555-4001-129

Meridian SuperNode

Meridian SL-100

Intelligent Peripheral Equipment (IPE) Reference Manual

MSL14 Standard 08.01 November 2000

NORTEL NETWORKS™

Meridian SuperNode

Meridian SL-100

Intelligent Peripheral Equipment (IPE) Reference Manual

Publication number: 555-4001-129

Product release: MSL14
Document release: Standard 08.01
Date: November 2000

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense. Allowing this equipment to be operated in such a manner as to not provide for proper answer supervision is a violation of Part 68 of the FCC Rules, Docket No. 89-114, 55FR46066.

The MSL-100 system is certified by the Canadian Standards Association (CSA) with the Nationally Recognized Testing Laboratory (NRTL).

This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe A respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

YEAR 2000 READINESS DISCLOSURE

This information was originally published prior to October 19,1998. The foregoing legend applies retroactively in accordance with the U.S. Year 2000 Information and Readiness Act and on an ongoing basis.

Publication history

To comply with Nortel Networks Technical Documentation Standards, the Publication history will only contain updates for the current release and two prior releases.

November 2000

Release 08.01, MSL14, Standard. This version includes information on the enhanced IPE controller (EXPEC) card.

May 2000

Release 07.01, MSL12, Standard. This version represents the standard release of this document and includes some minor pagination and graphics differences from the previous version.

November 1999

Release 06.02, MSL11, Standard. This version includes information on the enhanced IPE controller (EXPEC) card.

Contents

About this document

When to use this document

This book describes Intelligent Peripheral Equipment (IPE). Included is information on the IPE hardware, provisioning an Intelligent Peripheral Equipment Column (IPEC), cabling and environmental specifications, feature implementation, logs, software and hardware maintenance and diagnostics, and operational measurements (OMs). This document is part of the documentation package that supports Nortel Networks Meridian SL-100 products.

How this document is organized

This document is divided into the following chapters:

- Chapter 1, “IPE product overview", gives a brief description of the Intelligent Peripheral Equipment (IPE), and Intelligent Peripheral Equipment Column (IPEC). This includes a list of required software and descriptions of the XSM, the controller card interfaces, and the telephones that are supported by IPE.
- Chapter 2, “IPE architecture", lists, describes, and illustrates the hardware included in the IPEC and in the pedestal base.
- Chapter 3, “Provisioning an IPEC", describes the cabinet lineup and IPE used in Remote Switching Centers (RSCs).
- Chapter 4, “Cabling specifications", describes the external and internal power cable requirements, the Extended System Monitor (XSM) alarm cable requirements, the switchboard cabling requirements, the ground cabling, and the cabling cardcage modules to the cross-connect terminal.
- Chapter 5, “Environmental specifications", describes requirements relating to the ambient temperature, the relative humidity, the power specifications, the heat dissipation, and the weights and dimensions.
- Chapter 6, “Feature implementation", describes how to download the IPE software, the controller card message translation, the system initialization functions, the attendant console feature implementation, the Integrated Voice and Data (IVD) feature implementation, the 500/2500 analog feature

implementation, the IPE on Remote Cluster Controllers (RCCs), and the Remote Switching Center (RSC) to IPE Emergency Standalone (ESA).

- Chapter 7, “Log and fault reports", briefly describes the XSM maintenance interface as it pertains to log and fault reports. This includes unsolicited fault reports, fault cleared reports, and periodic audits. This is followed by a list and descriptions of IPE-related logs
- Chapter 8, “Software maintenance and diagnostics", describes the maintenance state indicators, the circuit card state indicators, the Command Interpreter (CI) commands, the IPE maintenance commands, the PM nodes types, peripheral maintenance, line card maintenance, and facility maintenance.
- Chapter 9, “Hardware maintenance tools", provides information about hardware maintenance tools.
- Appendix A, “Operational measurements", lists the Operational Measurements (OMs) for IPE. A further reference where details of these OMs can be found is given.
- Appendix B, “Installation awareness", provides some cautionary information on how to avoid a short circuit condition that could occur during installation and sometimes during routine maintenance functions.
- “List of terms" lists the full names for the acronyms and abbreviations found in this document.

How to check the version and issue of this document

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

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

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

This document is written for all MSL-100 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in *Commercial Systems Master Index of Publications* or the *Defense Switched Network Master Index of Publications.*

References in this document

The following documents are referred to in this document:

- *Disk Maintenance Subsystem Reference Manual*, 297-1001-526
- *Commands Reference Manual*, 297-1001-822
- *Line Side T-1 Interface (LTI) for IPE Services Guide*, 555-4001-022
- *Digital Line Module (DLM) Reference Manual*, 555-4001-101
- *M2000 Digital Telephones Reference Manual*, 555-4001-110
- *M3000 Touchphone Reference Manual*, 555-4001-112
- *Meridian Modular Telephones Reference Manual*, 555-4001-114
- *Meridian Communications Adapter (MCA) Reference Manual*, 555-4001-123
- *Defense Switched Network Feature Description Manual*
- *Defense Switched Network Translations Guide*
- *Defense Switched Network Service Order Reference Manual*
- *Defense Switched Network Log Reports Manual*
- *Defense Switched Network Customer Data Schema*
- *Commercial Systems Feature Description Manual*
- *Commercial Systems Translations Guide*
- *Commercial Systems Service Order Reference Manual*
- *Commercial Systems Log Reports Manual*
- *Commercial Systems Customer Data Schema*

What precautionary messages mean

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

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

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

ATTENTION

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

DANGER Possibility of personal injury

DANGER

Risk of electrocution

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

WARNING Possibility of equipment damage

DANGER

Damage to the backplane connector pins

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

CAUTION Possibility of service interruption or degradation

CAUTION

Possible loss of service

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

How commands, parameters, and responses are represented

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

Input prompt (>)

