commands

Table 41-16 lists and describes the menu commands available at the ELIU level of the MAP terminal.

Table 41-16 ELIU-level menu commands

MAP #	Command	Description
0	QUIT	Quits from the ELIU level to the PM level
2	POST	Posts an ELIU for maintenance
3	LISTSET	Lists the contents of a posted set of ELIUs
6	TST	Tests an ELIU or set of ELIUs.
7	BSY	Manually busies an ELIU or set of ELIUs
8	RTS	Returns to service an ELIU or set of ELIUs
9	OFFL	Sets an ELIU or set of ELIUs to offline
10	LOADPM	Loads the ELIU with the software load listed in the inventory table. If you use the file name option, LOADPM loads the ELIU with the indicated load.
11	DISP	Displays all ELIUs in the specified state
12	NEXT	Displays the next ELIU in the posted set
14	QUERYPM	This command displays • faults that now exist in the ELIU • information on the posted ELIU, its host LIM, and the two F-bus PFI taps that associate with the ELIU

The TST command runs diagnostics on the posted ELIU or ELIUs. The tests that run depend on the state of the posted ELIU. The posted ELIU can be in service or out of service. If the test fails, the circuit location display lists the correct cards.

When the RTS command executes, a set of out-of-service diagnostics runs on the ELIU. If the diagnostic tests complete correctly, the ELIU returns to service. If the diagnostic tests do not complete correctly, the ELIU remains in the system busy or manual busy state. A reset sequence precedes a return to service from the system busy state.

Use of the FORCE option with the RTS command causes the following:

- The diagnostics pass and the ELIU returns to service without regard for the service ability of the ELIU.
- A manual busy (not accessible) ELIU changes to the system busy state. System maintenance attempts to return to service the ELIU on a periodic base.

ELIU non-menu commands

Table 41-17 lists and describes some of the non-menu commands available at the ELIU level that supports ELIU maintenance activities. Non-menu commands include:

- non-menu commands for the ELIU level
- menu and non-menu commands from higher levels that support the ELIU level
- CI level commands that support the ELIU level

Table 41-17 ELIU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted ELIU
DUMP	CI level command that creates a system image of the ELIU
REMLOGIN	CI level command that allows you to login to an ELIU from another computer

Frame relay interface unit

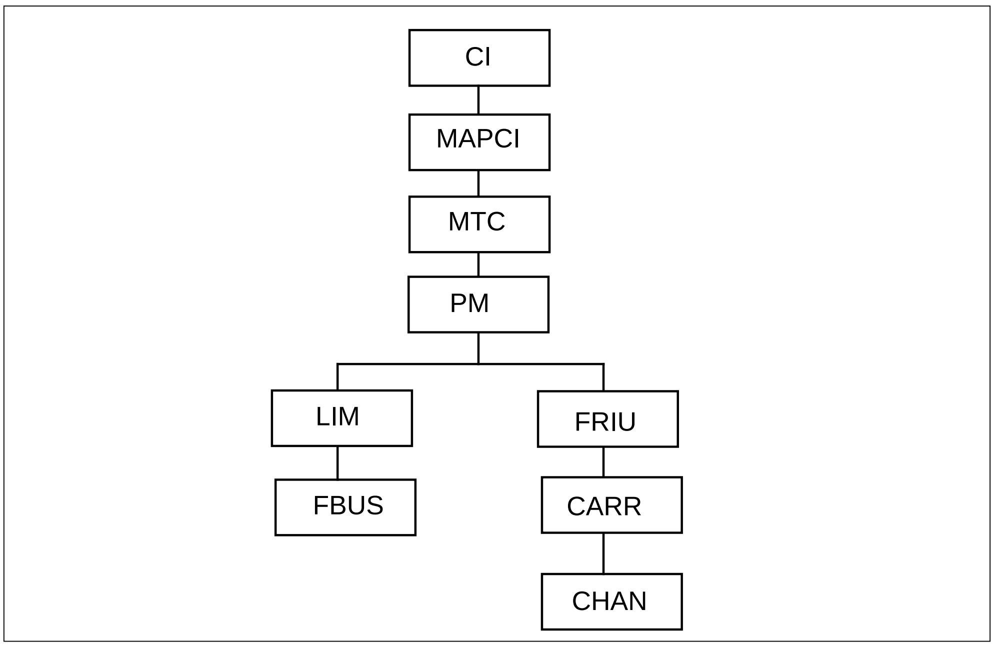
Access the frame-relay interface unit (FRIU) level of the MAP terminal from the PM level. Maintenance actions at this level include:

- problem solving for FRIU cards
- access to the CARR (carrier) level to problem solve for carrier faults and access the CHAN level

FRIU MAP levels

Four different levels of the MAP system support the FRIU. These include the PM level, the FRIU level, the CARR level, and the CHAN (channel) level. Figure 41-12 shows the FRIU-related levels of the MAP terminal.

Figure 41-12 FRIU-related MAP levels



To access the FRIU level from a MAP terminal, type

>MAPCI; MTC; PM; POST FRIU friu_no

and press the Enter key.

where

friu_no
is the FRIU you must post.

To access the CARR level, use the CARR menu command at the FRIU level. To access the CHAN level, use the CHAN menu command at the CARR level.

FRIU system status display

Figure 41-13 shows a system status display at the FRIU level.

Figure 41-13 FRIU-level system status display

```
CM    MS    IOD    Net    PM    CCS    Lns    Trks    Ext    Appl
.     .      .      .      .     .      .      .       .       .

FRIU              SysB    ManB      Offl   CBsy    ISTb  Insv
0  Quit     PM     0       0         0       0      0     123
2  Post     FRIU   0       0         0       0      0       5
3  ListSet
4
5             FRIU  3  InSv  Rsvd
6  Tst_
7  Bsy_
8  RTS_
9  OffL
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM_
15
16 QueryFB
17
18 Carr
         userid
   TIME   hh : mm>
```

FRIU CARR system status display

The system display at the CARR level provides details on the status of the carriers of the posted FRIU. Figure 41-14 shows a system status display of the CARR level of a T1 carrier that is not channelized.

Figure 41-14 FRIU CARR level system status display

```
   CM     MS     IOD     Net     PM     CCS     Lns     Trks     Ext     Appl
   .      .       .       .      .       .       .        .        .       .

FRIU CARR                SysB     ManB      Offl     CBsy    ISTb   InSv
0  Quit        PM         0        0         7        0       0      20
2              FRIU       0        0         3        0       0       2
3
4
5              FRIU 49 InSv      Rsvd

6              CARRIER  Mtce  /Busy  Alarm    BER  ES  SES  UAS
7  Bsy_        InSv                          -9.0   0   0    0
8  RTS_
9  OffL_                                   1 1 1 1 1 1 1 1 1 1 2 2 2 2 2
10              CHANNEL  1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
11                       N . . . . . . . N . . . . . . . . . . . . . . .
12
13 Perfmon
14 QryCarr_
15 Loop_
16
17
18 Chan_
         userid
   TIME   hh : mm>
```

Note: The shaded section of Figure 41-14 shows the system status display for a channelized T1 carrier.

FRIU CHAN system status display

The system display at the CHAN level provides details on the status of the channels on the posted T1 carrier. Figure 41-15 shows a system status display of the CHAN level of a T1 carrier that is not channelized.

Note: The system status display for a channelized T1 carrier shows the status of each of the 24 channels of the carrier.

Figure 41-15 FRIU CHAN-level system status display

```
CM    MS    IOD    Net    PM    CCS    Lns    Trks    Ext    Appl
.     .      .      .      .     .      .       .      .       .

FRIU CHAN          SysB    ManB      Offl   CBsy    ISTb  Insv
0  Quit     PM     0       0         7       0       0      20
2  Post     FRIU   0       0         3       0       0       2
3
4
5               FRIU 49  InSv  Rsvd
6               CARRIER  Mtce  /Busy  Alarm   BER  ES  SES  UAS
7  Bsy_         InSv                         -9.0   0   0    0
8  RTS_
9  OffL
10              CHANNEL    1
11 QLMI                    N
12 PING_
13 QTraff       CHANNEL
14 QryCHAN      InSv    /NoLMI          ( 24 x DS0)_
15 Loop_
16 MDLCtst
17 QPLLC_
18
         userid
   TIME   hh : mm>
```

FRIU menu commands

Table 41-18 lists and describes the menu commands available at the FRIU level of the MAP terminal.

Table 41-18 FRIU-level menu commands (Sheet 1 of 2)

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
2	POST	Displays an FRIU or set of FRIUs.
3	LISTSET	Displays the devices in a list of specified FRIUs
6	TST	Tests an FRIU or set of FRIUs.
7	BSY	Manually busies an FRIU or set of FRIUs.
8	RTS	Returns to service a FRIU or set of FRIUs.
9	OFFL	Sets an FRIU or set of FRIUs to the offline state.
10	LOADPM	Executes a load sequence on the posted FRIU or posted set of FRIUs.

Table 41-18 FRIU-level menu commands (Sheet 2 of 2)

MAP #	Command	Description
11	DISP	Displays all FRIUs of a specified type.
12	NEXT	Displays the next LIM in a posted set.
14	QUERYPM	Displays engineering and status information for the posted FRIU or posted set of FRIUs.
18	CARR	Accesses the CARRIER sublevel.

FRIU CARR menu commands

Table 41-19 lists and describes the menu commands available at the CARR level of the MAP system.

Table 41-19 FRIU CARR level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
7	BSY	Manually busies the specified carrier.
8	RTS	Configures the carrier channel(s) and buffers and returns to service the carrier.
9	OFFL	Sets the carrier to offline.
13	PERFMON	Displays performance data on the carrier
14	QRYCARR	Displays engineering and status information on the posted carrier.
15	LOOP	Sets posted carrier in remote/local loopback mode.
18	CHAN	Accesses the CHANNEL sublevel.

FRIU CHAN menu commands

Table 41-20 lists and describes the menu commands available at the CARR level of the MAP terminal.

Table 41-20 FRIU CHAN-level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP system.
2	POST	Displays an FRIU or set of FRIUs.
7	BSY	Manually busies the posted channel.
8	RTS	Returns the posted channel to service.
9	OFFL	Sets the posted channel to offline.
11	QLMI	Displays operation statistics on the local management interface (LMI) in the posted channel.
12	PING	Displays delay between FRS network nodes for a data link connection identifier.
13	QTRAFF	Displays channel performance statistics on posted channel.
14	QRYCHAN	Displays engineering and status information on the posted channels.
15	LOOP	Sets posted channel in remote/local loopback mode.
16	HDLCTST	Performs HDLC loopback tests.
17	QPLLC	Displays traffic and status information on permanent logical link connection (PLLC) configured on this access or the primary or secondary trunk.

FRIU non-menu commands

Table 41-21 lists and describes some of the non-menu commands that support FRIU maintenance activities available at the FRIU level. Non-menu commands include:

- non-menu commands for the FRIU level
- menu and non-menu commands from higher levels that support the FRIU level

CI level commands that support the FRIU level

Table 41-21 FRIU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted FRIU.
DCON	CI level command that displays connection information.
DINFO	CI level command that displays FRIU agent information.
DNS	CI level command that displays entries in node status table.
FLOGIN	CI level command that, on central node that allows maintenance personnel to login to the FRIU and execute commands.
FRSDISP	CI level command that displays frame relay service agent, directory number, or customer information.
HELP	CI level command that provides command syntax.
PMRESET	CI level command that resets specified FRIU.
QUERY	CI level command that displays information about current remote CI session.

Table 41-22 lists and describes some of the non-menu commands that support FRIU maintenance activities available at the FRIU CARR level.

Table 41-22 FRIU CARR non-menu commands (Sheet 1 of 2)

Command	Description
ABTK	CI level command that ABORTS all maintenance activity on the posted FRIU.
DCON	CI level command that displays connection information.
DINFO	CI level command that displays FRIU agent information.
DNS	CI level command that displays entries in node status table
FLOGIN	CI level command that, on central node, allows maintenance employees to login to the FRIU and execute commands.
FRSDISP	CI level command that displays frame relay service agent, directory number, or customer information.
HELP	CI level command that provides command syntax.

Table 41-22 FRIU CARR non-menu commands (Sheet 2 of 2)

Command	Description
PERFMON	Displays performance data on a posted FRIU carrier.
QUERY	CI level command that displays information about current remote CI session

Table 41-23 lists and describes some of the non-menu commands that support FRIU maintenance activities available at the FRIU CHAN level.

Table 41-23 FRIU CHAN non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted FRIU.
CAPQUERY	Displays progress of frame capture.
CAPSTART	Starts frame capture on specified channel.
CAPSTOP	Stops frame capture on specified channel and starts to process frames in capture buffer.
DCON	CI level command that displays connection information.
DINFO	CI level command that displays FRIU agent information.
DNS	CI level command that displays entries in node status table.
FLOGIN	CI level command on central node that allows maintenance personnel to login to the FRIU and execute commands.
FRSDISP	CI level command that displays frame relay service agent, directory number, or customer information.
HELP	CI level command that provides command syntax.
QUERY	CI level command that displays information about current remote CI session.

Network interface unit

Access the network interface unit (NIU) level of the MAP terminal from the PM level. Maintenance actions at this level include:

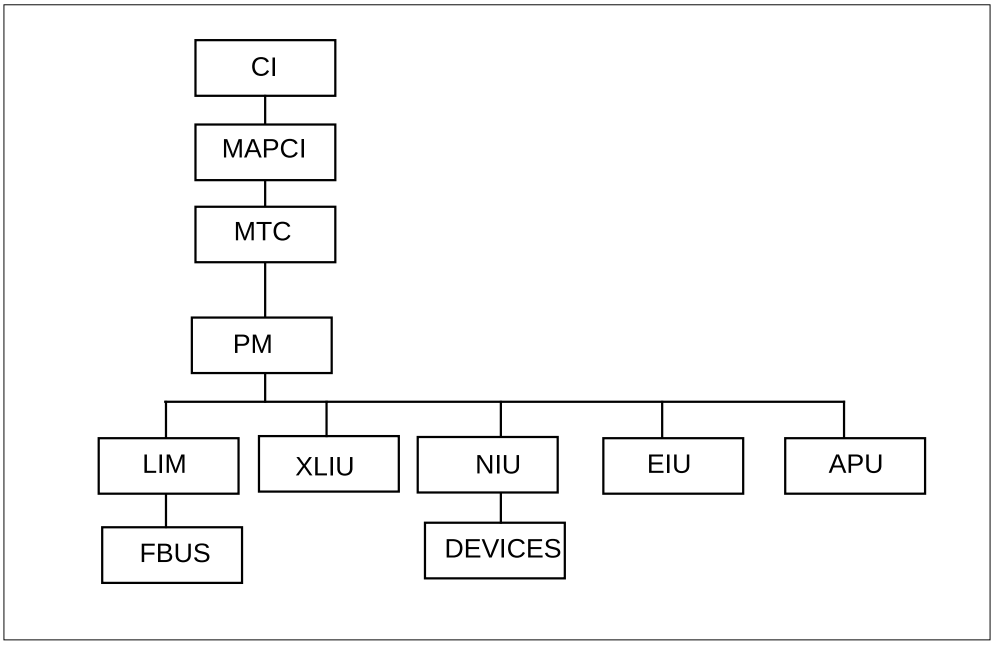
- problem solving for NIU cards
- problem solving for DS30 links to the switching network

- problem solving for channel bus faults
- access to the DEVICES level

NIU MAP levels

Figure 41-16 shows the NIU-related levels of the MAP system.

Figure 41-16 NIU-related MAP levels



To access the NIU level from a MAP terminal, type

>MAPCI; MTC; PM; POST NIU niu_no

and press the Enter key.

where

niu_no
is the NIU you must post.

Use the DEVICES command at the NIU level to access the DEVICES

NIU system status display

The system display at the NIU level provides details on the status of the NIU and the NIU units. Figure 41-17 shows a system status display at the NIU level. The highlighted information appears at the NIU DEVICES level system status display.

Figure 41-17 NIU-level system status display

```
   CM     MS     IOD     Net     PM     CCS     Lns     Trks     Ext     Appl
    .      .      .       .       .      .       .       .        .       .

NIU                 SysB     ManB      Offl     CBsy    ISTb  InSv
 0 Quit        PM     0        0         0        0       4     14
 2 Post        NIU    0        0         0        0       0      2
 3 ListSet
 4
 5             NIU  2:    InSv
 6 Tst_        Unit 0:    InAct InSv
 7 Bsy_        Unit 1:    Act InSv
 8 RTS_
 9 OffL                   Net Links
 10 LoadPM_               0  1  2  3    CBUS ports OOS
 11 Disp_      PB 0       .  .  _  _         .
 12 Next       PB 1       .  .  _  _         .
 13 SwAct_
 14 QueryPM_
 15 Devices
 16
 17
 18         userid
   TIME    hh : mm>
```

NIU menu commands

Table 41-24 lists and describes the menu commands available at the NIU level.

Table 41-24 NIU-level menu commands (Sheet 1 of 2)

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP terminal.
2	POST	Posts a set of NIUs.
3	LISTSET	Lists the identification numbers of the posted NIUs.
6	TST	Tests one or both units of a posted NIU. TST can test a link between units.
7	BSY	Manually busies one or both units of a posted NIU. BSY can busy a link between units.