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

```
>BSY
```

Commands and fixed parameters

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

```
>BSY CTRL
```

Variables

Variables are shown in lowercase letters:

```
>BSY  CTRL  ctrl_no
```

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

Responses

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

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

FP 3 Busy CTRL 0: Command passed.
```

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

Procedure 1

At your location

1 Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no

and pressing the Enter key.

where

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

Example of a MAP response:

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

FP 3 Busy CTRL 0: Command passed.

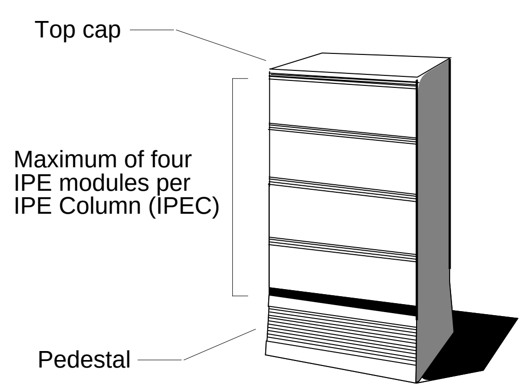
1 IPE product overview

The Intelligent Peripheral Equipment (IPE) provides a common peripheral for the Meridian SL-100 product line. The IPE also provides a single common peripheral with common line cards for the SL-100 system, Meridian 1 system, and Meridian SuperNode system, as well as a cost-effective solution for upgrades and extensions.

The IPE is a single-shelf module containing a controller card and 16 slots available for analog and integrated voice and data (IVD) digital lines. IPEs are packaged as modular, stackable units. Up to four IPEs can be contained in one IPE column (IPEC). The Meridian power distribution cabinet (MPDC) provides an external -48 V (dc) power supply to the IPE. The MPDC provides dc power to the IPE lineup, which is separate from the standard SL-100 lineup.

The following figure shows four IPE modules contained in one IPEC. This type of architecture and peripheral consolidation allows easy installation of equipment and provides a flexible, cost-effective method of growth.

Figure 1 IPE column with four modules



Refer to Chapter 2, “IPE architecture", for additional information about the IPEC hardware and configurations.

Status reporting with XSM functionality

Each IPEC requires one extended system monitor (XSM) that can be configured as a master XSM or as a slave XSM. (Refer to Chapter 2 for details.) One master XSM supports up to 64 columns using a daisy chain of serial communication links. Thus, one master XSM can potentially support up to 256 (64 x 4) IPE modules. The master XSM reports status over an RS-232-C communication link to the system central processing unit (CPU) and responds to the system status inquiry messages.

The functionality provided by the XSM system monitor maintenance interface allows operating company personnel to perform the following tasks:

- monitor the IPE system status using dedicated RS-232-C link(s) and be alerted when status change occurs
- organize the IPE nodes into column/module and master/slave configuration for system status monitoring
- perform system configuration changes and maintenance actions by using the standard human-machine interface mechanism
- improve the system availability by having an autonomous power monitoring and control system that provides up-to-the-second fault detection data

Refer to Chapter 2, “IPE architecture", for additional information on the XSM.

Software required

The following table lists the software components required for IPE functionality.

Table 1 MSL IPE functionality contents (Sheet 1 of 2)

Functionality	Number	Title
extended peripheral equipment	AD3064	Attendant Consoles on IPEs
	AM0032	XPEC Call Processing - Phase I
	AM0033	IPE PM Maintenance - Phase II
	AM0034	IPE Downloading
	AM0035	CC/IPE Feature Regression
	AM0036	IPE Service Orders/Query Commands
	AM0037	IPE PM Maintenance - Phase I
	AM0038	XPM Support of IPEs
	AM0039	IPE Lines Table Control
	AM0040	XPE Lines Maintenance - Phase I
	AM0041	IPE PM Table Control/Call Processing

Table 1 MSL IPE functionality contents (Sheet 2 of 2)

Functionality	Number	Title
	AM0042	XPEC Monitor
	AM0043	XPEC Message Translation
	AM0044	XPEC Maintenance - Phase I
	AM0103	XPEC Firmware
	AM0124	XPEC Maintenance - Phase II
	AM0125	IPE PM Maintenance - Phase III
	AM0126	IPE Lines Maintenance - Phase II
	AM0127	XPE Link Diagnostics
	AM0128	Analog Lines on IPE
	AM0129	XPEC Message Interface - Phase II
	AM0130	XPEC Call Processing - Phase II
	AM0131	XPM-IPE Interface Optimization
	AM0132	Overload Control for IPEs
	AM0133	IPE on RCC
	AM0134	DTSR, Audits for IPEs
	AM0135	PM Debug Interface to XPEC Monitor
	AM0140	XPEC Self Test and Diagnostics Firmware
	A59007133	Enhanced IPE Controller
MSL Auto Recovery DLM/IPE	AD7674	Auto Recovery DLM/IPEs

The Load Content Record (LCR) lists the current software load and Nortel Networks functionalities. Similar information can be viewed on a MAP terminal by entering the following command:

>SOC;SELECT ALL BRIEF;LEAVE

and pressing the Enter key.

Controller card interfaces

The controller card provides primary interface and control functions for the IPE. The controller card also receives messages from its host XPM, from line cards, and from terminating devices such as sets and terminals. The controller card communicates with its line cards through the IPE backplane by DS30X connections. The DS30A interface between the line group controller (LGC) and controller card provides a minimum of two and a maximum of six links.

The NT7D07AC controller card is the original card that supported the IPE module. A new NT7D07BA controller card was introduced in MSL11 that provides enhanced capabilities not supported on the NT7D07AC. Refer to Chapter 2, “IPE architecture", for additional information on the controller cards.

Call processing and feature software support connections between all terminal types served by the IPE, digital line module (DLM), line concentrating module (LCM), line concentrating module enhanced (LCME), and trunk types served by SL-100 digital trunk controller (DTC) and line trunk controller (LTC).

Enhanced IPE controllor card

The enhanced IPE controller (EXPEC) card is a new generation of the IPE controller (XPEC) card that provides all of the functionality of the XPEC card as well as some new capabilities.

The capabilities provided by the EXPEC controller card include the following:

- increased performance resulting from a faster CPU and an upgraded operating system
- non-volatile Flash memory for storage for an IPE software load and a modification to the MAPCI RTS command. These components allow customers to restore the IPE to service with the software load stored in Flash memory without the delay of downloading the software from the computing module (CM)

For customers using Switch Manager, the GUI-based management platform for the MSL-100, the EXPEC controller card provides additional capabilities that are described below:

- an Ethernet interface and TCP/IP protocol software which allow the IPE to communicate with Switch Manager and which provide increased bandwidth for file transfer.
- the ability to transfer loads, utilizing the Ethernet port, while the IPE is in an Inservice (INSV) or Inservice Trouble (ISTB) state. The load in flash memory becomes active after the RTS PM FLASH CI command is issued.

  Note 1: In certain circumstances, Switch Manager can transfer loads while the IPE is in a manual busy (MANB) state. The IPE requires a valid load with a valid IP address set in the IPE prior to the IPE being placed in the MANB state. In addition, if the IPE is returned-to-service (RTS) while Switch Manager is transferring a load, the connection to Switch Manager is lost, resulting in an incomplete load file in the flash memory of the IPE.

  Note 2: For any communication with Switch Manager to occur, the IPE must be provisioned/datafilled as an Ehhanced XPEC, with a valid IP address, valid subnet mask, and valid gateway. A RTS must be performed to set these parameters in the IPE. Any changes to these parameters will require a subsequent RTS to activate the change.

- the ability to maintain multiple software load versions in Flash memory and to designate the load to be booted when the IPE is returned to service from Flash memory
- a set of modified log messages to report status information associated with new hardware and software capabilities

RTS FLASH

The MAPCI RTS command has been modified to include a FLASH parameter for support of the EXPEC card. The FLASH parameter is only available when the IPE is posted at the PM level of MAPCI and if the IPE is datafilled as an enhanced XPEC with an enabled IP port. This parameter allows you to return the EXPEC card to service by directing the card to execute the active software load from its on-board Flash memory.

Limitations and Restrictions

The CM must first be upgraded to MSL11 or higher before you can install a new IPE with the EXPEC controller card.

To transfer load files to the IPE through its Ethernet interface with the Switch Manager, your LAN must have one or more repository hosts. Each host must contain a copy of the load files and must provide a RFC-959 compliant FTP server for accessing the files.

Transferring a load utilizing the Ethernet port is different than loading the IPE using the LOADPM command. Switch Manager transfers loads to flash memory, utilizing the ethernet port, while the IPE is in an INSV or ISTB state. The load in flash memory becomes active after the RTS PM FLASH CI command is issued.

> ***Note:*** The LOADPM command, as previously supported, can only be issued while the IPE is in a MANB state. This load becomes active after the RTS PM command is issued..

Line cards