Table 41-24 NIU-level menu commands (Sheet 2 of 2)

MAP #	Command	Description
8	RTS	Returns to service one or both units of a posted NIU. RTS can return to service a link between units.
9	OFFL	Sets an NIU to the offline state. Both units must first be manually busy.
10	LOADPM	Loads one or both units of a posted NIU. The units must first be manually busy.
11	DISP	Displays a list of all NIUs in a given state.
12	NEXT	Displays the next NIU in a posted set.
13	SWACT	Switches the active and inactive NIU units.
14	QUERYPM	Displays information about a posted NIU, including PM type, size of memory, node status, and REX scheduling.
15	DEVICES	Accesses the DEVICES level of the MAP system.

NIU DEVICES-level menu command

Table 41-25 lists and describes the menu command that supports NIU maintenance activities available at the DEVICES level.

Table 41-25 NIU DEVICES-level menu command

MAP #	Command	Description
5	TRNSL	Displays information about NIU link and port assignments.

NIU non-menu commands

Table 41-26 lists and describes some of the non-menu commands that support NIU maintenance activities available at the NIU level. Non-menu commands include:

- non-menu commands for the NIU level
- menu and non-menu commands from higher levels that support the NIU level

CI level commands that support the NIU level

Table 41-26 NIU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted NIU.
DCON	CI level command that displays connection information.
DNS	CI level command that displays entries in node status table
HELP	CI level command that provides command syntax.
PMRESET	CI level command that resets specified NIU.
QUERY	CI level command that displays information about current remote CI session

Voice processing unit

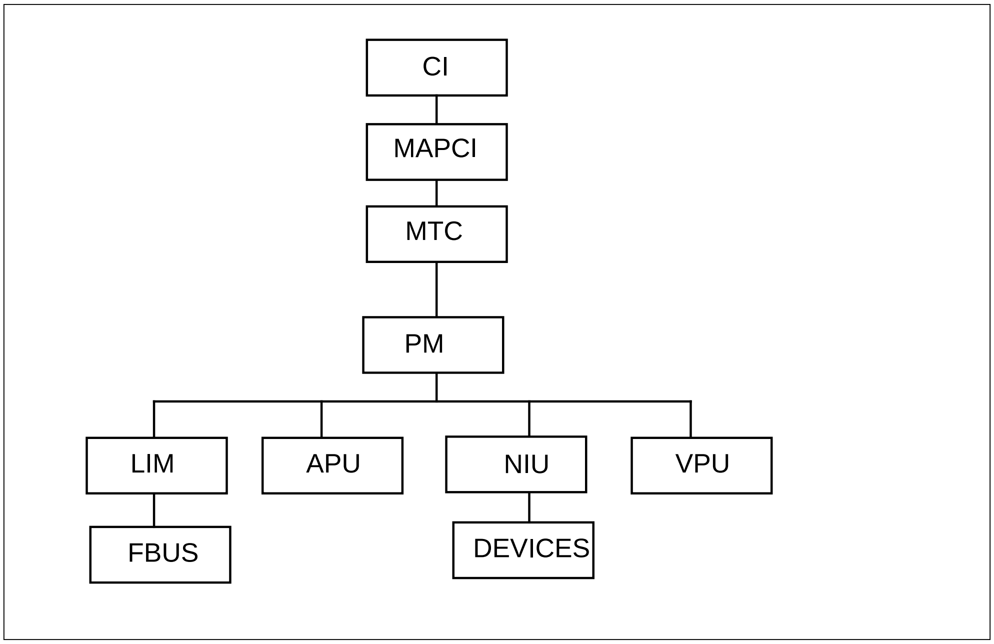
Access the voice processing unit (VPU) level of the MAP system from the PM level. Maintenance actions at this level include problem solving for VPU cards.

VPU MAP levels

Figure 41-18 shows the VPU-related levels of the MAP system.

> ***Note:*** The VPU supports several applications and services. Faults in the VPU level can relate to faults in other subsystems.

Figure 41-18 VPU-related MAP levels



To access the VPU level from a MAP terminal, type

>MAPCI; MTC; PM; POST VPU vpu_no

and press the Enter key.

where

vpu_no
is the VPU you must post.

VPU system status display

The VPU uses a common ASU system status display. Refer to Figure 41-2 for a diagram of this system status display.

VPU menu commands

Table 41-27 lists and describes the menu commands available at the VPU level of the MAP terminal.

Table 41-27 VPU-level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP display.
2	POST	Displays a VPU or set of VPUs.
3	LISTSET	Displays the devices in a list of specified VPUs
6	TST	Tests a VPU or set of VPUs.
7	BSY	Manually busies a VPU or set of VPUs.
8	RTS	Returns a VPU or set of VPUs to service.
9	OFFL	Sets a VPU or set of VPUs to offline.
10	LOADPM	Executes a load sequence on the posted VPU or set of VPUs.
11	DISP	Displays all the VPUs in a posted set.
12	NEXT	Displays the next VPU in a posted set.
14	QUERYPM	Displays engineering and status information for the posted VPU or set of VPUs.

VPU non-menu commands

Table 41-28 lists and describes the non-menu commands available at the VPU level of the MAP system. Non-menu commands include:

- non-menu commands for the VPU level
- menu and non-menu commands from higher levels that support the VPU level

CI level commands that support the VPU level

Table 41-28 VPU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted VPU.
FINDDEV	CI level command that creates a directory. The directory contains all the devices of a given type available in a remote VPU node.
HELP	CI level command that provides command syntax.
PMRESET	CI level command that performs a reload-restart to initialize VPU again.
REMLOGIN	CI level command on the central node that allows you to login to a VPU and execute CI commands.

X.25/X.75/X.75' link interface unit

Access the X.25/X.75/X.75' link interface unit (XLIU) level of the MAP terminal from the PM level. Maintenance actions at this level include problem solving for XLIU cards.

XLIU MAP levels

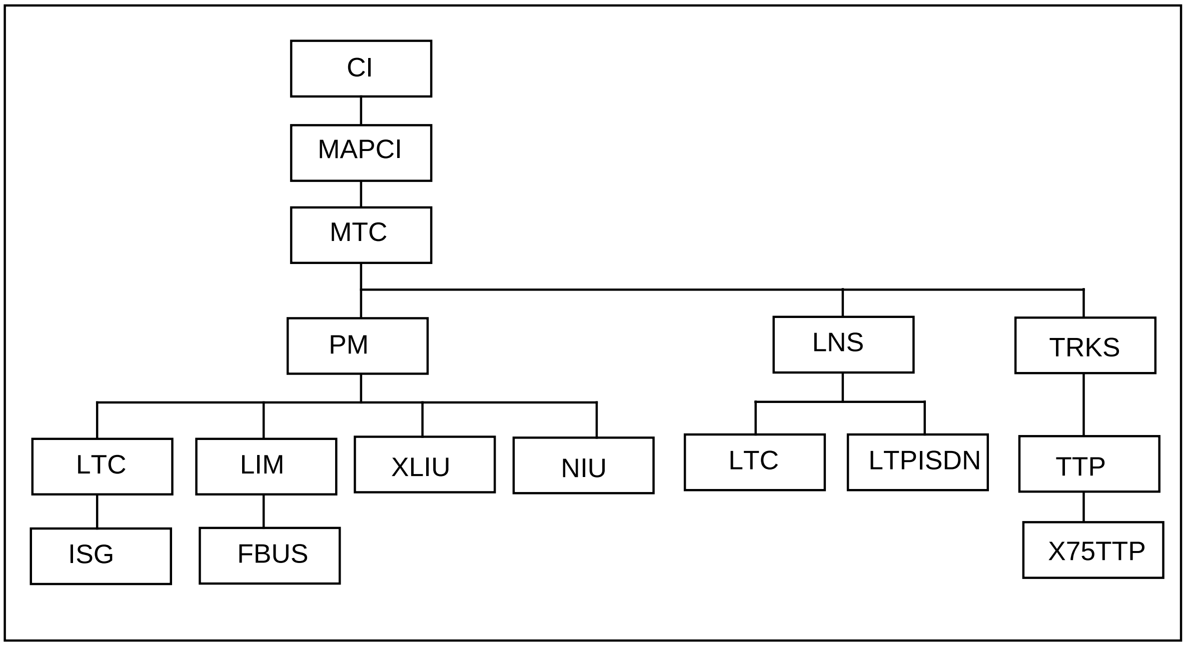
The XLIU level of the MAP terminal performs maintenance activities on a given XLIU or a set of XLIUs.

Figure 41-19 shows the XLIU-related levels of the MAP system.

> ***Note:*** The XLIU supports the DMS Packet Handler. The DMS Packet Handler crosses a number of levels in the MAP terminal. This section describes maintenance of the XLIU. Maintenance of the DMS Packet Handler is beyond the range of this guide.

Refer to the *Maintenance Guide*.

Figure 41-19 XLIU-related MAP levels



To access the XLIU level from a MAP terminal, type

>MAPCI; MTC; PM; POST XLIU xliu_no

and press the Enter key.

where

xliu_no
is the XLIU you must post.

XLIU system status display

The XLIU uses a common ASU system status display. Refer toFigure 41-2 for a diagram of this system status display.

XLIU menu commands

Table 41-29 lists and describes the menu commands available at the XLIU level of the MAP terminal.

Table 41-29 XLIU-level menu commands

MAP #	Command	Description
0	QUIT	Changes the display to a higher level of the MAP terminal.
2	POST	Displays an XLIU or set of XLIUs.
3	LISTSET	Lists the identification numbers of the posted XLIU or set of XLIUs.
6	TST	Runs in-service or out-of-service diagnostics on the posted XLIU or set of XLIUs.
7	BSY	Manually busies an XLIU or set of XLIUs.
8	RTS	Runs diagnostics and returns to service the XLIU or set of XLIUs.
9	OFFL	Takes an XLIU or set of XLIUs offline.
10	LOADPM	Executes a load sequence on the posted XLIU or set of XLIUs.
11	DISPLAY	Displays a list of all XLIUs in a given state.
12	NEXT	Displays the next XLIU in a posted set.
14	QUERYPM	Displays engineering and status information on the posted XLIU or set of XLIUs.

XLIU non-menu commands

Table 41-30 lists and describes some of the non-menu commands that support XLIU maintenance activities available at the XLIU level. Non-menu commands include:

- non-menu commands for the XLIU level
- menu and non-menu commands from higher levels that support the XLIU level
- CI level commands that support the XLIU level

Table 41-30 XLIU non-menu commands

Command	Description
ABTK	CI level command that aborts all maintenance activity on the posted XLIU.
HELP	CI level command that provides command syntax.
PMRESET	CI level command that performs a reload-restart to initialize the XLIU again.
QBB	CI level query command that displays Bb channel connection information.
QCOUNTS	CI level query command that displays or resets the protocol counts for an XLIU.
QLOOP	CI level query command that displays the logical terminal identifiers, directory numbers, and terminal endpoint identifiers on the posted loop.
QPHF	CI level query command that displays information about packet handler configuration.
QSCONN	CI level query command that displays special connection information for an integrated services digital network (ISDN) peripheral. This information includes all special connections to an ISDN XLIU service group (XSG).
Note: Query commands are not part of the MAP system, but you can execute query commands at any level of the MAP system.	

42 LPP related card requirements

This chapter highlights the procedures for how to remove and replace cards in link peripheral processor (LPP) peripheral modules (PM). It provides background information to maintenance personnel with experience. This chapter allows maintenance personnel to troubleshoot LPP PMs. This chapter also provides precautions for maintenance personnel to consider when they remove and replace cards.

This chapter supplements *Card Replacement Procedures*, which provides step-by-step procedures for how to remove and replace every LPP PM card.

Removal and replacement procedures for circuit cards

Link interface module

As you replace link interface module (LIM) cards, remember the following precautions:

- Make sure you power down the local message switch (LMS) shelf before you remove any cards.
- Make sure you verify that the mate LIM unit, the mate frame transport bus (F-bus), and the nodes on the mate F-Bus are in-service and fully equipped. Do this check before you manually busy the LIM unit with a card that has faults. Failure to do this check can isolate the application specific units (ASU).
- If you unseat the local message switch processor circuit pack (NT9X13DB), you bypass the safety interlock. Make sure that the card that you will remove is in the manually busy LIM unit before you unseat the card.
- Make sure that you do not busy all LIM ports to the DMS-Bus. You can lose traffic when you busy the last port and return the first port to service.

Refer to *Card Replacement Procedures* for the specific procedures for how to remove and replace LIM cards.

Application specific units

As you replace ASU cards, remember these precautions:

- Make sure you deactivate links and connections to outside applications and services, like CCS7, before you replace the correct ASUs.
- Removal of the integrated processor/F-Bus circuit pack (NTEX22AA/BA) causes a loss in service.
- Replacement of a V.35 interface paddleboard (NT9X77) removes an LIU7 from service and interrupts messaging on the associated CCS7 link. If you replace an in-service card, perform this procedure during a low traffic period.
- Removal of the channel bus controller circuit pack (NTEX25AA/BA) from the NIU terminates service and terminates channelized access for the link interface shelf (LIS).
- Removal of the channel-bus interface circuit pack (NTEX26AA) from an LIU7 removes the LIU7 from service and interrupts messaging on the associated CCS7 link. If you replace an in-service card, perform this procedure during a low traffic period. The NTEX26AA is in LPPs equipped for channel access.
- When you reconnect an NIU DS30 link interface paddleboard (NTEX28AA), do not cross-connect the cables. The NIU may lose service when you return the NIU to service.
- Removal of the RAP processor card (NTMX97) from the VPU terminates service.
- Determine which ASUs support what application or service and consider what can happen if you replace a card, or take the ASU out of service. Your switch has a different configuration of ASUs, and this configuration can work as a group to support an external application or service.
- Each NTEX22 card is different. Check the two-letter suffix before you replace cards.
- You can equip the LIS with NTDX16 power supplies, which provide full redundancy. If one NTDX16 power converter fails, or requires powering off, or replacement, the other NTDX16 power converter supplies power for the entire LIS.

Always refer to *Card Replacement Procedures* for the specific procedures for how to remove and replace LIU cards.

Removal and replacement procedures for other equipment

There are no special procedures for the removal and replacement of equipment other than circuit cards.

43 LPP trouble isolation and correction

This chapter highlights procedures for isolating and correcting faults in link peripheral processor (LPP) peripheral modules (PM). The chapter describes basic troubleshooting procedures. These procedures are different for each LPP PM. The chapter also describes tests that isolate faults in some LPP PMs. This chapter also provides background information to assist maintenance personnel with experience in troubleshooting faults in LPP PMs.

Troubleshooting procedures

Troubleshooting procedures vary from switch to switch. The procedures depend on the types of provisioned LPP PMs and on the applications and services the LPP PMs support. All LPP PMs have the same trouble indicators and standard troubleshooting procedures.

Checking trouble indicators

The system uses the following trouble indicators:

- alarms
- log reports
- operational measurements

Alarms

Maintenance software generates alarms when it detects and cannot correct a service-affecting failure. An alarm can be audible, a lighted LED, or a code under a subsystem banner at the MAP terminal. Maintenance personnel must correct the condition and clear the alarms as quickly as possible.

The system codes the alarms based on the severity of the fault and the requirement that the condition be corrected. Table 43-1lists and describes PM alarm codes.

Table 43-1 PM alarm codes

Alarm	MAP display	Description
Critical	(*C*)	Indicates a service outage or potential service outage.
Major	(M)	Indicates a service-degrading fault that threatens the operations of the PM.
Minor	(blank)	Indicates a service-degrading fault that does not affect the operations of the PM.
None	.	Indicates that all PMs function correctly.

Use the following guidelines when clearing alarms.

- When the MAP terminal displays more than one alarm of the same severity, clear the alarms from the left of the screen to the right side.
- If while fixing an alarm another alarm of greater severity occurs, respond to the new alarm. Do not continue attempts to clear the least severe alarm.

To minimize the occurence of alarms, correctly perform routine system maintenance, and make use of OMs and log reports.

Log reports

Log reports are records of the operations of the hardware and software resources within the switch. A log report is a message that the DMS switch sends when an important event occurs in the switch or one of the its peripherals. Log reports include state and activity reports. Log reports also include reports on hardware faults, test results, or other conditions that can affect the performance of the switch.

Several logs record events that affect LPP PMs. Refer to page 38-1 of this guide for descriptions of these LPP-related logs.

Use log reports as an analysis tool to provide detailed information on existing and potential system troubles. The system often produces logs that reflect the normal operations of the switch. A sudden increase in the volume of logs or a large number of the same logs normally indicates a fault or potential fault.

Log report PM181 is a primary tool that isolates LPP faults. This log is a report that you did not request. The system generates log report PM181 when an exception occurs. An exception could be a failed hardware component or a failed diagnostic. PM181 isolates faults to the unit, card, and port levels.

Single PM181 log reports could be the result of transient faults. Repeated patterns can indicate a fault. Refer to the card lists in the PM181 log report and begin standard troubleshooting procedures.

Refer to "Log Report Reference Manual" for more information on log reports.

Operational measurements

Operational measurements (OM) are records of the performance of hardware and software resources within the switch. The DMS OM system collects data from all resources within the switch. The system organizes the data into groups so that maintenance personnel can easily review the data.

The system organizes OMs into groups. Several OM groups record performances that affect LPP PMs. Refer to page 39-1 of this guide for descriptions of these LPP-related OM groups.

Review OMs on a daily or weekly basis, depending on how important the component is, and how great the potential for faults. OMs are the primary resource for detecting both existing and potential system troubles.

Refer to *Operational Measurements Reference Manual*, 297-1001-300, for more information on OMs.

Reviewing datafill

In order to troubleshoot faults in LPP PMs you must review datafill. LPP PMs depend on data entries for application functionality. Incorrect datafill can create faults in the PM.

Table 43-2 lists and describes some of the datafill tables that support LPP PMs.

Table 43-2 LPP-related datafill tables (Sheet 1 of 3)

Table	Description
CARRMTC	Provides carrier maintenance templates.
CLLI	Defines X.75 identifier
ENSITES	Lists all the sites referenced in table EXNDINV.
ENTYPES	Lists all the types referenced in table EXNDINV.
ESRVATTR	Defines the component parts of an enhanced services resource.

Table 43-2 LPP-related datafill tables (Sheet 2 of 3)

Table	Description
ESRVCAP	Defines service-wide configuration parameters for the enhanced services.
EXNDINV	Identifies IP addresses and host names of nodes external to the switch.
IPHOST	Configures SuperNode nodes as IP hosts.
IPNETWRK	Stores all IP-specific information for the IP network.
IPPROTO	Stores the configuration information for TCP/IP.
IPROUTER	Stores IP-specific information for each EIU.
IPTHRON	Provides the mechanism to avoid congestion on the DS30 links
LIDINFO	Provides information for transferring data from the inactive to the active side during a dump and restore.
LIMCDINV	Identifies the cards in a LIM.
LIMINV	Identifies the LIMs for the system.
LIUINV	Contains the LIU inventory for the system.
LMPTINV	Describes the port connection on each LIM.
MSCDINV	Enables adjustments to the characteristics information of the system cards and bus extension units.
NIUINV	Contains the NIU inventory.
OFCENG	Contains office engineering parameters.
PVCINFO	Provides permanent virtual circuit (PVC) for DMS Packet Handler.
PVDNAGEN	Stores all information on frame relay service agents.
PVDNCHAN	Associates frame-relay service agents with their FRIU channels.
PVDNCUST	Identifies all customers and their frame-relay service agents and connections.
RMCONFIG	Specifies the number of telnet sessions and which EIUs will be used to connect these sessions.

Table 43-2 LPP-related datafill tables (Sheet 3 of 3)

Table	Description
SNIXAPPL	Contains information about the type of application that runs on a UNIX node.
SNIXINFO	Contains basic configuration information for nodes that run UNIX.
SNIXVOLS	Holds the SOS filename that represents the UNIX file system.
SPECCONN	Defines the hardware configuration of the X.25-packet service.
SUSHELF	Defines the equipment configuration of a link interface shelf (LIS) or single-shelf LPP (SS LPP) shelf. This table provides basic location information for the shelf, like the floor identifier. This table also associates product equipment codes (PECs) of circuit cards, with shelf numbers. PECs of circuit cards include power supplies.
TRKGRP	Defines the trunk and the characteristics of the trunks.
TRKMEM	Used to map service profile to hardware.
TRKSGRP	Defines the trunks and the characteristics of the trunks.
VPSRVDEF	Used to datafill default configurations and options for VPU services.
VPUSERV	Contains information that relates to the services that VPU nodes provide.
X75INFO	Defines service data for X.75-packet service.
XLIUMAP	Provides information for transfer of data from the active to the inactive side during a dump and restore.
XSGDEF	Defines the hardware configuration of the X.25-packet service.

Standard troubleshooting procedure

The standard procedure for problem isolation and clearing is as follows:

1 Silence audible alarms.

2 To isolate the problem read status displays. Trace problem codes to the menu level you must access to clear the problem.

3 Busy the hardware to remove system access to the component that has faults. This procedure allows you to perform maintenance activity without system interference.

4 Test the component that has faults and identify the card you must replace. Replace the damaged card and test the component again.

5 Return to service the hardware.

Many LPP PMs have special problem solving procedures, like procedures to busy links or clear alarms in related LPP PMs. You must follow these procedures.

Locating and clearing faults

Locating and clearing faults in the link interface module

CAUTION
Loss of applications and services
Do not busy both units of a LIM. If you busy both units, the entire LIM is busy. ASUs on that LIM and applications and services that the ASUs support, will not be available.

To isolate problems in the link interface module (LIM), perform a minimum of one of the following tasks:

- Use the maintenance state of the LIM to solve problems. Table 43-3 lists and describes possible faults with LIM maintenance states.
- Use the TST command at the MAP terminal to test each LIM unit.
- Use the QUERYPM command at the MAP terminal to determine the state of each LIM unit, F-bus, and DS30 links to the DMS-Bus.
- Run a routine exercise (REx) test on the LIM units. A description of this test appears later in this chapter.
- Perform a switch of activity (SWACT) of the LIM units. A description of this test appears later in this chapter.
- Use log reports and operational measurements to identify problems and problem areas that cause faults. Log report PM181 helps isolate LIM problems.

Table 43-3 LIM maintenance states

LIM state	Cause	Resource
ISTb LIM unit	• A system card reports a problem that does not affect service. • An interface card reports a problem. • Clocking links between the LIM unit and the DMS-Bus are out of service • System isolates the LIM unit from the DMS-Bus • The mate LIM unit is OOS. • The cross-connections between the two LIM units are OOS. • The software load in the LIM unit does not match the entered loadname in table LIMINV.	PM181 log generated.
ISTb (NA) LIM unit	Audit detected a loss of communication with an LIM unit.	System checks links and increases the speed of the audit of the mate LIM unit.
SysB LIM unit	• A system card reports a fault that affects service. • LIM unit does not communicate with the DMS-Bus and a minimum of at least one link is available. • LIM unit data is not in sync with the DMS-Bus.	

PM181 log generated.

System attempts to RTS LIM unit.

Related components

Each LIM contains two local message switches (LIM unit 0 and LIM unit 1) that operate in load sharing mode. When problems in one unit generate alarms, and the second unit assumes the processing for the full traffic load. Problems in both units generate critical alarms. Isolate and clear these problems immediately.

Communications problems generate LIM problems. A loss of all DS30 links with the DMS-Bus changes both LIM units to SysB. If you return to service the links, you can return to service the LIM units. Problems in the links between the two LIM units also generate LIM alarms.

Problems in connected LIMs can generate alarms. If you cannot isolate a problem in an LIM, post the connected LIM. Try to isolate the problem in the connected LIM.

Locating and clearing faults in the frame transport bus

CAUTION
Loss of applications and services
Do not busy both F-buses of a LIM. If you busy both F-buses, ASUs on that LIM, and applications and services the ASUs support, will not be available.

To isolate faults in the frame transport bus (F-bus), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the F-bus.
- Use the TST command at the MAP terminal to test the F-bus taps.
- Use the QUERYPM command at the MAP terminal to determine the state of each F-bus, taps, LIM unit, and ASUs.
- Use the QUERYFBUS command to isolate diagnostic failures on the F-bus.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports in the MS and PM groups report events that occur in F-bus operations.

Related components

Problems in one or both LIM units can cause F-bus faults. The F-bus interface cards in these units cause many of these problems. Problems in an ASU or the F-bus tap to an ASU do not cause F-bus alarms. A power fault in a link interface shelf generates a critical alarm and changes both F-buses to SysB.

Locating and clearing faults in the application processor unit

CAUTION
Loss of voice service
The APU is a simplex unit. When the APU is not available for service, the VPUs in the VPP are not available for service. The VPUs cannot provide the voice services for the call-processing applications assigned by datafill.

To isolate faults in the application processor unit (APU), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the APU
- Use the QUERYPM command at the MAP terminal to determine the state of the APU, F-bus taps, and F-bus and LIM units
- Clear any LIM or F-bus alarms.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify APU problems. Log reports in the OMX, UADA, and UOAM series identify APUX problems.

Related components

An *(NA)* after a maintenance state indicates the APU lost communication with the DMS-Bus. This loss of communication indicates a problem in the path between the APU and the LIM.

APUs work with voice processing units (VPU), network interface units (NIU), and Ethernet interface units (EIU). Problems with these ASUs affect the operations of the APU.

Locating and clearing faults in the CCS7 link interface unit

CAUTION
Loss of service to LIU7
When the system isolates an LIU7 for any reason, the LIU7 goes SysB (NA) rather than ISTb (NA). The system isolates an LIU7 when you power down the LIS or remove the NTEX22 card.

To isolate faults in the CCS7 link interface unit (LIU7), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the LIU7.
- Use the QUERYPM command at the MAP terminal to determine the state of the LIU7, F-bus taps, and F-bus and LIM units
- Clear any MS alarms.
- Clear any LIM or F-bus alarms.
- Perform loopback tests on the LIU7 links to the CCS7 network.
- Run a CCS7 bit error ratio (C7BERT) test. A description of this test appears later in this section.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify LIU7 faults. Log reports in the CCS series indicate CCS7 faults.

Running a C7BERT test

Maintenance personnel can execute, monitor, and analyze the bit error rate (BERT) of a CCS7 signaling link (SL) on the LIU7 from the MAP terminal.

Maintenance personnel can test internal operation and the CCS7 capabilities outside the switch through loopback control. This integrated C7BERT ability eliminates the need for separate test equipment. This feature identifies hardware problems that affect link performance before and after the link goes in to service.

The identification of bit errors verifies the quality of CCS7 data transmission. The system identifies the errors before the errors affect link selection, routing addresses, and service and feature information types.

Related components

An *(NA)* after a maintenance state indicates that the LIU7 lost communication with the DMS-Bus. This loss of communication indicates a fault in the path between the LIU7 and the LIM.

The LIU7s work with application processing units (APU), Ethernet interface units (EIU), and network interface units (NIU) to support some applications. Problems in these LIUs affect the operations of the LIU7.

Locating and clearing faults in the Ethernet interface unit

CAUTION
Loss of billing information
The EIU is a simplex PM. Many offices have pairs of EIUs. Each LAN connection requires only one EIU. If you disable the EIU, you can terminate the LAN connection. The loss of this connection terminates billing information that transmits through the EIU to a LAN-based node.

To isolate faults in the Ethernet interface unit (EIU), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the EIU.
- Use the QUERYPM command at the MAP terminal to determine the state of the:
  - EIU
  - set of EIUs
  - F-bus taps
  - F-bus unit
  - LIM unit
- Perform a switch of activity (SWACT) of the EIUs, if the EIU is in a set. A description of this test appears later in this chapter.
- Clear any LIM or F-bus alarms.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, and PM181 identify EIU faults. Log reports in the ITN series identify protocol conversion errors.
- Use commercial software tools to monitor local area network (LAN) performance. According to your application, a single interface at a UNIX

work station can support both LAN and switch management. Traffic characteristics to monitor include:

- The bit rate increases with increases in packet size. Larger packets mean less packets each second.
- The bit rate decreases with increases in the number of hosts. When more hosts are present, more collisions occur for each packet.
- The average transmission delay increases with the number of hosts.

Related components

An (NA) after a maintenance state indicates the EIU lost communication with the DMS-Bus. This loss of communication indicates a problem in the path between the EIU and the LIM.

Every LAN that connects to the switch requires a single EIU. It is recommended that you have two EIUs for each LAN. The two EIUs provide fault-tolerant communications to the LAN. The two EIUs can operate in hot-standby or load-sharing mode. In hot-standby mode, one EIU carries the full traffic load. If the EIU fails, traffic shifts to the standby EIU. In load-sharing mode, both EIUs carry traffic. Each EIU has the ability to carry the full traffic load if the mate EIU fails.

EIUs work with voice processing units (VPU), network interface units (NIU), and CCS7 link interface units (LIU7). Problems in these ASUs affect the operations of the APU.

The EIU is out-of-service when the LAN that the EIU supports is out-of-service. LAN problems can result from different occurrences. These occurrences include damaged cables, software problems, computer failures, or operator errors. The LAN is not available when the EIU that provides the interface to the LAN is out-of-service.

> ***Note:*** Failures in different components can cause a failure of the Ethernet interface paddle board (EIP). These components include the LAN, the media access unit (MAU), or the attachment unit interface (AUI). Check these components if the EIP appears on a damaged card list.

Locating and clearing faults in the frame relay interface unit

To isolate faults in the frame-relay interface unit (FRIU), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the FRIU.
- Use the QUERYPM command at the MAP terminal to determine the state of the FRIU, F-bus taps, and FBUS and LIM units.
- Clear any LIM or F-bus alarms.

- Use the QRYCARR and QRYCHAN to determine the state of posted carriers or channels of the FRIU.
- Use the PERFMON command to display performance data on a posted FRIU carrier.
- Perform loopback tests to make sure that each FRIU and associated T1 carrier can carry data packets with an acceptable error rate. Information that describes how to perform a loopback test appears later in this section.
- Execute the Frame Capture utility to monitor frame traffic at the FRIU.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify FRIU faults. Log reports in the FRS series identify DataSPAN faults.

Performing a loopback test on the FRIU

You can use loopback tests to locate and clear faults in the FRIU. Maintenance personnel can perform two types of loopback tests. The two types of loopback test are a remote loopback at the FRIU, and a remote-end loopback on the FRIU channel from the far-end.

Maintenance personnel perform a remote loopback when the FRIU can not recognize the in-band loopback message. In a remote loopback, the incoming bit data stream loops back to the other end. To enable a remote loopback at the carrier (CARR) level, the FRIU must be InSv or ISTb. The T1 carrier must be ManB. After the T1 carrier enables the remote loopback, the T1 carrier changes to ManB-R.

In a remote-end loopback, maintenance personnel select a channel and request a loopback from the far-end. The channel must be ManB, and the FRIU and the T1 carrier must be InSv or ISTb. The state of the channel changes to ManB-RE during the remote-end loopback.

For procedures on how to conduct loopback tests, refer to *Maintenance Guide* .

Related components

An *(NA)* after a maintenance state indicates the FRIU lost communication with the DMS-Bus. This loss of communication indicates a fault in the path between the FRIU and the LIM.

Locating and clearing faults in the network interface unit

To isolate faults in the network interface unit (NIU), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the NIU.
- Use the QUERYPM command at the MAP terminal to determine the state of the NIU, F-bus taps, and F-bus and LIM unit.
- Clear any LIM or F-bus alarms.
- Run a routine exercise test (REx) on the NIU units. A description of this test appears later in this chapter.
- Perform a switch of activity (SWACT) of the NIU units. A description of this test appears later in this chapter.
- Use the TRNSL command at the DEVICES level to review information on the devices that connect to the NIU.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify NIU faults.

Related components

An *(NA)* after a maintenance state indicates the NIU lost communication with the DMS-Bus. This loss of communication indicates a fault in the path between the NIU and the LIM.

NIUs work with application processing units (APU), Ethernet interface units (EIU), and CCS7 link interface units (LIU7) to support some applications. Problems in these ASUs affect the operations of the LIU7.

Both halves of the NIU on a shelf can carry all traffic on the shelf. You can take one half of an NIU out of service to perform tests and maintenance procedures without loss of service.

> ***Note:*** All NIU services must be available and InSv before you return the C-bus to service.

Locating and clearing faults in the voice processing unit

> ***Note:*** A VPU becomes SysB when the RTIF initiates a restart. The VPU becomes SysB (NA) and recovers to InSv after 5 min. A VPU changes state to SysB when a fault that affects service appears in one of the following:

- recording and announcement (RAP)
- channel bus interface (CBI)
- integrated processor and F-bus (IPF) cards

To isolate faults in the voice processing unit (VPU), perform a minimum of one of the following tasks:

- Use the TST command at the MAP terminal to test the VPU.
- Use the QUERYPM command at the MAP terminal to determine the state of the VPU, F-bus taps, and F-bus and LIM units.
- Clear any LIM or F-bus alarms.
- Clear any NIU APU alarms.
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify VPU faults.

Related components

An (NA) after a maintenance state indicates the VPU lost communications with the DMS-Bus. This loss of communication indicates a fault in the path between the VPU and the LIM.

VPUs work with application processing units (APU) and network interface units (NIU) to support some applications. Problems in these ASUs affect the operations of the VPU.

Locating and clearing faults in the X.25/X.75/X.75' link interface unit

CAUTION
Loss of packet processing service.
The XLIU is a simplex unit. If you remove an XLIU from service, X.25/X.75/X.75' packet processing on the XLIU stops.

To isolate faults in the X.25/X.75/X.75' link interface unit (XLIU) perform the following tasks:

- Use the TST command at the MAP terminal to test the XLIU.
- Use the QUERYPM command at the MAP terminal to determine the state of the XLIU, F-bus taps, and F-bus and LIM units
- Use log reports and operational measurements to identify problems or problem areas that cause faults. Log reports PM102, PM128, PM180, PM181 identify XLIU faults. Log reports in the DMSPH series identify DMS Packet Handler faults.

Related components

Line and trunk faults can affect XLIU operations. These faults appear under the Lines (LNS) or Trunks (TRKS) headers of the MAP display. Line and trunk faults are beyond the range of this guide.

For more information on line and trunk faults, refer to *Maintenance Guide*.

Fault isolation tests

Running a routine exercise test

A routine exercise (REx) is a series of state changes and tests that the switch performs. Routine exercises are a form of preventive maintenance. The switch runs these tests at regular intervals. Maintenance personnel can manually control the tests to perform problem solving procedures.

For most two-unit PMs, a REx detects faults that affect service in the inactive unit. The REx takes the unit out-of-service, runs a set of diagnostics, and returns to service the unit. This process does not affect service from the PM.

The LPP has three two-unit PMs: the LIM, the F-bus, and the NIU. The switch can contain other units, like the EIU, assembled in arrangements of two or more units.

> ***Note:*** A REx test cannot run on a single-shelf LPP.