The IPE supports the following line cards:

- digital line card (DLC), NT8D02
- analog line card (ALC), NT8D03
- analog message waiting line card (MLC), NT8D09
- line side T-1 interface card (LTI), NT5D11
- Meridian Integrated Conference Bridge (MICBII), NT5D51
- Meridian HomeOffice II (MHO II Release 2), NTQR02AA

> ***Note:*** The LTI card is an analog card that emulates a DLC. The LTI card interfaces with a T-1 link, carrying 24 channels to the SL-100 switch. This card occupies two card slots in the IPE shelf.

Automated datafill and resource allocation for the IPE

This feature includes two functions for the intelligent peripheral equipment (IPE):

- ringing resource allocation
- automated datafill for IPE line cards

Ringing resource allocation

Ringing resource allocation exploits the full capability of the IPE's ringing generator. Currently there are two types of ringing generators available for IPE use, NT6D42 and NT7D03. Each ringing generator supports simultaneously ringing analog sets. NT6D42 supports sixteen and NT7D03 supports eight.

This feature makes more efficient use of ringing resources within the IPE. Due to hardware limitations of ringing generators for analog phone sets, concurrent ringing can only be supplied to a limited number of phones without physically damaging the ringing generators.

Table control is used to differentiate between ringing generators. The IPE now only recognizes the ringing generator that can ring eight phones. The throttling that the IPE currently uses is based on the actual ringing generator and notification is sent to the IPE setting its maximum ringing resource (MRR). The MRR value is entered in table IPEINV at the MRR field and is acheived by executing the QUERYPM command or by executing the RTS command. In order to trace resource inadequacies for phones needing the resource, but failing to get it, a log is produced indicating this failure. Additionally, an operational measurement is pegged to keep statistics.

Automated datafill for IPE line cards

This feature allows the MSL-100 system to poll the IPE line cards and dynamically datafill the line card information into table LNINV. This capability allows MSL-100 users to make immediate upgrades of existing card types for the IPE without software intervention.

This automatic datafill procedure provides the following benefits:

- Minimal software patches are needed.
- Accurate and up-to-date product inventory is provided on the user's switch.
- Support can accurately identify and resolve field problems.
- It minimizes human error.

Currently, a feature activity must be opened for any new version of line card that must be datafilled in table LNINV for the IPE. If table LNINV is not updated with the new product code of the line card, the current software does not allow the activation of that product.

Automated datafill is a plug and play design. It allows automatic datafill of a line card's product engineering code (PEC) in table LNINV and maps proper test and diagnostic procedures to the line card.

To accomplish this functionality, the automated datafill operation of this feature is concerned primarily with polling cards within the IPE, creating a table for compatible cards, and binding diagnostic routines for compatible cards. The new table containing the compatible cards is considered the kernel of this feature. Information taken from it provides the data needed to properly automate the process of datafilling the IPE's line cards.

The automated datafill for IPE line cards assumes that new line card version codes will be one of the following types:

- 8D02, digital line card
- 8D03, analog line card

- 8D09, analog/message waiting line card
- 5D11, line side T1

Accompanying features

This feature works in conjunction with the following features:

- AD9695, CCM: Automated Datafill for IPE Line Cards.
- AD9724, IPE: Automated Datafill and Resource Allocation for the IPE.
- AX0947, MSL: Flexible Voice/Data LEN

Hardware requirements

Automated datafill and resource allocation has the following hardware requirements:

- MSL-100 enhanced core/SuperNode small edition (ECORE/SNSE) switch
- line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC) peripheral module
- IPE peripheral module
- NT5D11, NT5D51, NT8D02, NT8D03, or NT8D09 line cards
- ringing generators NT6D42, NT7D03, NT8040

Supported telephones

The IVD service provides simultaneous voice and data communications at speeds up to 19.2 kbp/s asynchronous and 64 kbp/s synchronous over a single, twisted-pair subscriber loop. The following digital telephone sets and data options are supported by the IVD feature:

- Meridian digital telephones
  - M2009 (no longer manufactured)
  - M2018 (no longer manufactured)
  - M2112 (no longer manufactured)