In an LPP, a REx is not always necessary. Under normal conditions, both LMS units operate in load-sharing mode and carry traffic. An LMS that provides service is normally free of faults. An out-of-service test like a REx does not normally find faults not detected during normal operations. When an LMS goes out-of-service, the LMS and F-bus units lose redundancy. This loss of redundancy affects service.

REx tests are important for maintenance of the LPP. The REX tests make sure that the fault detection circuits of the unit function correctly. When the fault detection circuits of the LMS do not function correctly, problems can occur. The unit can appear to function correctly and loses traffic. A unit that does not function correctly and cannot detect this fault can cause fault reports in other system components. In this condition, problem solving becomes a problem.

When LIM-related components report faults that you cannot detect, run a manual REx on the affected LIM. The REx command is a menu command at the LIM level of the MAP terminal.

Before you run a REx on a unit, the system must meet all of the following conditions:

- each LMS unit of the LIM must be in-service or in-service trouble. A load name mismatch must cause the in-service trouble.
- each LMS unit must have four open links to the message switch
- both cross links must be open
- no isolated nodes can be present on the F-bus of the LIM when you take the LMS unit out of service

The REx for an LMS unit consists of the following four steps:

1 The LIM maintenance system busies the unit.

2 The system resets the unit out-of-band.

3 The system tests the unit out-of-service.

4 The system returns to service the unit.

A normal REx takes less than 15 min to run, if the text does not detect any problems. When a REx runs, the MAP terminal posts a minor alarm (LIMREx) for the affected LIM.

Performing a switch of activity

A switch of activity (SWACT) is the procedure to switch activity between the two units of a two-shelf PM. The active unit becomes the inactive unit and the inactive unit becomes the active unit. The new active unit assumes call processing.

The PM or the CC can initiate a SWACT if the active unit detects a fault from which the system cannot recover. Maintenance personnel can manually initiate a SWACT through the MAP display.

There are four types of SWACTs: a warm SWACT, a controlled warm SWACT, an uncontrolled warm SWACT, and a cold SWACT. The following describes each type of SWACT and conditions under which the different SWACTs occur:

- A warm SWACT occurs by default after a system reload or restart. The system maintains established calls. The system drops calls that are in transient states, like dialing and ringing states.
- A controlled warm SWACT occurs when maintenance personnel issue the SWACT command from the PM level of the MAP terminal. Maintenance personnel can also issue the command because of a scheduled diagnostic, like the REx test. The system maintains established calls and drops calls that are in a transient state.

- An uncontrolled warm SWACT results from a hardware failure or a trap in the active unit. When an uncontrolled SWACT occurs, the CC and the PM exchange a series of messages to communicate about the event. The SWACT is complete when the CC receives the gain message from the newly active unit.
- A cold SWACT occurs when a SWACT occurs and the system disables a warm SWACT at the MAP terminal. The system drops all calls.

Diagnostic tests

Many diagnostic tools are available on DMS SuperNode switches. The types of tools available depend on:

- the applications the switch supports
- the batch change supplement (BCS) running on the switch
- the features that run on the switch

For more information on the diagnostic tests available to your switch refer to the following documents:

- *Listing of Technical Assistance Manuals*, TAM-1001-000
- *TAS Nonresident Tool Listing Technical Assistance Manual*, TAM-1001-001
- *BCS Maintenance Synopsis*, TAM-1001-005

Product test tools

Frame Capture Utility

The Frame Capture Utility is a product test tool for the FRIU. The frame capture utility captures frames that an FRIU on the T1 carrier receives or transmits. The system copies the frames to an ASCII file on the DMS-Core for analysis.

When you run the Frame Capture utility, you affect FRIU service. When you initiate the Frame Capture process, the FRIU changes to the ISTb state. When you complete the Frame Capture process, the FRIU returns to the InSv state.

For procedures and conditions for use of the Frame Capture utility refer to "Maintenance Guide".

CCS7 Test Utility

The CCS7 Test Utility (C7TU) is a product test tool for the CCS7 link interface unit (LIU7). C7TU also supports the message-switch and buffer for CCS7 (MSB7).

C7TU allows you to monitor CCS7 links on service switching points (SSP), signaling transfer points (STP), and service control points (SCP). CI-level commands allow you to query a routeset, record and display reports, and display message codes that the utility understands. You can monitor a maximum of four links at the same time.

Two versions of C7TU exist. The CCS7 Protocol Monitor Tool (PMT7) allows you to monitor messages. The PMT7 does not allow you to intercept or send messages. The CCS7 Integrated Link Protocol Test Tool (ILPT7) allows you to use C7TU to monitor, intercept or send messages.

44 LPP troubleshooting chart

This chapter provides reference charts to problem solve for link peripheral processor (LPP) alarms. The charts identify alarms, alarm causes, and the problem solving actions return to service the PM.

This chapter is a high-level summary of LPP alarm clearing procedures. This chapter is in this guide to help maintenance personnel with experience to maintain LPP PMs. For alarm clearing procedures, refer to *Alarm and Performance Monitoring Procedures*.

Link interface module

Table 44-1 lists link interface module (LIM) alarms. The table also lists possible alarm causes, and problem solving procedures to clear the fault and return the LIM to service. For the procedures to clear these alarms, refer to *Alarm and Performance Monitoring Procedures*.

Table 44-1 Clearing LIM alarms (Sheet 1 of 4)

Alarm condition	Possible cause	Procedures
Critical	The system loses DS30 links with the DMS-Bus and both LIM units are SysB (RU).	1. Manually busy one of the LIM units. 2. Query the LIM unit. 3. Return to service the DS30 links. 4. Return to service the LIM unit.
	The system loses LIM unit cross-links and both LIM units are SysB (RU).	1. Manually busy one of the LIM units. 2. Query the LIM unit. 3. Return to service the cross-links. 4. Return to service the LIM unit.

Table 44-1 Clearing LIM alarms (Sheet 2 of 4)

Alarm condition	Possible cause	Procedures
	Communication between the two LIM units fails, and both LIM units are SysB (RU).	1. Manually busy one of the LIM units. 2. Query the LIM unit. 3. Test the LIM unit through the mate LIM unit. 4. Replace any cards that have faults. 5. Load the LIM unit. 6. Return to service the LIM unit.
	The system loses data synchronization between the two units, and both LIM units are SysB (RU).	1. Manually busy one of the LIM units. 2. Query the LIM unit. 3. If you used the mate LIM unit, busy and test the mate LIM unit. 4. If you did not use the mate LIM unit, contact the next level of support.
	A power fault causes both LIM units to be system busy.	1. Examine the fail lamps of the NT9X30 power converters. 2. If the fail lamp on either unit is lit, busy that unit and replace the NT9X30 card. 3. Return to service the unit.
	One LIM unit is system busy and the other LIM unit is manually busy.	1. Determine why the LIM unit is manually busy. 2. Begin problem solving for the LIM unit most possible to return to service.
Major	A complete LIM is manually busy.	1. Determine from office records and operating company personnel why the LIM is manually busy. 2. When you have permission, choose a LIM unit to troubleshoot. 3. Query the LIM unit to isolate the fault. 4. Clear the fault, according to the internal fault status. 5. Isolate and clear the fault in the second LIM unit.

Table 44-1 Clearing LIM alarms (Sheet 3 of 4)

Alarm condition	Possible cause	Procedures
	External resources, like a fault with communications to the DMS-Bus, affect the LIM.	1. Choose a LIM unit to problem solve. 2. Query the LIM unit to display more information on the fault. 3. Follow the correct procedures to isolate and clear the fault.
	One LIM unit is SysB and the other LIM unit is ISTb.	1. Manually busy the LIM unit that is SysB. 2. Use standard problem solving procedures to clear the fault. 3. Isolate and clear the fault in the LIM unit that is ISTb.
	Faults are present in a joined LIM.	1. Post the next LIM in the posted set of ISTb LIMs. 2. Use standard troubleshooting procedures to clear the fault.
Minor	One LIM unit is ManB and the other LIM unit is ISTb.	1. Determine from office records or operating company personnel why the LIM unit is manually busy. 2. When you have permission, begin problem solving for the ManB LIM unit. 3. When the ManB LIM unit returns to service, problem solve for the ISTb LIM unit.
	Both LIM units are ISTb.	1. Choose a LIM unit to problem solve. 2. Query the LIM unit to display more information about the fault. 3. If the crosslinks between the two LIM units are out-of-service, restore the links. Follow standard problem solving procedures to isolate and clear the fault. 4. Post the mate LIM unit and follow the previous steps to isolate and clear the fault.

Table 44-1 Clearing LIM alarms (Sheet 4 of 4)

Alarm condition	Possible cause	Procedures
	One LIM unit is ISTb.	1. Use standard problem solving procedures to isolate and clear the fault.

Frame transport bus

Table 44-2 lists frame transport bus (F-bus) alarms. The table also lists possible alarm causes, and problem solving procedures. To clear the fault and return to service the F-bus, refer to *Alarm and Performance Monitoring Procedures*.

> ***Note:*** The MAP terminal identifies F-bus alarms under the PM banner as LIMF alarms.

Table 44-2 Clearing F-bus (LIMF) alarms (Sheet 1 of 2)

Alarm condition	Possible cause	Procedures
Critical	A power fault in a link interface shelf (LIS) changes both F-buses to SysB.	1. To check for a power fault at the LIM, examine the fail lamps of the NT9X30 power converters.
		2. If a fail lamp is lit, replace the NT9X30 card. If a fail lamp is not lit, select one F-bus and use standard problem solving procedures to isolate and clear the fault.
	A manual action changes both F-buses to ManB or OffL.	1. Determine from office records or operating company personnel why the manual action occurred.
		2. When you have permission, choose one F-bus to problem solve. Use standard problem solving procedures to isolate and clear the fault.
		3. When the first F-bus returns to service, begin problem solving for the second F-bus. Use standard problem solving procedures to isolate and clear the fault.

Table 44-2 Clearing F-bus (LIMF) alarms (Sheet 2 of 2)

Alarm condition	Possible cause	Procedures
	One F-bus is SysB and the mate F-bus is ManB.	1. Determine from office records or operating company personnel why the F-bus is manually busy. 2. Use standard procedures to problem solve for the ManB F-bus. 3. When the ManB F-bus returns to service, use standard prodedures to problem solve for the SysB F-bus.
Major	One F-bus is ManB, and the mate F-bus is InSv.	1. Determine from office records or operating company personnel why the F-bus is manually busy. 2. When you have permission, use standard procedures to problem solve for the F-bus.
	One F-bus is SysB, and the mate F-bus is InSv.	1. Use standard problem solving procedures to isolate and correct the fault.
	A LIM unit has faults. One F-bus is SysB (RU). The mate F-bus is InSv.	1. Use standard problem solving procedures to isolate and correct the fault in the LIM unit. 2. Return to service the LIM unit. 3. Return to service the F-bus.
Minor	There is no minor LIMF alarm.	

Application processor unit

Table 44-3 lists application processor unit (APU) alarms. The table also lists possible alarm causes and the problem solving procedures to clear the fault and return to service the APU. For the procedures that clear these alarms, refer to *Alarm and Performance Monitoring Procedures*.

Table 44-3 Clearing APU alarms (Sheet 1 of 3)

Alarm condition	Possible cause	Procedures
Critical	A minimum of one APU is SysB because of a fault in the APU.	1. Wait 15 min while the system tries to clear the fault. 2. If the APU remains SysB, the APU has a damaged card. Use standard problem solving procedures to isolate and clear the APU fault. 3. Return to service the APU.
	A minimum of one APU is SysB (NA) because of a fault in the LIM of the APU. The fault can also be in the F-buses of the LIM.	1. Post the LIM associated with the SysB (NA) APU. 2. Clear any LIM or F-bus alarms and return to service these components. 3. If the APU remains SysB, the APU has a damaged card. Use standard problem solving procedures to isolate and clear the APU fault. 4. Return to service the APU.
	A minimum of one APU is ISTb (NA) because of a fault LIM or the APU. The fault can also be in the F-buses of the LIM.	1. Post the LIM associated with the ISTb (NA) APU. 2. Clear any LIM and B-bus alarms and return to service these components. 3. If the APU remains ISTb, the APU has a card that has faults. Use standard problem solving procedures to isolate and clear the APU fault. 4. Return to service the APU.

Table 44-3 Clearing APU alarms (Sheet 2 of 3)

Alarm condition	Possible cause	Procedures
Major	A minimum of one APU is ManB because of a damaged APU card.	1. Determine from office records or operating company personnel why the APU is ManB. 2. Use standard problem solving procedures to isolate and clear the fault. 3. Return to service the APU.
	A minimum of one APU is ManB (NA) because of a fault in the LIM or in the F-buses of the LIM.	1. Post the LIM that associates with the ISTb (NA) APU. 2. Clear any LIM and F-bus alarms and return to service these components. 3. If the APU remains ISTb, the APU has a damaged card. Use standard problem solving procedures to isolate and clear the APU fault. 4. Return to service the APU.
Minor	A minimum of one APU is ISTb because of a damaged F-bus tap.	1. Return to service the tap that has faults. 2. Return to service the APU.
	A minimum of one APU is ISTb because of a loadname mismatch.	1. Correct the loadname mismatch. 2. If the APU remains ISTb, the APU has a card that has faults. Use standard problem solving procedures to isolate and clear the APU fault. 3. Return to service the APU.
	A minimum of one APU is ISTb because the UNIX is OOS.	1. Load the APU again. 2. If the APU remains ISTb, the APU has an APU card that has faults. Use standard problem solving procedures to isolate and clear the APU fault. 3. Return to service the APU.

Table 44-3 Clearing APU alarms (Sheet 3 of 3)

Alarm condition	Possible cause	Procedures
	A minimum of one APU is ISTb because the SNIX component is OOS.	1. Load the APU again. 2. If the APU remains ISTb, the APU has an APU card that has faults. Use standard problem solving procedures to isolate and clear the APU fault. 3. Return to service the APU.

CCS7 link interface unit

Table 44-4 lists CCS7 link interface unit (LIU7) alarms. The table also lists possible alarm causes, and problem solving procedures to clear the fault and return to service the LIU7. For the procedures to clear these alarms, refer to *Alarm and Performance Monitoring Procedures* to clear these alarms.

Table 44-4 Clearing LIU7 alarms (Sheet 1 of 6)

Alarm condition	Possible cause	Procedures
Critical	A minimum of one LIU7 is SysB because of a damaged card.	1. Clear any MS alarms. 2. List all LIU7s that are SysB. 3. Query the LIU7 to determine the name of the linkset that associated with the LIU7. 4. Post the SysB LIU7. 5. Use standard problem solving procedures to isolate and clear the LIU7 fault. 6. Return to service the LIU7. 7. Post the linkset that associates with the LIU7. 8. If the linkset that associates with the LIU7 is 00S, wait 8 min for the system to establish the link again. If the system does not establish the link again, activate the link manually. When the link is InSv, the procedure is complete.

Table 44-4 Clearing LIU7 alarms (Sheet 2 of 6)

Alarm condition	Possible cause	Procedures
	A minimum of one LIU7 is SysB (NA) because of a fault in the LIM. The fault can also be in the F-bus of the LIM.	1. Clear any MS alarms. 2. List all LIU7s that are SysB. 3. Query the LIU7 to determine the name of the linkset associated with the LIU7. 4. Access table SUSHELF to determine the frametype. 5. Post the SysB (NA) LIU7. 6. If the frametype is SCC or EMC, contact the next level of support. This step concludes your problem solving actions. 7. If the frametype is LIM, post the LIM that associates with the damaged LIU7. Clear any LIM and F-bus alarms, and return to service these components. 8. If the LIU7 remains OOS, use standard problem solving procedures to isolate and clear the LIU7 fault. 9. Return to service the LIU7. 10. 0Post the linkset associated with the LIU7. 11. 1If the linkset associated with the LIU7 is 00S, wait 8 min to see if the system establishes the link again. If the system does not establish the link again, activate the link manually. When the link is InSv, the procedure is complete.

Table 44-4 Clearing LIU7 alarms (Sheet 3 of 6)

Alarm condition	Possible cause	Procedures
	A minimum of one LIU7 is ISTb (NA) because of a fault in the LIM or in the F-bus of the LIM.	1. Clear any MS alarms. 2. List all the LIU7s that are SysB. 3. Query the LIU7 to determine the linkset associated with the LIU7. 4. Access table SUSHELF and determine the frame type. 5. Post the ISTb (NA) LIU7. 6. If the frametype is SCC or EMC, contact the next level of maintenance. This step concludes your troubleshooting. 7. If the frametype is LIM, post the LIM that associates with the damaged LIU7. Clear any LIM and F-bus alarms, and return these components to service. 8. If the LIU7 remains OOS, use standard troubleshooting procedures to isolate and clear the LIU7 fault. 9. Return the LIU7 to service. 10. 0Post the linkset that associates with the LIU7. 11. 1If the linkset that associates with the LIU7 is 00S, wait 8 minutes to see if the link re-establishes. If the link does not re-establish, activate the link manually. When the link is InSv, the procedure is complete.

Table 44-4 Clearing LIU7 alarms (Sheet 4 of 6)

Alarm condition	Possible cause	Procedures
Major	One or more LIU7 is ManB.	1. Clear all MS alarms. 2. List all the LIU7s that are ManB. 3. Query the LIU7 to determine the name of the corresponding linkset. 4. Determine from office records or operating company personnel why the LIU7 was ManB. 5. When you are permitted, use standard troubleshooting procedures to isolate and clear the LIU7 fault. 6. Return the LIU7 to service. 7. Post the linkset that associates with the LIU7. 8. If the linkset that associates with the LIU7 is 00S, wait 8 minutes to see if the link re-establishes. If the link does not re-establish, activate the link manually. When the link is InSv, the procedure is complete.

Table 44-4 Clearing LIU7 alarms (Sheet 5 of 6)

Alarm condition	Possible cause	Procedures
	A minimum of one LIU7 is ManB (NA).	1. Clear all MS alarms. 2. List all the LIU7s that are ManB (NA). 3. Access table SUSHELF to determine the frametype. 4. Query the LIU7 to determine the name of the linkset associated with LIU7. 5. Determine from office records or operating company personnel why the LIU7 is ManB (NA). 6. If the frametype is SCC or EMC, contact the next level of support. This step concludes your problem solving actions. 7. If the frametype is LIM, post the LIM that associates with the LIU7 that has faults. Clear any LIM and F-bus alarms, and return to service these components. 8. If the LIU7 remains OOS, use standard problem solving procedures to isolate and clear the LIU7 fault. 9. Return to service the LIU7. 10. 0Post the linkset associated with the LIU7. 11. 1If the linkset associated with the LIU7 is 00S, wait 8 min for the system to establish the link again. If the system does not establish the link again, activate the link manually. When the link is InSv, the procedure is complete.

Table 44-4 Clearing LIU7 alarms (Sheet 6 of 6)

Alarm condition	Possible cause	Procedures
Minor	A minimum of one LIU7 is ISTb because of a damaged F-bus tap.	1. Clear all MS alarms. 2. List all the LIU7s that are ISTb. 3. Query the LIU7 to determine the name of the linkset that associates with the LIU7. 4. Use standard problem solving procedures to isolate and correct the F-bus taps that have faults. 5. Return to service the LIU7. 6. Post the linkset that associates with the LIU7. 7. If the linkset that associates with the LIU7 is 00S, wait 8 min for the system to establish the link again. If the system does not establisht the link again, activate the link manually. When the link is InSv, the procedure is complete.
	A minimum of one LIU7 is ISTb because of loadname mismatch.	1. Clear all MS alarms. 2. List all the LIU7s that are ISTb. 3. Query the LIU7 to determine the name of the linkset that associates with the LIU7. 4. Correct the loadname mismatch. 5. Return to service the LIU7. 6. Post the linkset associated with the LIU7. 7. If the linkset associated with the LIU7 is OOS, wait 8 min for the system to establish the link again. If the system does not establish the link again, activate the link manually. When the link is InSv, the procedure is complete.

Ethernet interface unit

Table 44-5 lists Ethernet interface unit (EIU) alarms. The table also lists possible alarm causes, and the problem solving procedures to clear the fault and return to service the EIU. For the procedures to clear the alarms, refer to *Alarm and Performance Monitoring Procedures*.

Table 44-5 Clearing EIU alarms (Sheet 1 of 2)

Alarm condition	Possible cause	Procedures
Critical	A minimum of one EIU is SysB because of a fault in the EIU.	1. Manually busy the EIU and attempt to return to service the EIU. 2. If the EIU remains SysB, it has a card that has faults. Use standard problem solving procedures to isolate and clear the EIU fault. 3. Return to service the EIU.
	A minimum of one EIU is SysB (NA) because of a fault LIM of the EIU. The fault can also be in the F-buses in the LIM .	1. Post the LIM associated with the SysB (NA). 2. Clear any LIM or F-bus alarms and return these components to service. 3. If the EIU remains SysB, it has a card that has faults. Use standard troubleshooting procedures to isolate and clear the fault. 4. Return the EIU to service.
	One or more EIU is ISTb (NA) because of a fault LIM of the EIU. The fault can also be in the F-buses of the LIM .	1. Return the taps that have faults to service. 2. If the EIU remains ISTb, it has a card that has faults. Use standard troubleshooting procedures to isolate and clear the EIU fault. 3. Return the EIU to service.
Major	One or more EIU is ManB because of a fault in the EIU.	1. Determine from office records or operating company personnel why the EIU is ManB. 2. Use standard troubleshooting procedures to isolate and clear the EIU fault. 3. Return the EIU to service.

Table 44-5 Clearing EIU alarms (Sheet 2 of 2)

Alarm condition	Possible cause	Procedures
	One or more EIU is ManB (NA) because of a fault in the LIM of the EIU. The fault can also be in the F-buses of the LIM.	1. Post the LIM associated with the ManB (NA) EIU. 2. Clear any LIM or F-bus alarms and return these components to service. 3. If the EIU remains OOS, use standard troubleshooting procedures to isolate and clear the EIU fault. 4. Return the EIU to service.
Minor	One or more EIU is ISTb because of a fault in the F-bus taps.	1. Return the taps that have faults to service. 2. Return the EIU to service.
	One or more EIU is ISTb because of a loadname mismatch.	1. Correct the loadname mismatch. 2. If the EIU remains ISTb, it has a card that has faults. Use standard troubleshooting procedures to isolate and clear the EIU fault. 3. Return the EIU to service.
	One or more EIU is ISTb because of a problem on the local area network (LAN).	1. Wait 5 minutes for the system to clear the fault. 2. If the system does not clear the fault, contact the next level of maintenance.

Frame relay interface unit

Table 44-6 lists frame relay interface unit (FRIU) alarms. The table also lists the possible causes, and the troubleshooting procedures that clear the fault and return the FRIU to service. Refer to *Alarm and Performance Monitoring Procedures* that clear these alarms.

Table 44-6 Clearing FRIU alarms (Sheet 1 of 4)

Alarm condition	Possible cause	Procedures
Critical	One or both FRIU is SysB (NA) because of a fault in the LIM or the F-bus of the LIM.	1. Clear any associated LIM alarms. 2. Post any FRIUs that are ISTb. All F-bus taps between the FRIU and the F-bus are either ManB or SysB. 3. Query each FRIU to determine its LIM unit. 4. Post the LIM unit. 5. Access the F-bus level of the MAP system. 6. Choose an F-bus tap to troubleshoot. If the F-bust tap is ManB, determine why the tap is ManB. If the F-bus tap is SysB, change the state to ManB. 7. Use standard troubleshooting procedures to return the tap to service. You only need to return to service one of the two taps to return the FRIU to service. 8. Use standard troubleshooting procedures to return the second tap to service.

Table 44-6 Clearing FRIU alarms (Sheet 2 of 4)

Alarm condition	Possible cause	Procedures
	A reload restart occurred, or power to the LIM was interrupted, and all FRIUs for that LIM are SysB. The T1 carriers that associate with the FRIUs are out of service.	1. Contact the next level of support, as required. 2. Clear any associated LIM or F-Bus alarms. 3. Post any FRIUs that are ISTb. All F-bus taps between the FRIU and the F-bus are either ManB or SysB. 4. Query each FRIU to determine its LIM unit. 5. Post the LIM unit. 6. Access the F-bus level of the MAP system. 7. Choose an F-bus tap to troubleshoot. If it is ManB, determine why it is ManB. If it is SysB, change its state to ManB. 8. Use standard troubleshooting procedures to return the tap to service. You only need to return to service one of the two taps to return the FRIU to service. 9. Use standard troubleshooting procedures to return the second tap to service.
	A problem with an FRIU made it SysB.	1. Check the PM log reports for DataSPAN and identify the type of fault. 2. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-6 Clearing FRIU alarms (Sheet 3 of 4)

Alarm condition	Possible cause	Procedures
Major	The indicated number of FRIUs are ManB. The FRIUs are out of service, and the T1 carriers that associate with the FRIUs not carry traffic.	1. Post a ManB FRIU and determine if the FRIU is ManB or ManB (NA). 2. If the FRIU is ManB, use standard troubleshooting procedures to isolate and correct the fault. 3. If it is ManB (NA), the taps between the F-bus and the FRIU are either ManB or SysB. Isolate the taps that have faults. Use standard troubleshooting procedures to correct the fault and return the taps to service. 4. Return the FRIU to service.
Minor	A load name mismatch made the indicated number of FRIUs ISTb.	1. Check the entries in table LIUINV. 2. Reload the FRIU at a time when the FRIU causes a minimal interruption of service. 3. For additional help, contact the next level of support.
	The T1 carrier that associates with the FRIU is SysB and changes the FRIU to ISTb.	1. Use standard troubleshooting procedures to isolate and clear the T1 carrier fault. 2. Return the F-bus taps to service.
	The T1 carrier that associates with the FRIU is ManB and changes the FRIU to ISTb.	1. Check with office records and operating company personnel to determine why the T1 carrier is ManB. 2. When you are permitted, return the carrier to service.
	One of the F-bus taps has faults and made the FRIU ISTb.	1. Isolate the F-bus tap that has faults 2. Clear the fault. 3. Return the F-bus tap to service.

Table 44-6 Clearing FRIU alarms (Sheet 4 of 4)

Alarm condition	Possible cause	Procedures
	One F-bus is SysB or ManB, and the FRIUs that associate with the F-bus are ISTb.	1. Isolate the F-bus that has faults. 2. Clear the F-bus fault. 3. Return the F-bus to service.
	The Frame Relay Capture Tool is active at the FRIU, and the FRIU is ISTb.	1. Contact maintenance personnel to determine if you can stop Frame Capture. Turn Frame Capture OFF when the test finishes.

Network interface unit

Table 44-7 lists network interface unit (NIU) alarms. The table also lists the possible causes, and the troubleshooting actions that clear the fault and return the NIU to service. Refer to *Alarm and Performance Monitoring Procedures* for how to clear these alarms.

Table 44-7 Clearing NIU alarms (Sheet 1 of 6)

Alarm condition	Possible cause	Procedures
Critical	One or more NIU is SysB because of an NIU card that has faults.	1. Post the SysB NIU. 2. Troubleshoot one NIU unit. Manually busy one NIU unit, or troubleshoot a ManB unit. 3. Use standard troubleshooting procedures to return the NIU unit to service. 4. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 5. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-7 Clearing NIU alarms (Sheet 2 of 6)

Alarm condition	Possible cause	Procedures
	One or more NIU is SysB (NA) because of a fault in the LIM or the F-bus of the LIM.	1. Post the SysB NIU. 2. Query the NIU to determine its LIM. 3. Post the LIM. 4. Clear any LIM or F-bus faults and return the components to service. 5. If the NIU remains OOS, manually busy one NIU unit or troubleshoot a ManB NIU unit. 6. Use standard troubleshooting procedures to return the NIU unit to service. 7. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 8. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-7 Clearing NIU alarms (Sheet 3 of 6)

Alarm condition	Possible cause	Procedures
	One or more NIU is ISTb (NA) because of a fault in the LIM or the F-buses of the LIM.	1. Post the ISTb NIU. 2. Query the NIU to determine its LIM. 3. Post the LIM. 4. Clear any LIM or F-bus faults and return the components to service. 5. If the NIU remains OOS, manually busy one NIU unit or troubleshoot a ManB NIU unit. 6. Use standard troubleshooting procedures to return the NIU unit to service. 7. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 8. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-7 Clearing NIU alarms (Sheet 4 of 6)

Alarm condition	Possible cause	Procedures
Major	One or more NIU is ManB because of a damaged NIU card.	1. Post the ManB NIU and select a ManB NIU unit to troubleshoot. 2. Determine from office records or operating company personnel why the NIU unit is ManB. 3. When you are permitted, use standard troubleshooting procedures to return the NIU unit to service. 4. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 5. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-7 Clearing NIU alarms (Sheet 5 of 6)

Alarm condition	Possible cause	Procedures
	One or more NIU is ManB (NA) because of a fault in the LIM or the F-buses of the LIM.	1. Post the ManB (NA) NIU. 2. Query the NIU to determine its LIM. 3. Post the LIM. 4. Clear any LIM or F-bus faults and return the components to service. 5. If the NIU remains OOS, begin troubleshooting one NIU unit. 6. Use standard troubleshooting procedures to return the NIU unit to service. 7. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 8. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Table 44-7 Clearing NIU alarms (Sheet 6 of 6)

Alarm condition	Possible cause	Procedures
Minor	One or more NIU is ISTb.	1. Post the ISTb NIU. 2. If one unit is SysB (NA), ManB (NA), or ISTb (NA), there is a fault in the LIM or the LIM's F-buses. Post the LIM, clear any LIM or F-bus faults, and return the components to service. This may clear the NIU minor alarm and return the NIU to service. 3. Select an NIU unit to troubleshoot. ManB a SysB unit, or begin troubleshooting a ManB unit. 4. Use standard troubleshooting procedures to return the NIU unit to service. 5. If the NIU remains OOS, use standard troubleshooting procedures to return the second NIU unit to service. 6. Switch activity from the active unit to the inactive unit. If the SWACT fails, manually busy the inactive unit. Use standard troubleshooting procedures to isolate and correct the fault.

Voice processing unit

Table 44-8 lists voice processing unit (VPU) alarms. The table also lists the possible causes, and the troubleshooting procedures that clear the fault and return the VPU to service. Refer to*Alarm and Performance Monitoring Procedures* for how to clear these alarms.

Table 44-8 Clearing VPU alarms (Sheet 1 of 2)

Alarm condition	Possible cause	Procedures
Critical	One or more VPU is SysB because of a fault in the VPU.	1. Clear any NIU alarms. 2. Use standard troubleshooting procedures to isolate and clear the VPU fault. 3. Return the VPU to service.
	One or more VPU is SysB (NA) because of a fault in the LIM or the F-buses of the LIM.	1. Clear any NIU alarms. 2. Post the LIM that associates with the VPU. 3. Clear any LIM or F-bus alarms and return these components to service. 4. If the VPU remains OOS, use standard troubleshooting procedures to isolate and clear the VPU fault. 5. Return the VPU to service.
	One or more VPUs are ISTb because of a fault in the LIM or the F-buses of the LIM.	1. Clear any NIU alarms. 2. Return the damaged taps to service. 3. If the VPU remains OOS, use standard troubleshooting procedures to isolate and clear the VPU fault. 4. Return the VPU to service.
Major	One or more VPU is ManB because of a fault in the VPU.	1. Clear any NIU alarms. 2. Determine from office records and operating company personnel why the VPU is ManB. 3. Use standard troubleshooting procedures to isolate and clear the VPU fault. 4. Return the VPU to service.

Table 44-8 Clearing VPU alarms (Sheet 2 of 2)

Alarm condition	Possible cause	Procedures
	One or more VPU is ManB (NA) because of a fault in the LIM or the F-buses in the LIM.	1. Clear any NIU alarms. 2. Post the LIM associated with the VPU. 3. Clear any LIM or F-bus alarms, and return these components to service. 4. If the VPU remains OOS, use standard troubleshooting procedures to isolate and clear the VPU fault. 5. Return the VPU to service.
Minor	One or more VPU is ISTb because of taps that have faults.	1. Clear any NIU alarms. 2. Return the F-bus taps to service. 3. If the VPU remains OOS, it has a card that has faults. Use standard troubleshooting procedures to isolate and correct the VPU fault. 4. Return the VPU to service.
	One or more VPU is ISTb because of a loadname mismatch.	1. Correct the loadname mismatch and return the VPU to service. 2. If the VPU remains OOS, it has a card that has faults. Use standard troubleshooting procedures to isolate and correct the VPU fault. 3. Return the VPU to service.

X.25/X.75/X.75' link interface unit

Table 44-9 lists X.25/X.75/X.75' link interface unit (XLIU) alarms. The table also lists the possible causes, and the troubleshooting actions that clear the fault and return the XLIU to service. Refer to *Alarm and Performance Monitoring Procedures* for how to clear these alarms.

Table 44-9 Clearing XLIU alarms

Alarm condition	Possible cause	Procedures
Critical	A NIU that has faults caused the XLIU to become SysB.	1. Clear the critical alarm on the NIU that has faults. 2. Return the NIU to service. 3. Return the XLIU to service.
	A problem with the LIM or with one or both F-buses caused the XLIU to become SysB.	1. Post the LIM for the XLIU. 2. Check the status of the F-bus taps. Correct any faults. 3. Return the F-bus tap to service. 4. Return the XLIU to service.
	A problem with the LIM or with one or both F-buses caused the XLIU to become SysB (NA).	1. Contact the next level of maintenance.
Major	The LIM or one or both F-buses is ManB, and the XLIU is ManB.	1. Check with office records and operating company personnel to determine why the XLIU is ManB. 2. When you are permitted, return the XLIU to service.
	The LIM or one or both F-buses is ManB, and the XLIU is ManB (NA).	1. Post the LIM for the XLIU. 2. Check the status of the F-bus taps and correct any faults. 3. Return the F-bus tap to service. 4. Return the XLIU to service.
Minor	An F-bus tap that associates with the XLIU is damaged and caused the XLIU to be ISTb.	1. Return the F-bus tap to service. 2. Return the XLIU to service.
	The XLIU has a load name mismatch and it is ISTb.	1. Contact the next level of maintenance to change either the default load or the running load.
	The system has reached an XLIU congestion threshold	1. Investigate the frequency of congestion and provision the lines on the XLIU as required.

45 LPP advanced troubleshooting procedures

This chapter describes advanced troubleshooting procedures for the link peripheral processor (LPP). The chapter summarizes procedures chapter 44 mentions, and also summarizes procedures for how to power up and down the LPP.

This chapter provides background information to assist maintenance personnel with experience in troubleshooting LPP peripheral modules (PM). Refer to *Alarm and Performance Monitoring Procedures* for the step-by-step procedures for how to perform these tasks.

Task list

A list of the advanced troubleshooting procedures described in this chapter, along with the starting page number for that procedure follows.