  - M2317
- M3000 Touchphone (no longer manufactured)
- touch asynchronous data option (TADO)
- Meridian modular telephones (MMTs)
  - M2006
  - M2008
  - M2008HF

  - M2216 ACD-1
  - M2216 ACD-2 (supported but no longer manufactured)
  - M2616
  - M2616 CT
  - M3901
  - M3902
  - M3903
  - M3904
  - M3905
- Meridian communication adapter (MCA)
- Analog terminal adapter (ATA)
- Meridian Communicator

All digital telephones can transmit or receive voice and data communications simultaneously. This capability allows a user to talk on a directory number (DN) loop while using an attached data terminal.

The MADO, TADO, and MCA use RS-232-C interfaces for data terminal equipment (DTE) and support data speeds from 110 byte/s to 19.2 Kbyte/s (the MCA supports 19.2 Kbyte/s in asynchronous mode and 64 Kbyte/s in synchronous mode). The MADO, TADO, and MCA have autobaud capability and are compatible with existing SL-100 DATAPATH products. MADO, TADO, and MCA support SL-100 keyboard dialing or keyboard dialing compatible with the Hayes Smartmodem command protocol.

The IPE supports the following analog telephone sets and attendant console:

- analog sets
  - 500/2500 sets
  - 500/2500 sets with message waiting lamp
- Meridian SL-100 attendant console (uses analog ports)

The following NTPs contain detailed information about supported telephones:

- *M2000 Digital Telephones Reference Manual*, 555-4001-110
- *M3000 Touchphone Reference Manual*, 555-4001-112
- *Meridian Modular Telephones Reference Manual*, 555-4001-114,
- *Meridian Communications Adapter (MCA) Reference Manual,* 555-4001-123

Refer also to the list of related documentation in the “About this document" chapter.

Translations and service orders

The following NTPs contain information about defining the tables needed for the IPE.

- *Commercial Systems Translations Guide*
- *Defense Switched Network Translations Guide*

The following NTPs contain information about service orders.

- *Commercial Systems Service Order Reference Manual*
- *Defense Switched Network Service Order Reference Manual*

2 IPE architecture

This chapter describes the hardware requirements for an Intelligent Peripheral Equipment Column (IPEC). This section also describes the Extended System Monitor (XSM) located in the IPEC pedestal and includes configuration dependencies and switch settings information.

Each IPEC consists of the following components:

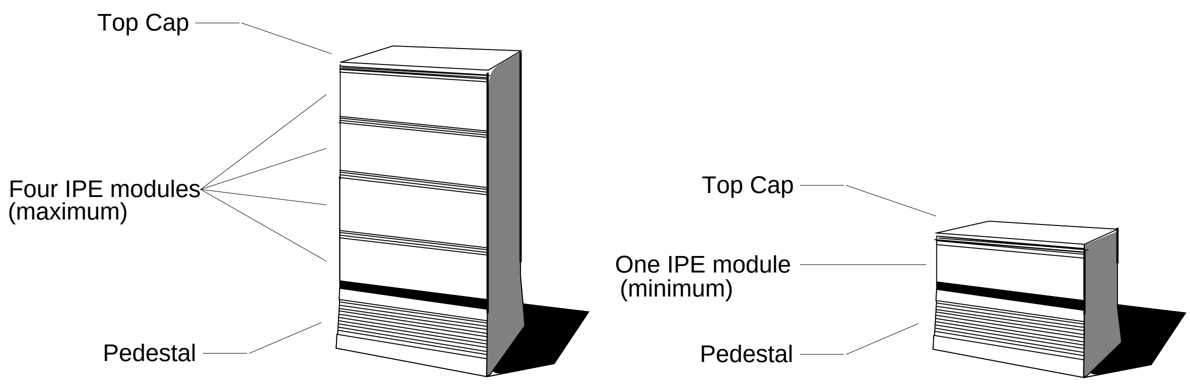
- up to four Universal Equipment Modules (UEMs) to house IPEs
- up to four IPEs, each with the following components:
  - Peripheral Equipment Power Supply (PEPS), dc version
  - controller card
  - up to 16 line cards (analog, digital, or both)
  - for analog line cards only, a dc ringing generator
- pedestal base (which contains the XSM, listed below)
  - Power Distribution Unit (PDU)
  - blower unit
- expansion kit (used when two columns are configured side-by-side)
- two module side cover panels per IPE module when not using the expansion kit (maximum of eight)
- two front/rear cover panels per IPE module (maximum of eight)
- one top cap
- cable harnesses
- trim panels and labels
- XSM card (contained in the pedestal)

Minimum and maximum IPEs in one IPEC

The smallest single-column configuration for an IPEC contains only one UEM, which contains the housing framework for one IPE module. The largest single-column configuration for an IPEC contains four UEMs.

The following figure shows the minimum and maximum modules allowed in an IPEC.

Figure 2-1 Minimum and maximum modules in an IPEC



Note: Each IPE column must have a pedestal and top cap. When columns are installed side-by-side, an expansion kit is used to join the columns. Side panels are installed to cover the exposed sides.

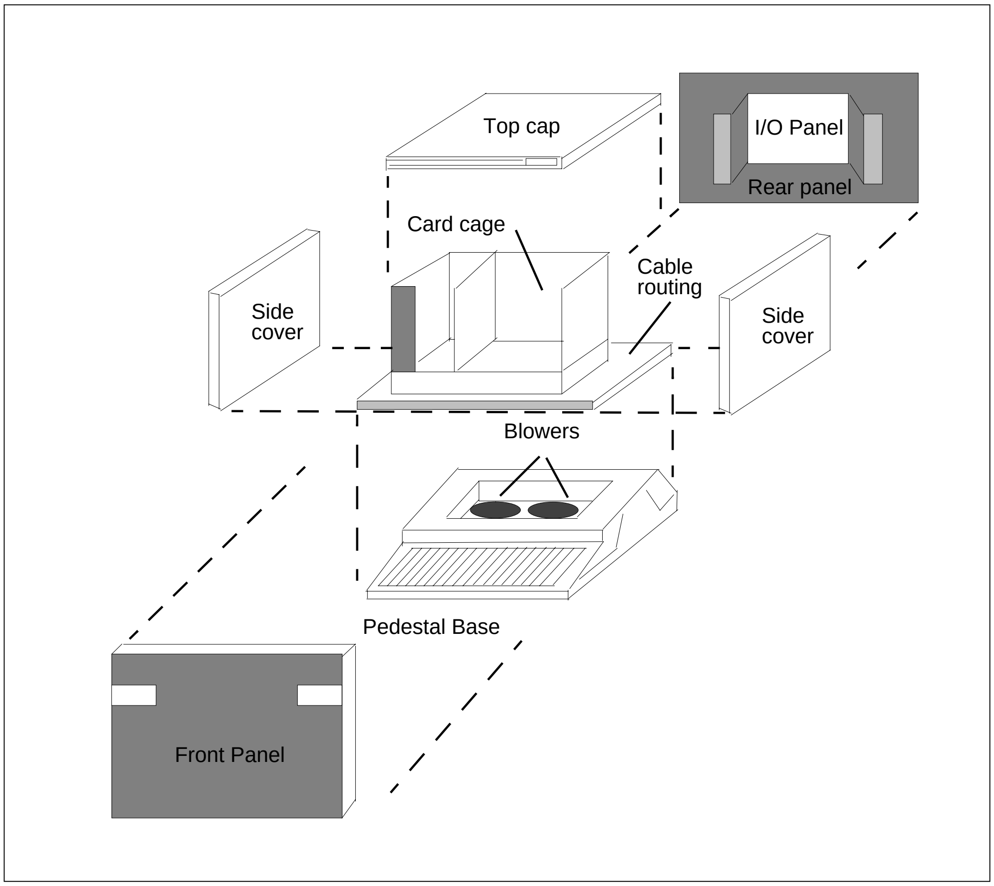
Note: The pedestal, expansion kit, side panels, and top cap shown in the previous figure are described later in this section.

Universal equipment module

The Universal Equipment Module (UEM, NT8D37) provides the framework for housing the IPE module.

The following figure shows an exploded view of a single-module IPEC.

Figure 2 IPEC configuration—exploded view



IPE module components

An IPE module (NT8D37) is a single shelf. A maximum of four IPE modules can be stacked into one IPE column. Each IPE shelf can contain the following components:

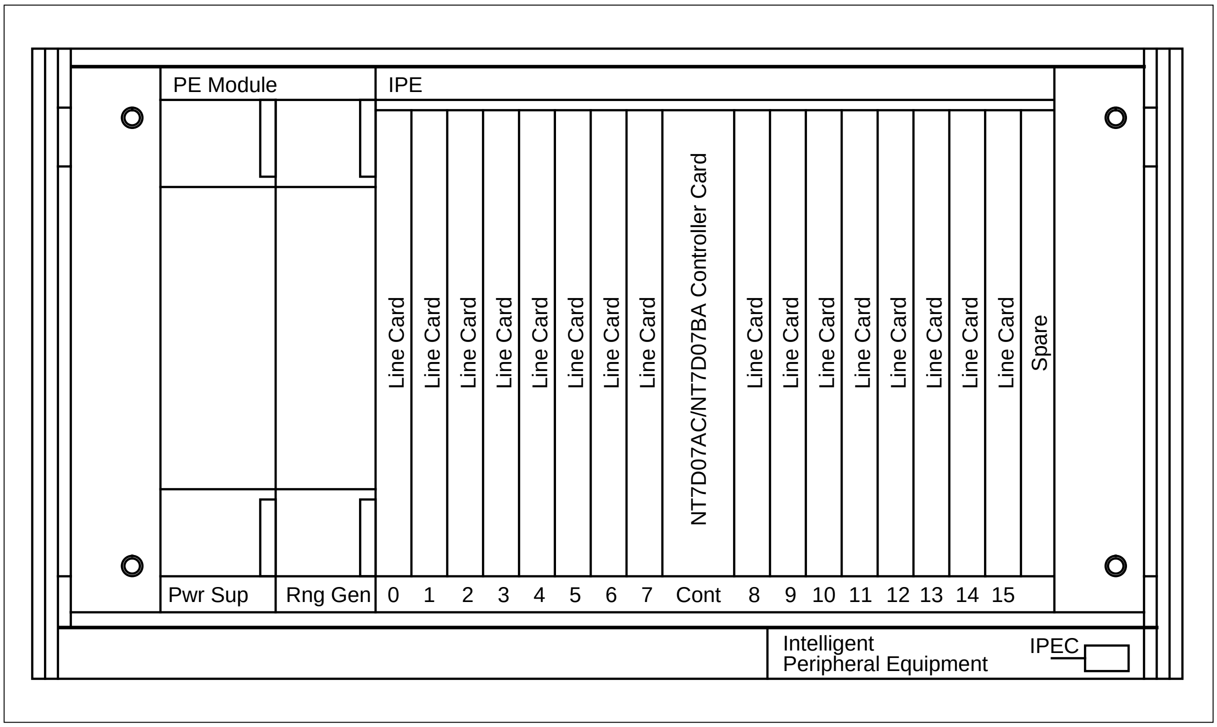
- one power supply card (PEPS, NT6D40)
- one controller card (NT7D07) provisioned between card slots 07 and 08
- up to 16 line cards. The IPE supports any mix of the following types of cards in slots 00 through 15.
  - — Digital Line Card (DLC), NT8D02
  - — Analog Message Waiting Line Card (MLC), NT8D09
  - — Analog Line Card (ALC), NT8D03

- — Line Side T-1 Interface Line Card (LTI), NT5D11 (requires two consecutive slots).