Table 45-1

Advanced troubleshooting procedures

Most of the advanced procedures that locate trouble that support LPP PMs are application-specific procedures beyond the range of this guide. Two procedures support the link interface module (LIM) and are common to most LPP PMs. A summary of these procedures follows.

Restoring LIM unit cross-links

This procedure describes the steps for how to restore the LIM unit cross-links to service.

At the MAP terminal

1 To determine the state of the LIM unit, type

>TRNSL unit_no

and press the Enter key.

2 To manually busy one of the closed cross-links, type

>BSY LINK unit_no link_no

and press the Enter key.

3 To return the cros-link to service, type

>RTS LINK unit_no link_no

and press the Enter key.

If the command	Do
passes	Step 4
fails and generates a card list	replace the cards that have faults and proceed to Step 4
fails and does not generate a card list	make sure the cross-link cables are plugged into the NT9X23 cards. Return the cross-links to service and proceed to Step 4

4 Continue to ManB and RTS the closed cross-links until all of them carry traffic.

5 You have completed this procedure.

Restoring DS30 links between the LIM and MS

This procedure lists the steps to restore the DS30 links between an LIM unit and an MS to service.

At the Map terminal, after you post a LIM unit

1 To display information about the DS30 links between the MS and the LIM unit, type

>TRNSL unit_no

and press the Enter key.

2 To access the MS level of the MAP display, type

>MS;SHELF 0

and press the Enter key.

3 To post the first MS card number, type

>CARD card_no

and press the Enter key.

where

card_no
is a value between 1 and 25

4 To return the MS port of the first DS30 link to service, type

>RTS ms_no PORT port_no

and press the Enter key.

where

port_no
is a value between 0 and 27

5 Access the second DS30 link.

If the second DS30 link is	Do
on the same MS card as the first link	Step 6
on a different MS card as the first link	post the second card numbe

6 To return the MS port of the second DS30 link to service, type

>RTS ms_no PORT port_no

and press the Enter key.

7 You have completed this procedure.

Powering up the LPP

This procedure describes how to power up an LPP in an ordered method. These procedures assume that the user powered down the LPP in an ordered method.

1 Switch on the power converters for each link interface shelf in the LPP.

2 Switch on the power converter for LIM unit 0.

3 Switch on the power converter for LIM unit 1.

At a MAP terminal

4 To access the LM level, type

>MAPCI;MTC;PM

and press the Enter key.

5 To post the LIM, type

>POST LIM lim_no

and press the Enter key.

6 To busy LIM unit 0, type

>BSY UNIT 0

and press the Enter key.

7 To load LIM unit 0, type

>LOADPM UNIT 0

and press the Enter key.

8 To test LIM unit 0, type

>TST UNIT 0

and press the Enter key.

9 To return the LIM unit to service, type

>RTS UNIT 0

and press the Enter key.

10 To load LIM unit unit 1, type

>LOADPM UNIT 1

and press the Enter key.

11 To return LIM unit 1, to service type

>RTS UNIT 1

and press the Enter key.

12 To access the F-bus level of the MAP, type

>FBUS

and press the Enter key.

13 To return F-bus 0 to service, type

>RTS FBUS 0

and press the Enter key.

14 To return F-bus 1 to service, type

>RTS FBUS 1

and press the Enter key.

15 To quit the F-bus level, type

>QUIT

and press the Enter key.

16 To access table LIUINV, type

>TABLE LIUINV

and press the Enter key.

17 To list all the tuples in table LIUINV, type

>LIST ALL

and press the Enter key.

18 Identify every ASU supported by the LIM

19 To quit from table LIUINV, type

`>QUIT`

and press the Enter key.

20 Choose an ASU to return to service.

21 To post the ASU, type

`>POST asu asu_no`

and press the Enter key.

where

asu
is a the type of ASU you want to post

asu_no
is a the the number of the ASU you wiant to post

22 To load the ASU, type

`>LOADPM`

and press the Enter key.

23 To return the ASU to service, type

`>RTS`

and press the Enter key.

If all ASUs are	Do
returned to service	Step 24
not returned to service	Step 20

24 You have completed this procedure.

Powering down the LPP

This procedure describes how to turn off an LPP in an ordered method. This procedure is useful in a natural disaster, where a system crash that is not managed could cause serious damage to the LPP and other parts of the switch.

At a MAP terminal

1 To access the LIM level, type

`>MAPCI;MTC;PM`

and press the Enter key.

2 To post the LIM, type

`>POST LIM lim_no`

and press the Enter key.

3 To access table LIUINV, type

`>TABLE LIUINV`

and press the Enter key.

4 To list all the tuples in table LIUINV, type

>LIST ALL

and press the Enter key.

5 Identify every ASU supported by the LIM

6 To quit from table LIUINV, type

>QUIT

and press the Enter key.

7 Choose an ASU to busy.

8 To post the ASU, type

>POST asu asu_no

and press the Enter key.

9 To busy the ASU, type

>BSY

and press the Enter key.

10 To put the ASU offline, type

>OFFL

and press the Enter key.

11 Determine if all the ASUs are busy.

If all ASUs are	Do
manually busy	Step 4
not manually busy	Step 7

12 To access the F-bus level of the MAP, type

>FBUS

and press the Enter key.

13 To manually busy F-bus 0, type

>BSY FBUS0

and press the Enter key.

14 To put F-bus 0 offline, type

>OFFL

and press the Enter key.

15 To manually busy F-bus 1, type

>BSY FBUS1

and press the Enter key.

16 To put F-bus 1 offline, type

>OFFL

and press the Enter key.

17 To quit the F-bus level, type

>QUIT

and press the Enter key.

18 To manually busy LIM unit 0, type

>BSY LIM UNIT 0

and press the Enter key.

19 To put LIM unit 0 offline, type

>OFFL

and press the Enter key.

20 To manually busy LIM unit1, type

>BSY LIM UNIT 1

and press the Enter key.

21 To put LIM unit 1 offline, type

>OFFL

and press the Enter key.

22 To quit the MAP display, type

>QUIT ALL

and press the Enter key.

23 Switch off the power converter for LIM unit 0.

24 Switch off the power converter for LIM unit 1.

25 Switch off the power converters for each link interface shelf in the LPP.

26 You have completed this procedure.

List of terms

ac

alternating current

ADAS

Automated Directory Assistance Service

ADTC

Austrian digital trunk controller

AIS

alarm indication signal

AIU

attachment interface unit

A-law

An international algorithm that uses a 13 segment quantizing design. The A-law uses the quantizing design to convert analog signals to digital signals and digital signals to analog signals.

ALT

automatic line testing

ANI

automatic number identification

APU

application processor unit

APUX

application processor unit with UNIX

ARP

address resolution protocol

application-specific integrated circuit (ASIC)
An integrated circuit designed for a specified application process.

application-specific unit (ASU)
A group of hardware and software components that performs a specified function on signals. The ASU only affects the signals that the channel buses (C-bus) and frame transport buses (F-bus) in a link peripheral processor (LPP) carry.

ASIC
application-specific integrated circuit

ASU
application-specific unit

Austrian digital trunk controller (ADTC)
A PCM30 digital trunk controller (DTC) adapted for use by Northern Telecom Austrian licensees. *See also* digital trunk controller.

automatic line testing (ALT)
A test of both line circuits and the loops that attach to line circuits. The ALT normally runs on a large group of lines during a low traffic period.

automatic number identification (ANI)
A system that automatically identifies a calling number. The system transmits the calling number to the automatic message accounting (AMA) office equipment for billing.

backplane
Connector blocks and special wire arrangements on the rear of a shelf. Printed circuit board modules normally mount in front of the backplane.

basic rate interface
A type of access to ISDN service provided by a set of time-division multiplexed digital information channels. The set includes two B-channels, one D-channel, and a minimum of one maintenance channel. Maintenance channels are normally described as 2B (channels) and D (channel). The system normally uses a BRI on a line between customer premises and a central office switch.

batch change supplement (BCS)
A DMS-100 Family software release.

bay
A structure of the DMS-100 switch that contains equipment. The bay contains equipment like shelves, frame supervisory panels, and cooling units.

BCS
batch change supplement

BER
Bit Error Rate

BERT
Bit Error Rate test

BIC
bus interface card

bipolar violation (BpV)
An error in the transmission of bipolar signals that occurs when two marks that follow without interruption have the same polarity.

bit error rate (BER)
The number of received bits that are in error. This number relates to the number of bits received. The system expresses the number as a number and as a power of 10.

bit error rate test (BERT)
A test that measures the transmission quality of a loop. A BERT transmits a known bit pattern over a line and compares the returned signal with the first pattern.

BpV
bipolar violation

BRI
basic rate interface

C7BERT
CCS7 bit error rate test

C7TU
CCS7 Test Utility

call condense block (CCB)
A data block that associates with a call from start to completion. The CCB contains enough information to describe a basic call and can extend for calls that require more data.

call processing busy (CPB)
The state in which call processing occurs. The system cannot seize the equipment involved in the call processing for maintenance.

calling number delivery (CND)

CLASS software that shows the ten-digit directory number (DN) information of a calling party. The software also shows the date and time of the call. The ten digit directory number contains the following:

- the three-digit numbering plan area (NPA) code
- the three-digit central office
- the four-digit station number

card

A plug-in circuit pack that contains components. In a DMS-switch, card is the term for a printed circuit pack or printed circuit board.

card maintenance unit (CMU)

A hardware controller circuit that the system uses for maintenance activities on some circuit cards.

CARR

carrier-level maintenance system

CBC

channel bus controller

CBI

channel bus interface

C-bus

channel bus

CC

central control

CCB

call condense block

CCC

central control complex

CCIS

common channel interoffice signaling

CCS

common channel signaling

CCS7

common channel signaling 7

CCS7 link interface unit (LIU7)

A peripheral module (PM) that processes messages that enter and leave a link peripheral processor (LPP) through individual-signaling data links. Each LIU7 has a set of cards and a paddle board in a link interface shelf in the LPP.

CD

collision detection

central control (CC)

A part of the NT40 processor that consists of the functions that process data with the associated data store (DS) and program store (PS).

central control complex (CCC)

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

central message controller (CMC)

A hardware device in the central control complex (CCC) frame. The CMC provides an interface between the CPU, network module controllers (NMC), and input/output controllers (IOC).

central side (C-side)

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

CFA

carrier failure alarm

CHAN

channel level maintenance system

channel bus (C-bus)

A proprietary Bell-Northern Research (BNR) copied 10-bit time division multiplexed bus that runs at 4 MHz. The C-bus connects network interface units (NIU) with link interface units (LIU).

channelized access

A method to provide direct access between a common channel signaling 7 (CCS7) network and link interface units (LIU). A link peripheral processor (LPP) contains the linked CCS7 and the LIUs. Channelized access provides this access without channel banks. A network interface unit (NIU) with a junctored network (JNET) module provides channelized access between the CCS7 network and LIUs. An enhanced network module (ENET) can also provide channelized access.

channel supervision message (CSM)
A message that each connected voice channel of a peripheral module (PM) receives and transmits continuously. The CSM contains a connection data byte. The connection data byte includes the channel supervision bit (CSB), and an integrity byte. The connection data byte issues call path integrity.

CI
command interpreter

CIP
channel bus interface processor

CLASS
custom local area signaling service

CLASS modem resource (CMR) card
The card used by CLASS features to transmit calling number and name information to customer premises equipment.

CM
computing module

CMC
central message controller

CMR
CLASS modem resource

CSMA
carrier sense multiple access

CSMA/CD
carrier sense multiple access with collision detection

CMU
card maintenance unit

CND
calling number delivery

CODEC
coder/decoder

command interpreter (CI)

A component in the support operating system that functions as the main interface between machine and user. The main actions of the CI include the following:

- reads lines entered by a terminal user
- breaks each line into known units
- analyzes the units
- recognizes command item-numbers on the input lines
- activates these commands

common channel signaling 7 (CCS7)

A digital message-based network signaling standard defined by the CCITT. The CCS7 separates call signaling information from voice channels so that interoffice signaling transmits over a separate link.

computing module (CM)

The processor and memory of the two-plane combined core (DPCC) used by DMS SuperNode. Each CM consists of a pair of CPUs with associated memory. These CPUs operate in a synchronous matched mode on two separate planes. Only one plane is active. The active plane maintains control of the system and the other plane is in standby mode.

CPB

call processing busy

CRC

cyclic redundancy check

C-side

central side

CSM

channel supervision message

cyclic redundancy check (CRC)

A method of problem detection. The system normally adds a 16-bit check character to each data block according to a repeated examination of each information bit.

DA

directory assistance

data line card (DLC)

The line card that connects a Datapath loop to a data unit. The DLC is part of a line subgroup in a line concentrating module. *See also* line card.

data store (DS)

The DS is one of the two elements of DMS-100 memory. The DS is part of the central control complex (CCC). The DS contains temporary information for each call, customer data, and office parameters. The other main element of a DMS-100 memory is the program store.

DCC

digroup control card

DCH

D-channel handler

D-channel handler (DCH)

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

DCM

digital carrier module

DCM-B

digital carrier module basic configuration

DCM-R

digital carrier module remote interface

DCM-S

digital carrier module basic configuration with clock synchronization

DF

distribution frame

dial tone speed recording (DTSR)

A measurement of the ability of the DMS-100 switch to return dial tone within a specified time period. The time period begins after the DMS-100 switch receives an off-hook signal. Operating company personnel can set the duration of the time period.

digital carrier module (DCM)

A peripheral module (PM) in a digital carrier equipment frame. The DCM provides speech and signaling interfaces between a DS30 network port and digital trunks. A DCM contains a maximum of five line cards.

digital phase-locked loop (DPLL)

A digital circuit that controls an oscillator to maintain a constant phase angle in relation to a reference signal source.

digital recorded announcement (DRA)

A set of one or more phrases that the system routes to a subscriber as a recorded announcement. The digital recorded announcement machine (DRAM) stores the DRA. System software initiates the DRA.

digital recorded announcement machine (DRAM)

A peripheral module for the DMS switch. The DRAM stores voice messages in digital form and provides access to a maximum of 30 different service voice announcements.

digital trunk controller (DTC)

The DTC is a peripheral module that connects DS30 links from the network through digital trunk circuits. *See also* Austrian digital trunk controller and international digital trunk controller.

Digitone

A service-related telephony feature that allows you to generate address information from a telephone set. The telephone set generates the address information in the form of dual-tone multifrequency (DTMF) signals. Press nonlocking buttons to activate the digitone service.

digroup control card (DCC)

This circuit is a part of the line concentrating module (LCM) unit control complex. The DCC provides eight DS30A ports for connection to the network in the host LCM. The DCC can use DS3COA ports to connect to the host interface equipment (HIE) shelf in the Remote Line Concentrating Module (RLCM).

direct memory access (DMA)

A device that moves blocks of continuous data to and from memory at a high rate.

directory assistance (DA)

A service that allows a subscriber to ask an operator for information from a telephone listing database.

directory number

The complete set of digits required to designate the station of a subscriber in one numbering plan area (NPA). The directory number is normally a three-digit central office (CO) code followed by a four-digit station number.

distribution frame (DF)

- A hardware device. One side of the DF provides metal terminations for cables that carry incoming and outgoing voice paths to peripheral modules (PM). The other side of the DF provides terminations for outside cables.
- A structure with terminations that connect permanent wiring to achieve connections through cross-connected wires.

DLC

- data line card
- dynamic load control

DMA

direct memory access

DMS

Digital Multiplex System

DMS-100

A part of a group of digital multiplexed switching systems. The DMS-100 is a local switch.

DMS-100 Family switches

A group of digital multiplexed switching systems. The DMS-100 Family switches group includes:

- DMS-100
- DMS-100/200
- DMS-100 switching cluster
- DMS-100 switching network
- DMS-200
- DMS-250
- DMS-300

DMS Bus

The messaging control component of the DMS SuperNode processor. The DMS-Bus components are a pair of message switches (MS).

DMS Core

The call management and system control part of the DMS SuperNode processor. The DMS-Core part of the DMS SuperNode consists of a computing module (CM) and a system load module (SLM).

DMS SuperNode

A central control complex (CCC) for the DMS-100 switch. The two major components of DMS SuperNode are the computing module (CM) and the message switch (MS). Both components work with the network module (NM), the input/output controller (IOC), and XMS-based peripheral modules (XPM).

DMS SuperNode SE (SNSE)

A smaller version of DMS SuperNode designed to service smaller offices with a maximum of 20 000 lines. The DMS Supernode SE is based on SuperNode technology. SNSE can be used with all current applications of SuperNode, that include common channel signaling 7 (CCS7) and international. SNSE supports all SuperNode software features at a reduced call processing ability.

DN

directory number

DPLL

digital phase lock loop

DRAM

digital recorded announcement machine

drawer

A sliding container in a shelf in the DMS-100 cabinet. A drawer contains components, like cards, to which the user needs easy access during maintenance and service requests.

DS

data store

DS-1

The 8-bit 24-channel 1.544-Mb/s digital signaling format used in DMS-100 Family switches. The DS-1 signal is the North American standard for digital trunks. The DS-1 is a controlled bipolar pulse stream. DS-1 is the standard signal used to connect Northern Telecom digital systems. DS-1 carries 24 DS-1 information channels of 64 kb/s each.

DS30

- A 10-bit, 32-channel, 2.048 Mb/s speech-signaling and message-signaling link used in the DMS-100 Family switches.
- The protocol that DS30 links use to communicate.

DS30A

A 32 channel transmission link between the line concentrating module and controllers in DMS-100 family switches. DS30A is like DS30, but the system uses DS30A for transmission over shorter distances.

DS512 fiber link

The fiber optic transmission link used in the DMS SuperNode processor. The DS512 connects the computing module (CM) to the message switch. One DS512 fiber link equals 16 DS30 links.

DSPC

digital signal processing cell

DTC

digital trunk controller

DTC7

digital trunk controller for common channel signaling 7

DTCO

digital trunk controller offshore

DTMF

dual-tone multifrequency

DTSR

dial tone speed recording

EEPROM

electrically erasable programmable read-only memory

EFF

extended frame format

EIC

Ethernet interface card

EIU

Ethernet interface unit

ELIU

Ethernet link interface unit

EMC

enhanced multipurpose cabinet

ENET

Enhanced Network

Enhanced Network (ENET)

A channel-matrixed time switch that provides pulse code modulated voice and data connections between peripheral modules. ENET also provides message paths to the DMS-Bus components.

ES

errored seconds

ESA

emergency stand-alone

ESF

extended superframe format

Ethernet interface unit (EIU)

The unit that connects the DMS SuperNode to the local area network.

Ethernet link interface unit (ELIU)

A unit that combines the functionality of the LIU7 and the EIU ASUs. The ELIU uses CM and EIU hardware. The ELIU generates TCP/IP messages. The ELIU is based on the LIU7. The ELIU is one end of a virtual CCS7 link. The ELIU allows the CCS7 to exchange messages with the ServiceBuilder SCP over an Ethernet local area network. The ELIU can perform global title translation.

EXT

external alarms maintenance system

extended superframe format (ESF)

A DMS SuperNode configuration that consists of 24 DS-1 frames that follow in sequence.

F-bus

frame transport bus

F-bus tap

frame transport bus tap

FCS

frame check sequence

FDL

facility data link

FIC

F-bus interface controller

frame

- One complete cycle of events (193 bits) in time-division multiplexing. The frame includes a sequence of time-slots for the different channels. The frame also includes additional bits that the frame uses to control framing.
- A unit of hardware in DMS that normally contains one bay, but can contain two or more functionally-related bays.

frame loss

The loss of one complete cycle of events (193 bits) in time-division multiplexing. This loss includes the loss of voice channels and control bits.

frame supervisory panel (FSP)

A facility that accepts the frame battery feed and ground return from the power distribution center. The FSP uses auxiliary fuses and feeds to distribute the battery feed. The FSP distributes the battery feed to the shelves of the frame or the bay that contains the FSP. The FSP also contains alarm circuits.

frame transport bus (F-bus)

An 8-bit bus that provides data communications between a line interface module (LIM) and the application-specific units (ASU). These ASUs are in a link peripheral processor (LPP) cabinet or frame. To make sure the communications are reliable, two load-sharing F-buses are present in each LPP. The system dedicates each F-bus to one of the two LMSs.

frame transport bus (F-bus) tap

A facility that provides messaging access to a frame transport bus (F-bus).

FRAP

frame relay access processor

FRIU
frame relay interface unit

FRS
frame relay service

FSP
frame supervisory panel

FTS
frame transport system

GDT
guaranteed dial tone

global title translation (GTT)
This process translates an application-specific address like a dialed 800 number to the Common Channel Signaling 7 (CCS7) network address. This address is normally the address of the appropriate service control point (SCP).

GTT
global title translation

guaranteed dial tone (GDT)
A service that guarantees that when a subscriber goes off-hook, the subscriber receives dial tone in a specified period of time. This period of time is normally 3 s.

HDLC
high-level data link control

HFP
HDLC frame processor

HIE
host interface equipment

high-level data link control (HDLC)
The channel that carries high-level control messages from central control between the digital carrier module (DCM) and remote line modules (RLM).

host office
A central office equipped to control peripheral modules (PMs) at remote locations.

IBERT

integrated bit error rate test

ICMO

incoming message overload

ICMP

Internet control message protocol

IDTC

international digital trunk controller

ILGC

international line group controller

ILM

integrated link maintenance

ILPT7

CCS7 integrated link protocol test tool

ILTC

international line trunk controller

IMC

intermodule communication

incoming message overload (ICMO)

An overload caused by a line card or business set. This overload occurs when these components send messages at a high rate to the line group controller (LGC) or the line trunk controller (LTC).

in-service (InSv)

A unit status in which call processing operates correctly.

in-service trouble (ISTb)

A state imposed on a unit that has problem indications but can continue to process calls.

InSv

In service

integrated bit error rate test (IBERT)

A test that you perform manually. You use an IBERT card to test the transmission quality of a given data line. The card is in the line drawer of a line concentrating module (LCM). The card generates the bit stream for an

IBERT. You can use an IBERT to test most types of lines that connect to the DMS switch. You can test lines that support the T-link protocol.

integrated services digital network (ISDN)

A set of standards that the CCITT proposed to establish compatibility between the telephone network and different data terminals and devices. ISDN is a completely digital network and an improvement from a telephone integrated digital network. ISDN provides end-to-end connections to support a wide range of services. These services include circuit-switched voice, circuit-switched data, and packet-switched data over the same local connection.

intermodule communication (IMC) links

XMS-based peripheral module (XPM) links that exchange call processing and diagnostic messages. These links also transmit software loads and data that relates to the loads between the active and inactive units.

international digital trunk controller (IDTC)

A digital trunk controller (DTC) that interfaces between a DMS switch and PCM-30 trunks.

international line group controller (ILGC)

A three-processor line group controller that connects PCM-30 links from the network to international line concentrating modules. *See also* line group controller.

international line trunk controller (ILTC)

A peripheral module (PM) that provides the services of the international line group controller (ILGC) and the international digital trunk controller. *See also* line trunk controller.

International Telecommunication Union (ITU)

The specialized telecommunication agency of the United Nations. The United Nations established ITU to provide standard communication procedures and practices around the world. The procedures and practices include frequency allocation and radio regulations.

interperipheral connection (IPC)

A connection in the interperipheral message link (IPML) in common channel signaling between offices. Two IPCs can share the message handling load.

interperipheral message link (IPML)

The path between the message switch and buffer (MSB) and the digital trunk controller (DTC). An IPML consists of two nailed-up cross-connections. These cross-connections are called interperipheral connections (IPC). These connections share the message handling load. Each connection can handle the full load if the other connection fails.

IOD
input/output device

IP
internet protocol

IPC
interperipheral connection

IPF
integrated processor and F-bus

IPML
interperipheral message link

ISDN
integrated services digital network

ISDN signaling processor (ISP)
A device that provides call control messaging and D-channel handler maintenance functions.

ISDN user part (ISUP)
A common channel signaling 7 (CCS7) message-based signaling protocol. The ISUP is a transport carrier for ISDN services. The ISUP provides the functionality for voice and data services in a CCS7 network.

ISP
ISDN signaling preprocessor

ISTb
In-service trouble

ISUP
ISDN user part

ITU
International Telecommunication Union

LAN
local area network

LAPB
link access procedure balanced

LAPD
: link access procedure on the D-channel

LC
: line card

LCA
: line concentrating array

LCC

- line card carrier
- line class code
- line control card

LCGA
: local carrier group alarm

LCM
: line concentrating module

LD
: line drawer

LED
: light-emitting diode

LEN
: line equipment number

LGC
: line group controller

LGCO
: line group controller offshore

LIFO
: last in, first out

light-emitting diode (LED)
: A device that emits light when the system applies the appropriate voltage to the device. LEDs work as front panel indicators in the DMS+-100 switch components. The LEDs are off when equipment state is normal.

LIM
link interface module

line card
One of the line circuit cards in a line drawer. *See also* data line card.

line concentrating array (LCA) shelf
A unit of the line concentrating module (LCM). An LCM has two LCA shelves.

line concentrating module (LCM)
A peripheral module (PM) that connects line trunk controller (LTC) or line group controller (LGC) and a maximum of 640 subscriber lines. The LCM uses two to six DS30A links to connect these components.

line drawer (LD)
A hardware device in the line module (LM) and line concentrating module (LCM) that contains line circuit cards.

line equipment number (LEN)
A seven-digit operating reference that identifies line circuits. The LEN provides location information on equipment. This information includes site, frame number, unit number, line subgroup (shelf), and circuit pack.

line group controller (LGC)
A peripheral module that connects interfaces DS30 links from the network to line concentrating modules (LCM). *See also* international line group controller.

line subgroup (LSG)
A group of a maximum of 32 line cards in a drawer of the line concentrating module (LCM). Each drawer contains two LSGs.

line test position (LTP)
A MAP terminal equipped to perform line tests.

line trunk controller (LTC)
A peripheral module (PM) that provides the services of the line group controller (LGC) and the digital trunk controller (DTC). The LTC supports line concentrating module (LCM) and AB trunks. *See also* international line trunk controller.

link

- In a DMS switch, a connection between any two nodes.
- A four wire group of conductors that provides transmit and receive paths for the serial speech or message data. These paths are between components of DMS-100 Family switches. Speech links connect peripheral modules (PM) to the network modules. Message links connect network message controllers or I/O controllers to the central message controller.

link access procedure balanced (LAPB)
An ISDN access protocol that supports links established on a B-channel. LAPB supports a data link that uses a fixed single-byte address standard to operate between the ISDN terminal and the network.

link access procedure on the D-channel (LAPD)
An ISDN access protocol that supports links established on a D-channel.

link interface module (LIM)
A peripheral module (PM) 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 component. An LIM consists of two local message switches (LMS) and two frame transport buses (F-bus). One LMS operates in load-sharing mode with the other LMS.

link interface unit (LIU)
A peripheral module (PM) that processes messages that enter and leave link peripheral processor (LPP) through an individual signaling data link.

link peripheral processor (LPP)
A DMS SuperNode equipment package that contains two types of peripheral modules (PM). These two PMs are a link interface module (LIM) and a link interface unit (LIU).

LIS
link interface shelf

LIU
link interface unit

LIU7
CCS7 link interface unit

LMS

local message switch

LMSP

local message switch processor

LNS

lines maintenance subsystem

local area network (LAN)

A network that permits the connection and communication among a group of computers. The LAN allows the computers to share resources like data storage devices and printers.

local carrier group alarm (LCGA)

A fault that indicates that the carrier detected a large number of bipolar violations (BPV) or frame loss. A minor alarm is 25% of the group. A major alarm is 50% of the group. A critical alarm is 75% of the group.

local message switch (LMS)

A high-capacity communications device that controls messaging between link interface units (LIU) in a link peripheral processor (LPP). An LMS also controls messaging between the LPP and the DMS-Bus component. The link interface module (LIM) uses a pair of LMSs to provide dual-plane redundancy.

LOF

loss of frame

log report

A message that the DMS switch sends when an important event occurs in the switch or a DMS-switch peripheral. A log report includes state and activity reports, reports on hardware and software faults, and test results. The log reports other events or conditions that can affect the performance of the switch. The system generates a log report in response to system or manual action.

loop

A local circuit between a central office (CO) and a subscriber telephone station. Also known as subscriber loop and local loop.

loop-around (L/A)

A test circuit in which the transmit path of a trunk or line circuit connects to the receive path. DMS-100 Family software apply L/A tests during diagnostic and maintenance procedures.

loop around diagnostic

A test circuit for the A-bit/B-word circuit pack, in which the transmit path connects to the receive path. An outgoing test byte tests the circuit pack. The byte loops around from the outgoing to the incoming data path during spare channel times. The system stores the byte in the incoming data memory. The 8085 microprocessor in the A-bit/B-word circuit pack performs periodic checks on the two values. The microprocessor reports an error if the values are not the same.

loop around message audit

An audit of a test circuit in which the transmit path of a line circuit connects to the receive path.

loopback

The reflection of data signals of known characteristics to the point where the signals began. The system performs loopback to compare the reflected bit stream with the transmitted bit stream.

LOS

loss of signal

LPP

link peripheral processor

LSG

line subgroup

LTC

- line trunk controller
- local test cabinet

LTP

line test position

maintenance and administration position

See also MAP.

maintenance level

See also MTC.

maintenance (MTCE) subsystem

- Hardware and software in the DMS-100 Family switches that detects, analyzes, and corrects faults in the system. The visual display unit

(VDU) displays system status. You can access the MTCE subsystem through the VDU keyboard.

- Central control (CC) software that maintains the system devices. This maintenance includes manual and automatic testing and the isolation and clearing of faults. Each type of peripheral has one maintenance subsystem.

maintenance trunk module (MTM)
In a trunk module equipment (TME) frame, a peripheral module (PM) that contains test and service circuit cards. The PM has special buses to accommodate test cards for maintenance. The MTM interfaces between the DMS-100 Family digital network and digital, or analog test and service circuits.

ManB
manually busy

MAP
Maintenance and administration position. A group of components that provides an interface between operating company personnel and the DMS-100 Family switches. The interface has a visual display unit (VDU) and a keyboard. The MAP interface also has a voice communications module, test facilities, and special furniture.

MAPCI
MAP command interpreter

mapper
A circuit pack that routes messages in the DMS SuperNode message switch.

master processor (MP)
In a DMS switch, the processor that contains the instruction set that implements the tasks assigned by the central control software. The MP performs all high-level tasks.

matching loss (ML)
A problem condition. A network path is not present between an incoming or originating call and a free customer line or acceptable outgoing trunk.

MAU
media access unit

Mbps
megabits per second

MBS

Meridian business set

MCS

micro-controller subsystem

MC68020

A Motorola Corporation (MC) 68000 series 32-bit microprocessor.

MDR7

CCS7 message detail recording

megahertz

MHz

memory card

A card that has a number of memory modules and common circuitry for those memory modules. These components are on a single memory card.

Meridian business set (MBS)

A telephone set that provides subscribers with push-button access to different business features. This set has one more field display than the electronic business set (EBS).

message (MSG)

The unit of information transfer between nodes in the DMS-100 switch. A message is incoming if a peripheral sends the message to the central control (CC). A message is outgoing if the CC sends the message to a peripheral. A message is a type of control mechanism in the I/O messages of the DMS-100 Family switches. The MSG byte makes sure that the incoming information is a data message.

message switch (MS)

A high-capacity communications ability. The MS functions as the messaging center for the two-plane combined core (DPCC) of a DMS SuperNode processor. The MS concentrates and distributes messages to control messaging between the DMS-Bus components. The MS allows other DMS-STP components to communicate with each other.

message switch and buffer (MSB)

A peripheral module (PM) that the DMS-100 Family switches use with a signaling terminal (ST). The switches use the MSB and the ST to connect to and operate in a common channel signaling environment. The MSB supports the ST and routes the messages received by the ST through the network module to the digital trunk controller. The MSB receives messages from the central control (CC). The MSB routes the messages to the signaling link through the ST. A different configuration of the MSB is present for each of the two protocols used to implement common channel signaling. *See also* message switch and buffer 6, message switch and buffer 7.

message switch and buffer 6 (MSB6)
The message switch and buffer for CCITT No. 6 Signaling (N6) and Common Channel Interoffice Signaling No. 6 (CCIS6) protocol. *See also*message switch and buffer.

message switch and buffer 7 (MSB7)
The message switch and buffer for Common Channel Signaling 7 (CCS7) protocol. *See also* message switch and buffer.

message switching
An arrangement that receives and stores a message until the correct outgoing line is available. When the line is available, message switching transmits the message again. *See also* circuit switching, store-and-forward switching center.

metallic test access
A hardware device that provides metallic connections between test access points and different types of test equipment. Test access points include the subscriber line circuits in a digital switching center.

MHz
megahertz

ML

- matching loss
- message link

MMU
memory management unit

MP
master processor

MS
message switch

MSB

- make set busy
- message switch and buffer

MSB6
message switch and buffer 6

MSB7
message switch and buffer 7

MSU
message signaling units

MTA
metallic test access

MTC (maintenance level)
A MAP level used to access several areas of the DMS-100 switch. The MTC can access: central control (CC), peripheral modules (PM), the lines maintenance subsystem (LNS), and other areas.

MTCE
maintenance

MTM
maintenance trunk module

Mu-law
A domestic algorithm that uses a 15 segment quantizing design to convert analog signals to digital signals and digital signals to analog signals.

NA
not accessible

nailed-up connection
A permanent network connection that forms part of the speech path between peripheral modules (PM) that have the appropriate equipment.

NET
networks maintenance subsystem

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

network module (NM)
The basic unit of the DMS-100 Family switches. The NM accepts incoming calls and connects the incoming calls to the appropriate outgoing channels. The NM uses connection instructions from the central control complex

(CCC) to form these connections. Network module controllers control the activities in the NM.

NIU

network interface unit

NM

network module

node

The terminating point of a link. The meaning of the word node depends on the context. A circuit can be a node in the context of another circuit in a module. The module can be a node in the context of another component of the network. Some common uses of the word node are:

- in network topology, a terminal of a network branch or a terminal common to a minimum of two network branches
- in a switched communications network, the switching points. The switching points include patching and control points.
- in a data network, the location of a data station that connects data transmission lines
- a unit of intelligence in a system. In a DMS switch, the units include the CPU, network module (NM), and peripheral modules (PM).

Northern Telecom (NT)

A part of the corporate structure that consists of Bell-Northern Research, Bell Canada, and Northern Telecom Ltd.

Northern Telecom publication (NTP)

A document that describes Northern Telecom hardware or software modules. The document can describe performance-oriented practices (POP) to use when you install, test, or maintain a system. Northern Telecom supplies this document as part of the standard documentation package that Northern Telecom provides to an operating company.