- — Meridian Integrated Conference Bridge (MICBII), NT5D51 (maximum of six cards per shelf)

- one dc (direct current) ringing generator (NT6D42). The ringing generator is required only when one or more MLC line cards are equipped.

The following figure shows the card layout for an IPE shelf.

Figure 2-3 xxIPE shelf card slots



Peripheral equipment power supply

A PEPS (Peripheral Equipment Power Supply) card resides on each IPE shelf. The PEPS provides power to the IPE shelf and regulates all the voltages required by the cards on the IPE shelf.

For all IPE power supplies, the XSM can detect the following status and fault reports.

- card functioning properly
- card completely shutdown
- card partially shutdown
- card not present

Controller cards

The IPE controller card, or XPEC (NT7D07AC), is a single pack that consists of a mother board and a daughter board. The card resides in the IPE shelf and serves up to 16 peripheral cards.

The enhanced IPE controller card, or EXPEC (NT7D07BA), was introduced in MSL11. It is a single pack that consists of a single board with a dual slot faceplate to disallow connection to the corresponding slot, which is not used on the MSL-100. The EXPEC provides enhanced capabilities compared with the XPEC. The new EXPEC includes the following components:

- a new processor called a Micro Processing Unit (MPU) within the controller
- an increase in RAM to 8 megabytes (Mb)
- communication with the EXPEC through an Ethernet port
- support 4Mb of FLASH memory
- support 256 kilobytes (Kb) of SRAM

The EXPEC controller card gives the customer's system added value by allowing the IPE system to remain in an INSV (inservice) condition while transferring the software into the FLASH memory. Booting the system from FLASH by performing a Bsy PM, RTS PM FLASH will momentarily take the IPE out of service to activate the new software. This service allows more flexibility in the schedule for upgrading system software, resulting in less down-time. In addition, the IPE hardware can be connected to an enterprise data network through the ethernet connection maintained by the MC68360 MPU, making software upgrades through the data network quicker and more convenient. Finally, the increase in DRAM, coupled with IPE version checking and an upgraded operating system, allows for a more refined and robust set of features for the IPE.

All network interfaces are handled through the Line Trunk Controller (LTC), Line Group Controller (LGC), Remote Cluster Controller (RCC) and Remote Cluster Controller 2 (RCC2). The controller card receives messages from the host XPM (Line Trunk Controller, Line Group Controller, or Remote Cluster Controller), peripheral line cards, and terminating devices (such as sets).

The IPE has an additional function as a central controller for the CARD-LAN bus, which is internal to each IPE module. The CARD-LAN bus is a serial bus on the IPE backplane used to communicate with the line cards. The serial bus provides a path where maintenance and control messages, other than Pulse Code Modulated (PCM) voice and data, can travel.

Note: The NT7D07AC controller card will be manufacture discontinued in December, 2000. It will still be maintained in the MSL11 release.

Customers that upgrade to MSL11 will perform the software upgrade to MSL11 before installing a new NT7D07BA or replacing an existing NT7D07AC with a NT7D07BA.

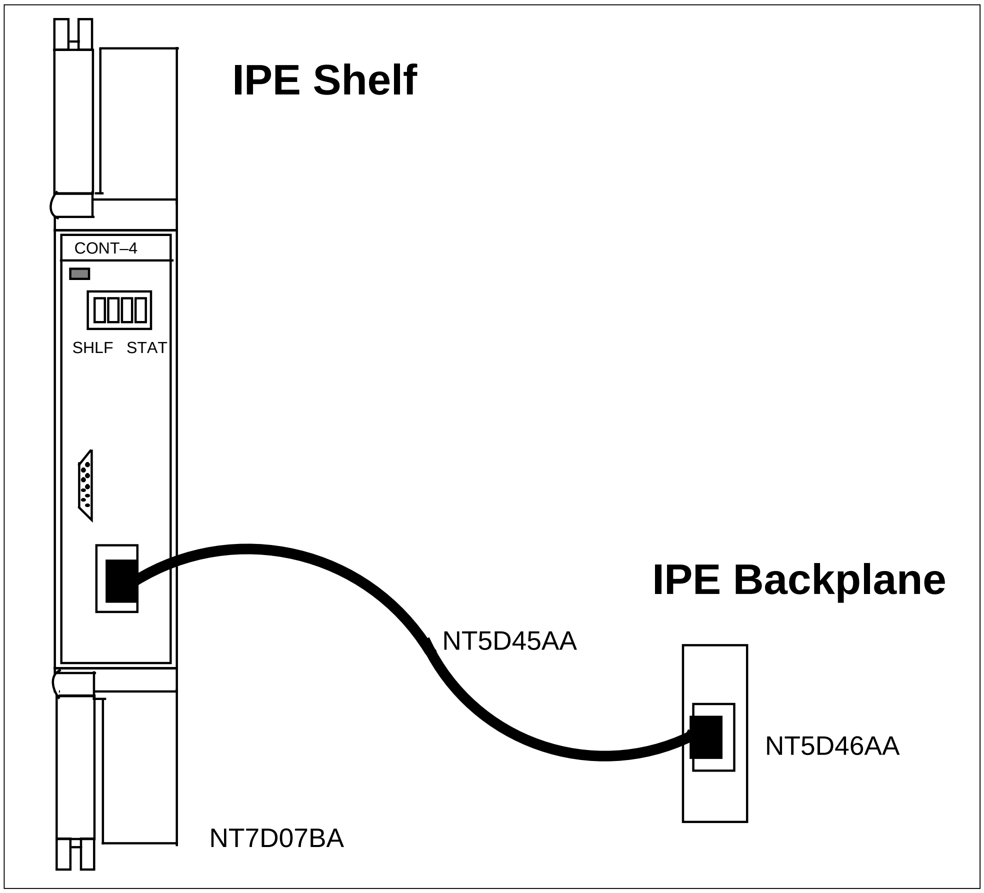
Customers will receive the new pack with the latest software load delivered on the EXPEC pack. To upgrade to the new EXPEC, the IPE is Manual Busied (ManB), the old pack is removed, and the new pack is installed. A RTS is then performed on the IPE with the new RTS FLASH MAPCI command to return-to-service the IPE from the load stored in flash memory. An optional Ethernet cable and bulkhead adapter is available for connection to the LAN. This optional connection is desireable to provide minimal downtime when loading the IPE.Datafill of Table IPEINV adds fields XPECTYPE and STATE. XPECTYPE specifies the controller type and can be set to either STANDARD for the NT7D07AC or ENHANCED for the NT7D07BA. Field STATE provides information on the ethernet connection to the IPE and can be set to either DISABLED if there is no ethernet connection or ENABLED if an ethernet connection exists. When ENABLED is datafilled, 3 more fields need to be entered: IPADDR specifies the IP address that will be used, SUBNET specifies the subnet mask information, and DFLT_GWY specifies the required default gateway address. Once RTS is performed on the new IPE, the IP address will be configured. Access to the IPE from Switch Manager will be available at this time.

Figure 4 Datafill example for table IPEINV

```
IPENM ADNUM FRTYPE SHPOS FLOOR ROW FRPOS EQPEC LOAD
CSPMNO IPEINFO MRR
CNTRLCD
--------------------------------------------
IPE1 00 0 18 IPEC 24 0 B 0 8D37DC IPE11AA RCC2 0 HIPE N (53) (52) (51)
(50)$ 8 ENHANCED ENABLED 47 198 136 125 47 255 255 240 47 198 136
```

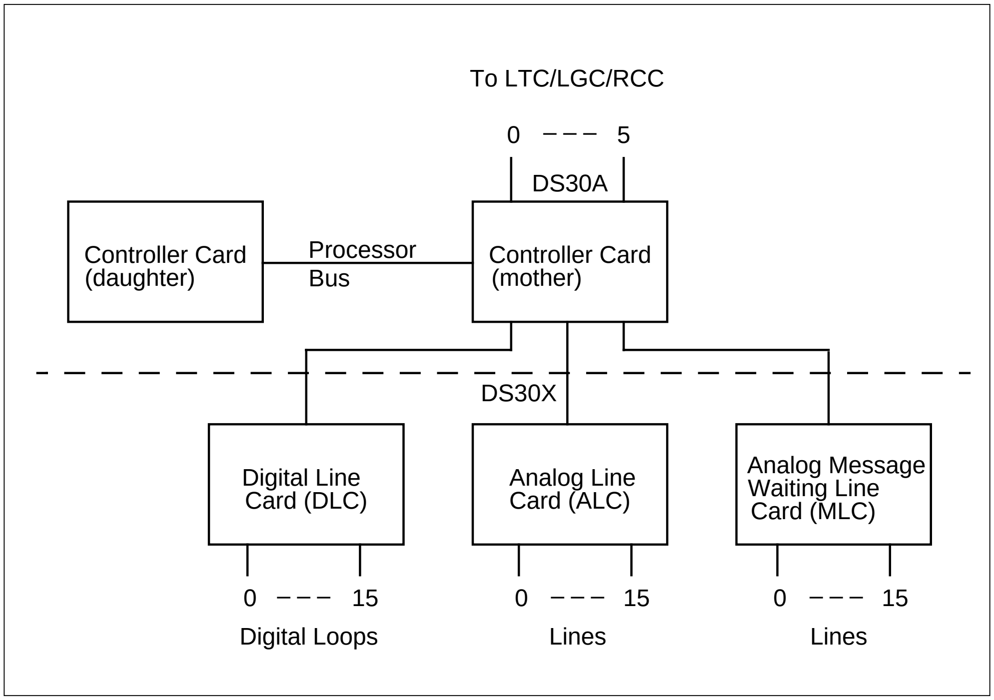
The figure that follows shows the ethernet cable conncetion to the bulkhead of the IPE shelf. The cable connects to J5 of the bulkhead. Route the cable to the front of the shelf on the bottom left side (facing the cabinet from the rear) and connect it to the Ethernet connector.

Figure 5 IPE shelf to backplane connection



The figure that follows shows the relationship of the controller card to the other cards in the IPE shelf.

Figure 6 IPE schematic



Line cards

All line cards except the LTI can be provisioned in any order in the 16 slots for the IPE module. The LTI card requires two consecutive slots. All cards within the IPE are simplex:

- Digital Line Card (DLC), NT8D02
- Analog Message Waiting Line Card (MLC), NT8D09
- Analog Line Card (ALC), NT8D03
- Line Side T-1 Interface Line Card (LTI), NT5D11
- Meridian Integrated Conference Bridge (MICBII)
- Meridian HomeOffice II (MHO II Release 2), NTQR02AA

Digital Line Card (NT8D02)

The Digital Line Card (DLC) interfaces to Integrated Voice and Data (IVD) digital terminals. These terminals include the M2000, M3000 series, and their respective data options. A DLC inserts into any line card slot on the IPE shelf and can interface with a maximum of 16 digital sets for each DLC card for a total of 32 ports.

The DLC is equipped with an Intel 8051-type microprocessor that performs functions such as control of card operation, card identification, self-test, status reporting to the controller, and maintenance diagnostics. The DLC interfaces to the controller card through a DS30X interface that carries multiplexed PCM voice and data information from the 16 sets (32 ports). The CARD-LAN serial bus carries control and maintenance messages between the controller card and DLC.

Analog Line Card (NT8D03)

The Analog Line Card (ALC) is an analog line card that interfaces with the controller card. The ALC allows analog sets such as 500 and 2500 sets to receive and make telephone calls. The ALC can be inserted into any line card slot in the IPE shelf.

> ***Note:*** In later configurations of the IPE, MLCs or LTIs are used instead of ALCs. (Refer to the “Analog Message Waiting Line Card" section in this chapter.)

Each ALC supports a maximum of 16 analog sets (500/2500) and can support the SL-100 attendant console. The ALC is equipped with an Intel 8051-type microprocessor that performs functions such as control of card operation, card identification, self-test, status reporting to the controller, and maintenance diagnostics.

The ALC provides the following functions:

- analog-to-digital and digital-to-analog conversion for the possible 16 analog telephone sets
- transmit and receive signaling messages over a DS30X time slot
- DC current to the telephone sets
- on hook/off hook detection
- connection for ringing signal through the ringing generator
- status of board
- tip and ring conductor with balanced 600 ohm termination
- self ID and vintage ID

Analog Message Waiting Line Card (NT8D09)

The MLC is basically an ALC that supports the message waiting lamp sets in addition to the 500/2500 sets. The MLC functions the same as the ALC previously listed and also provides the following additional functions:

- current limited connection for the message waiting lamp on the set
- flashing of the 1-Hz message waiting lamp signal at 150 V dc
- support for both A- and Mu-law companding
- method to test the lamp on the set

Line Side T-1 Card (NT5D11)

The LTI card combines the software interface of an analog card with a T-1 interface into a single IPE circuit pack. The LTI emulates the software interface of an ALC and provides a T-1 interface to voice mail and voice reponse unit (VRU) equipment. Because the LTI provides 24 ports, it requires 2 card slots, using 16 channels on the first slot and 8 channels on the second.

For more information on the LTI card, see the *Line Side T-1 Interface (LTI) for IPE Services Guide*, 555-4001-022

Meridian HomeOffice II (MHO II Release 2)

The MHO card is a telecommuting line card that connects a Meridian proprietary digital telephone and PC to the offica LAN from a home office. This is accomplished through:

- an ISDN Basic Rate Interface (BRI) line installed in the home office
- a HomeOffice Router connecting the PC to the corporate LAN and digital telephone to the corporate PBX

For more information on the MHO card, see the *Meridian HomeOffice (MHO) User Guide*, 555-8321-205

Ringing generator

The ringing generator (NT6D42) provides analog (500/2500) set ringing capabilities for the ALC and MLC cards and is required if analog lines are configured in the shelf. The ringing generator also supplies -150 V dc to the message waiting lamp sets.

The dc ringing generator operates from a nominal -48 V dc input and provides selectable ac ringing voltage outputs superimposed on -48 V dc. The frequency and voltage options are 20/25/50 Hz and 70/80/86 V ac. The ringing generator also supplies -150 V dc for message waiting lamp voltage for 500/2500 set applications.

The ringing generator mounts in the IPE module to the right of the PEPS.