NT

Northern Telecom

NTP

Northern Telecom publication

NUC

nailed-up connection

OAM

operation, administration, and maintenance

OAU
office alarm unit

ODT
offshore DTCO

office alarm unit (OAU)
A peripheral module (PM) in a trunk module equipment frame. The OAU is like the maintenance trunk module. The OAU contains circuit cards that interface with different types of office alarm circuits instead of test circuits.

OFFL
offline

offline (OFFL)

- Equipment or devices that are not under direct control of the CPU.
- An equipment state in which the input/output (I/O) knows the node. Connection information is defined, but normal I/O system maintenance activity cannot reach the node. In this state, you can access the node with a nonresident commissioning package. This action does not affect the rest of the system.
- Terminal equipment that is not connected to a transmission line.

OM
operational measurements

OOB
out-of-band

OOF
out of frame

OOS
out of service

operating system
Software that manages the basic resources of a computer. *See also* Support Operating System.

operation, administration, and maintenance (OAM)
All the tasks that you must perform to provide, maintain, or modify the services that a switching system provides. These tasks include supply of hardware, creation of service, verification of new service, and problem isolation and clearance.

operational measurements (OM)

The hardware and software resources of the DMS-100 Family switches. These resources control the collection and display of measurements taken on an operating system. The OM subsystem organizes the measurement data and manages the transfer of this data to displays and records. The system uses OM data for maintenance, traffic, accounting, and equipment decisions.

OPM

Outside Plant Module

OSI

Open Systems Interconnection

OSS

operational support system

out-of-band (OOB) signaling

Analog generated signaling that uses the same path as a voice-frequency transmission. In OOB signaling, the signaling frequencies are lower or higher than the frequencies for voice frequency transmission.

out of service (OOS)

An equipment state in which the system removes equipment from service. Operating company personnel also can remove equipment from service.

out-of-service test

A test that checks the address control circuit pack of a remote concentrator terminal (RCT).

outside plant module (OPM)

A stand-alone weatherproof enclosure. OPM connects two to six DS-1 links from a line group controller (LGC) at a host office and a maximum of 640 locally connected subscriber lines. An OPM consists of the following components:

- a line concentrating module (LCM)
- a remote maintenance module (RMM)
- a host interface equipment (HIE) shelf
- a power supply
- environmental control equipment
- a cable cross-connection for a maximum of 1280 pairs

packet

A group of binary digits that the system switches as a unit. This unit includes data and call control signals. The system arranges data, call control signals, and possible problem control information in a specified design for transmission through the network.

packet handler (PH)

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

packet-switched network

A communications system designed to carry packet data. In this network, external interfaces can handle different packet data designs. An interface computer handles the network conversion of these designs.

packet switching

Packet switching is a way to transmit data. The system sends addressed packets through a transmission channel. With this transmission method, the channel is only occupied for the duration of the transmission.

PAM

pulse amplitude modulation

P-bus

processor bus

PCM

pulse code modulation

PCM30

- A 32-channel 2.048 Mb/s speech-signaling and message-signaling link. The PCM30 works in international trunks
- The protocol that PCM30 uses to link communications

PCM30 digital trunk controller (PDTC)

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

PDTC

PCM-30 digital trunk controller

PEC

product engineering code

peripheral module (PM)

This term refers to hardware modules in the DMS-100 Family switches that interface with external line, trunk, or service abilities. A PM contains peripheral processors (PP), that perform local routines. PPs relieve the load on the CPU.

peripheral processor (PP)

A hardware device in the peripheral module (PM) that performs local processing without the CPU. The read-only memory (ROM) in the PM runs the peripheral processor. The PP releases CPU run time for higher level activities.

peripheral side (P-side)

The side of a node that faces away from the central control (CC) and toward the peripheral modules (PM).

per-trunk signaling (PTS)

A standard telephony method of signaling. This signaling method multiplexes the control signal of a call with voice or data over the same trunk.

plain old telephone service

Basic telephone service without special abilities.

PLGC

PCM30 line group controller

PM

peripheral module

PMT7

CCS7 Protocol Monitor Tool

port

In a DMS switch, the port is a point of connection. A speech or message link connects to peripheral module (PM), network module (NM), input/output controller, or central message controller (CMC).

POTS

plain old telephone service

PP

- peripheral processor
- program port

PPSN

public packet switch network

PRAM

programmable random access memory

product engineering code (PEC)

An eight-character code that identifies each commercial hardware item manufactured by Northern Telecom. The PEC is different for each item.

program store (PS)

In a DMS switch, programmed instructions for the different procedures required to perform processing, administration, and maintenance. PS is one of the two elements of a DMS-100 memory. The other element is data store.

PROM

programmable read only memory

protocol

A procedure required to initiate and maintain communication. Protocols are present at many levels in one network, like link-by-link, end-to-end, and subscriber-to-switch levels.

PS

program store

P-side

peripheral side

pulse amplitude modulation (PAM)

A modulation system that represents the size and polarity of an analog waveform at a series of sample times. PAM represents the analog waveform with pulses of equivalent size and polarity at the same relative times.

pulse code modulation (PCM)

- The process that converts an analog, or voice waveform, signal to a digital code.
- A form of modulation that samples, quantifies and codes the modulating signal. The PCM sends the modulating signal as a bit stream.
- The representation of an analog waveform. The PCM codes and quantifies samples of the signal to create this representation. Each piece

of information consists of a binary number that represents the value of the sample.

RA

rate adapter

RAM

random access memory

random access memory (RAM)

A static read/write memory system that stores information in separate address locations. RAM makes sure that access time is separate from location.

RAP

recording and announcement processor

RCC

Remote Cluster Controller

RCGA

remote carrier group alarm

RDAT

receive data

read-only memory (ROM)

A solid state storage chip programmed during manufacture. You cannot program this chip again.

receive data (RDAT)

A common bus in a maintenance trunk module (MTM), office alarm unit (OAU), or trunk module (TM). An RDAT carries data from the common control section of these modules. The RDAT carries the data to the trunk logic circuit in the interface circuits of these modules.

receive pulse amplitude modulation (RPAM)

A common bus in a maintenance trunk module (MTM), office alarm unit (OAU), or trunk module (TM). An RPAM carries pulse amplitude modulated speech samples from the common circuits in the modules. The RPAM carries the pulse amplitude modulated speech samples to the digital-to-analog (D/A) circuits in the module interface cards.

receiver off-hook

A condition that means that a telephone receiver is off-hook. Receiver off-hook normally indicates the loud tone heard when the receiver is off hook.

register

- The apparatus in an automatic switching system that receives address signals and controls the switching operations that follow the signal.
- The first unit in the group of common control equipment in an automatic central office (CO). The register receives address information and stores the information for possible conversion or translation. A register normally operates with a sender.

reload-restart

To set software pointers in a program to simulate a reload of software in to DMS-100 Family switches. The system retains office configuration and translation data. The system clears all other data.

remote carrier group alarm (RCGA)

An alarm that appears on the MAP display. RCGA indicates that a remote detected an excess of bipolar violations or frame loss. The remote carrier group alarm can also indicate that the remote digroup card is defective or not present.

remote cluster controller (RCC)

A two-shelf peripheral module (PM) that provides a master controller for all units at the Remote Switching Center (RSC). The host line trunk controller (LTC) controls the remote cluster controller.

remote line concentrating module (RLCM)

RCLM connects two to six DS-1 links from line group controller (LGC) at the host office and a maximum of 640 locally connected subscriber lines. An RLCM has one line concentrating module (RLCM), a remote maintenance module (RMM), and a host interface equipment (HIE) shelf.

Remote Switching Center (RSC)

The RSC is a remote common peripheral module (CPM). The RSC interfaces with a large number of analog lines, digital trunking, or both lines and trunking at a remote location. The RSC also handles remote-off-remote connections from other remote sites.

reset terminal interface (RTIF)

In DMS SuperNode, the RTIF is a user interface terminal that boots the system again and monitors the system state. The RTIF can be a remote terminal that connects through a modem or through a local terminal. The RTIF is also known as remote terminal interface.

restart

To establish the process that executes a routine after a program or data fault or machine failure. During a restart, you normally return to checkpoints placed at appropriate intervals. These checkpoints allow you to continue a job without starting at the beginning. The severity of the restart depends on the value of the resources that the restart resets.

return to service (RTS)
An action that allows an out-of-service unit or piece of equipment to process calls.

REx
routine exercise

RG
ringing generator

ringing generator
A generator that can be programmed and can produce many different ringing waveforms. The ringing generator produces these waveforms when the ringing generator receives a drive signal.

RLCM
remote line concentrating module

ROH
receiver off-hook

ROM
read-only memory

routine exercise (REx) test
An automatic test that internal software performs on DMS equipment.

RPAM
receive pulse amplitude modulation

RSC
Remote Switching Center

RTS
return to service

SCP
service control point

SCS
single change supplement

service control point (SCP)

A node in a common channel signaling 7 (CCS7) signaling network that supports application databases. The SCP accepts a query for information and retrieves the requested information from one of the SCP application databases. The SCP sends a response message to the originator of the request.

service switching point (SSP)

A common channel signaling 7 (CCS7) signaling node that interacts with the service control point (SCP). Together these components implement special service code features.

service trunk module (STM)

A peripheral module (PM) in the DMS-100 Family of switches that consists of two compact maintenance trunk modules (MTM).

SES

severe errored seconds

SF

super frame

SFP

store-and-forward processor

shelf

A shelf contains drawers, cards, or both drawers and cards.

signaling link (SL)

This term describes the first two levels of the common channel signaling 7 (CCS7) protocol. The levels are the physical level (level 1) and the link level (level 2). Level 2 functions and a level 1 signaling data link form an SL. This signaling link performs a reliable transfer of signaling messages between two signaling points (SP).

signaling point (SP)

A node in a common channel signaling 7 (CCS7) network. This node initiates, terminates, or transfers signaling messages from one signaling link to another signaling link.

signaling terminal (ST)

The hardware that performs fault checking, coding, and decoding of signaling messages. ST is present in Common Channel Interoffice Signaling No. 6 (CCIS6), CCITT No. 6 Signaling (N6), and common channel signaling No. 7. In CCIS6 and N6, the ST contains a signaling terminal controller, a modem, and a modem interface card. In CCS7, the signaling terminal is a single card.

signaling terminal array (STA) shelf
A shelf that contains two signaling terminal controller modules (STCM).

signaling terminal controller (STC)
In common channel interoffice signaling No. 6 (CCIS6) and ITU No. 6 Signaling (N6), one card receives and constructs signal units. This STC card controls modem interface and performs fault checks of signaling messages.

signaling terminal controller module (STCM)
A group of eight signaling terminal controllers (STC) associated with a message switch and buffer (MSB). *See also* signaling terminal controller.

signaling transfer point (STP)
A node in a common channel signaling 7 (CCS7) network that routes messages between nodes. Signaling transfer points transfer messages between incoming and outgoing signaling links. STPs do not normally originate or terminate messages. STPs do not originate and terminate network management (NWM) information. Signaling transfer points work in pairs. If one STP fails, the mate STP assumes the functions of the failed STP. This design makes sure that service continues without interruption.

silent switchman (SSMAN) test
A test that allows operating company personnel to prepare a subscriber loop for testing from a station. This test does not involve operating company personnel at the central office (CO). This test operates a cutoff relay in the line circuit. The test disconnects the subscriber loop from the office battery and ground so that the system can check the loop for faults.

SL
signaling link

SLC
speech link connecting

SOS
Support Operating System

SP
signaling point

SPM
service peripheral module

SR
station ringer

SSLPP
single-shelf link peripheral processor

SSMAN
silent switchman

SSP
service switching point

ST

- signaling terminal
- symbol table

STA
signaling terminal array

STB
signaling terminal buffers

STC
signaling terminal controller

STCM
signaling terminal controller module

STI
signaling terminal interface

STM
service trunk module

STP
signaling transfer point

subscriber line
A transmission path that connects the telephone of the subscriber to the central office (CO) equipment of the local telephone company.

subscriber loop test
A test that determines if a fault on the loop caused a failure of an extended diagnostic test.

subsystem
An application in a node that uses the routing functions of the signaling connection control part (SCCP). Subsystems can have addresses.

Support Operating System (SOS)

The software that sets up the environment for loading and executing the application software in the DMS-100 Family switches. The SOS includes the nucleus, file system, command interpreter, and loader.

SWACT

switch of activity

SWERR

software error report

switching network

A digital-switching matrix that connects the peripheral modules (PM). The switching network uses time-division multiplexing (TDM) to connect the PMs. The switching network components are digital-switching network modules controlled by a microprocessor. The switching network has two network planes for reliability. The switching network can connect to the central message controller (CMC) or the DMS-Bus and the PMs. The two generations of the switching network are the junctored network (JNET) and the enhanced network (ENET). The NT40 can use only the JNET, and the DMS SuperNode can use the JNET or the ENET.

switching office (SO)

A node in the common channel signaling 7 (CCS7) network. This node originates and terminates signaling messages that relate to the assembly and removal of associated ISDN user part (ISUP) trunks.

switch of activity (SWACT)

In a DMS fault tolerant system, this switch changes the states of two devices that perform the same function. A SWACT makes an active device inactive. A SWACT makes an inactive device active.

SysB

system busy

T0

outgoing end office trunk group

T1

The standard 24-channel, 1.544-Mbps pulse code modulation system used in North America. The name of the signal that this digital carrier carries is DS-1 link.

table

Two-dimensional figure that stores data associated with hardware and software in the DMS-100 Family switches.

T-bus

transaction bus

TCP

transmission control protocol

Technical Assistance Service (TAS)

This technical services organization of Northern Telecom is for operating companies in the United States. TAS handles all emergency and normal support. TAS also handles technical queries not related to pricing and product availability, cutovers, and software updates that include patches.

telescoping

The method to access, in sequence, lower levels of a MAP display to pinpoint a fault.

time-division multiplex (TDM)

A method of multiplexing to obtain a number of channels over a single path. This method divides the path into a number of time slots and assigns a repeated time slot to each channel. At the receiving end, the system assembles each time-separated channel again. TDM is is best for the transmission of digital data. TDM now transmits digitized speech and other signals. TDM can repeat time slot allocation at regular intervals (fixed cycle) or according to demand (dynamic).

time-division switching

A switching method that delays the information content of each incoming time slots. This switching method switches the information content to one of several outgoing time slots.

time switch

This circuit card changes the order of channels in a time-division multiplexed bit stream to switch speech channels in time. The time switch connects network-side channel to peripheral-side channel. The time switch also takes the least important bits from the speech channels. The time switch replaces these bits with A- and B-bits.

TM

trunk module

TM2

A trunk module (TM) with 30 pairs of two-wire circuit conductors wired to the distribution frame.

TM4

A trunk module (TM) with 60 pairs of four-wire circuit conductors wired to the distribution frame.

TM8

A trunk module with 120 pairs of 8-wire circuit conductors wired to the distribution frame.

TME

trunk module equipment

TOPS

Traffic Operator Position System

Traffic Operator Position System (TOPS)

A call processing system that consists of a number of operator positions. Each operator position consists of a visual display unit (VDU), a controller, a keyboard, and a headset.

transmission link (TL)

In a common channel signaling 7 (CCS7) network, a T1 digital carrier that terminates on a digital trunk controller (DTC). In the DMS switch, the TL is a single voice carrier. The voice carrier is a DS30 link over connections through the network and to the message switch and buffer 7 (MSB7).

TRKS

trunks maintenance subsystem

trunk module (TM)

The TM is a peripheral module (PM), in a trunk module equipment (TME) frame. The TM provides speech and signaling interfaces between a DS30 network port and analog trunks.

trunk module equipment (TME) frame

A frame that contains a minimum of one trunk module (TM), maintenance trunk module (MTM), or office alarm unit (OAU).

UAE

UNIX application environment

UART

universal asynchronous receiver/transmitter

UAS

unavailable seconds

unified processor (UP)

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

unit

One of two parts in an XMS-based peripheral module (XPM) or a line concentrating module. Each unit has separate processing abilities. The peripheral module (PM) has an active unit and an inactive unit. The active unit performs the processing, and the inactive unit is on standby.

universal synchronous/asynchronous receiver/transmitter (USART) link

A message switch (MS) link that provides communication between two local message switches (LIM units).

UP

unified processor

USART

universal synchronous/asynchronous receiver/transmitter

UTP

unshielded twisted pair

VDU

visual display unit

VPP

voice processing platform

VPU

voice processing unit

WAN

wide area network

warm restart

An initialization phase during which the system deallocates and clears temporary storage. The system drops all calls in transit. Calls in the talking state continue.

X.25

A ITU-defined network layer protocol. In packet switching, X.25 establishes, maintains, and clears virtual circuit connections between an ISDN terminal and a point in the packet switching network.

X.75

A ITU-defined network layer protocol. In packet switching, X.75 establishes, maintains, and clears virtual circuit connections between packet switching networks.

XDAT

transmit data

XLCM

A line concentrating module (LCM) with a 256kb memory load.

XLIU

X.25/X.75/X.75 link interface unit

XMS

A work station-based microcomputer with networking abilities. XMS is based on a Motorola 68000 microprocessor with system software written in Bell-Northern Research (BNR) Pascal.

XMS-based peripheral module (XPM)

The name for XMS 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).

XMS-based peripheral module product life upgrade strategy (XPM-PLUS)

The integration of a new processor complex into the XPM structure.

XPAM

transmit pulse amplitude modulation

XPM

XMS-based peripheral module

XPM-PLUS

XMS-based peripheral module product life upgrade strategy

ZCS

zero code suppression

DMS-100 Family

Peripheral Modules

Maintenance Guide

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