The following status and fault reports can be detected by the XSM and transmitted to the SL-100 CC.

- card functioning properly
- card completely shut down
- card partially shut down
- card not present

Pedestal base

Each column rests on a pedestal base (NT7D09) made of die-cast construction. The pedestal base (hereafter called “pedestal" in this guide) consists of a blower unit (with two blowers) and a -48 V dc Power Distribution Unit (PDU). The pedestal is equipped with the Extended System Monitor (XSM) to monitor IPEC status and generate frame alarms. These items are described in this chapter.

The IPEC pedestal assembly provides the physical support and logical frame position for the stackable IPE modules and top cap. Besides the items listed in the above paragraph, the pedestal houses the leveling feet, grill, -48 V dc PDU assembly, and other items such as the product label, air filter, PDU harness, panels, gaskets, and a Terminal Block (TB). The pedestal should be equipped with leveling feet to provide stability

Blower unit (NT8D52)

The blower unit (NT8D52) in the pedestal provides forced air cooling with two 2-speed fans. The fans normally operate at low speed; however, if a condition of thermal stress occurs, the fans are automatically switched to high speed. Both fans operate under normal conditions. If one of the two fans fails or the temperature reaches 149 °F (65 °C), an XSM fault report notifies the CC.

The IPE uses the following possible fan unit status and fault reports for the blower unit:

- Fan unit is operational
- Fan unit is not operational, and temperature alarm has been triggered
- Temperature is OK
- Unit has reached an excessively high temperature

Power Distribution Unit (NT7D67)

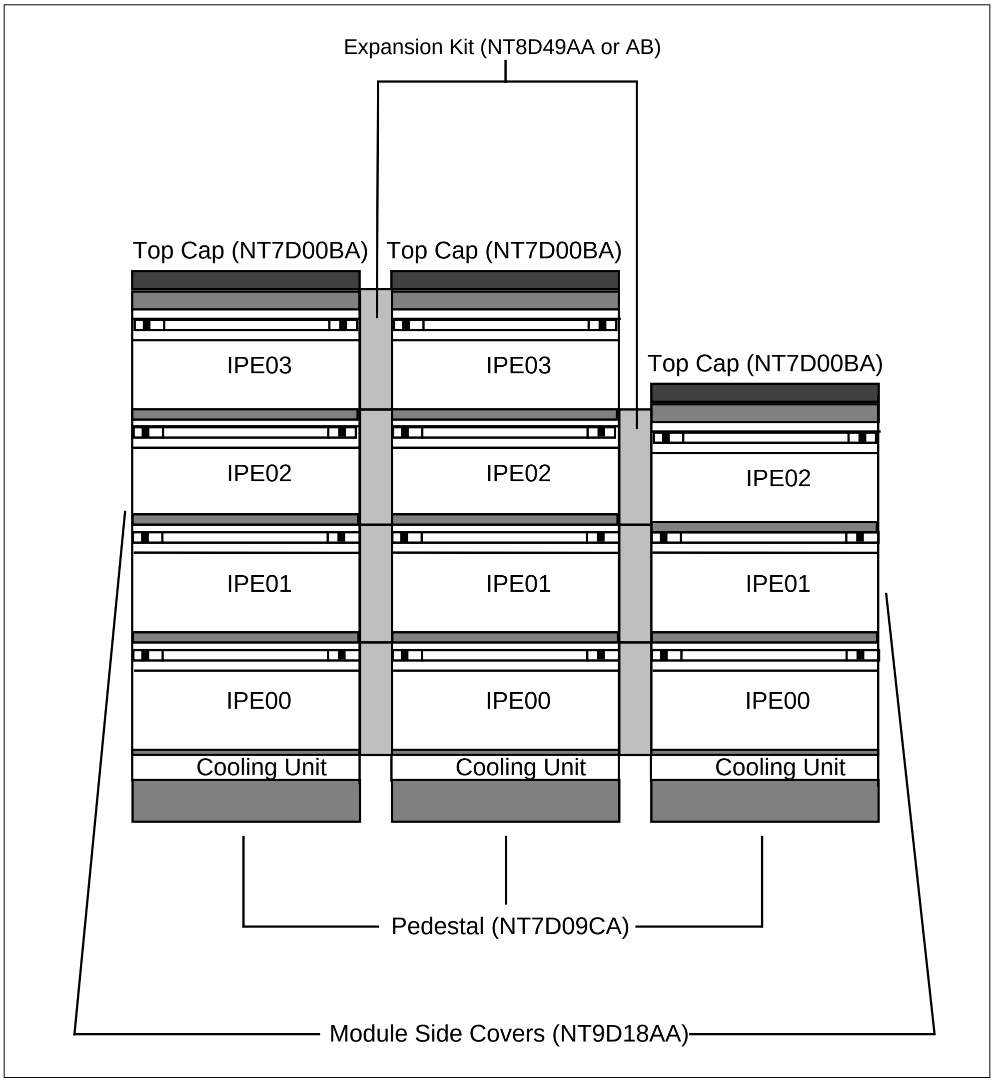
The Power Distribution Unit (PDU, NT7D67) receives dc power (-48 V dc nominal) from a battery source external to the IPEC and distributes the power to the IPE modules and to the blower unit in the pedestal through the circuit breakers.

Expansion kit (NT8D49)

The expansion kit (NT8D49) shown in the figure that follows bolts modules from separate IPECs together for side-by-side expansion. The kit includes an expansion spacer, Radio Frequency Interference (RFI) gasketing, and eight bushings. There is one kit for each module after the first column.

Installations on concrete floors require Expansion Kit NT8D49, and installations on raised computer floors in earthquake risk areas require Expansion Kit NT8D49BA.

Figure 7 Standard growth configuration



IPEC exterior completion

The exterior of the IPEC hardware also includes the side panels and top cap, described below.

Module front/rear panels (NT9D15)

Module front/rear panels (not shown in "IPEC configuration—exploded view" on page 2-3) cover the front and back of the column's exterior. The panel covering the front is identical to the panel covering the rear.

Module side panels (NT9D18)

The module side panels (shown in "IPEC configuration—exploded view" on page 2-3) complete the column's exterior. There are two side panels, one to cover each side of each module in the IPEC. These are needed only for sides that are exposed, not for sides that are bolted to another module.

Top cap (NT7D00)

A top cap (NT7D00) completes each IPEC. It is mounted on the highest module of each column. See figure "Minimum and maximum modules in an IPEC" on page 2-2 and figure "IPEC configuration—exploded view" on page 2-3.

The top cap consists of thermal sensors, a fan speed sensor, a front and rear exhaust grill, and a column alarm indicator. The sensors and alarm indicator interface with the XSM card located in the pedestal.

For sites requiring overhead cable entry to the IPEC, an optional Top Cap Rear Grill (P0699851) can be used.

Extended system monitor

The XSM (NT8D22) is a microprocessor-based circuit pack located in the IPE pedestal base. The XSM monitors the operation and status of the IPE power supplies, ringing generators, column thermal sensors, and blower units.

Master and slave XSMs

One IPEC can contain up to four IPE modules, numbered from 0 to 3 (bottom to top). Each IPEC requires one XSM that can be configured either as a master or a slave. Two 8-position DIP switches on the XSM indicate the system configuration, XSM function, and address.

One master XSM supports up to 64 columns (itself and up to 63 slave XSMs located in other columns) using a daisy chain of serial communication links. Only the master XSM reports the status (of itself and the slaves connected to it) to the system Central Processing Unit (CPU) or responds to the system status inquiry messages.

Slave XSMs under the control of a given master XSM must be numbered sequentially (DIP switch setting). Failure to do so results in incorrect fault reports being generated for any slave XSM missing from the sequence. For example, if slave XSMs are numbered 1, 3, 4, and 8, the master XSM would report that slaves 2, 5, 6, and 7 are not reporting.

If additional slaves are added to the daisy-chain with a previously configured and working master XSM, the DIP switch setting for the master XSM must be changed to reflect the new number of slave XSMs under the control of the master XSM.

The XSM status is reported to the system CPU over an RS-232-C communication path. The XSM reports monitored status, responds to system status inquiry commands, and performs automatic shutdown to prevent hazardous thermal (high temperature) conditions.

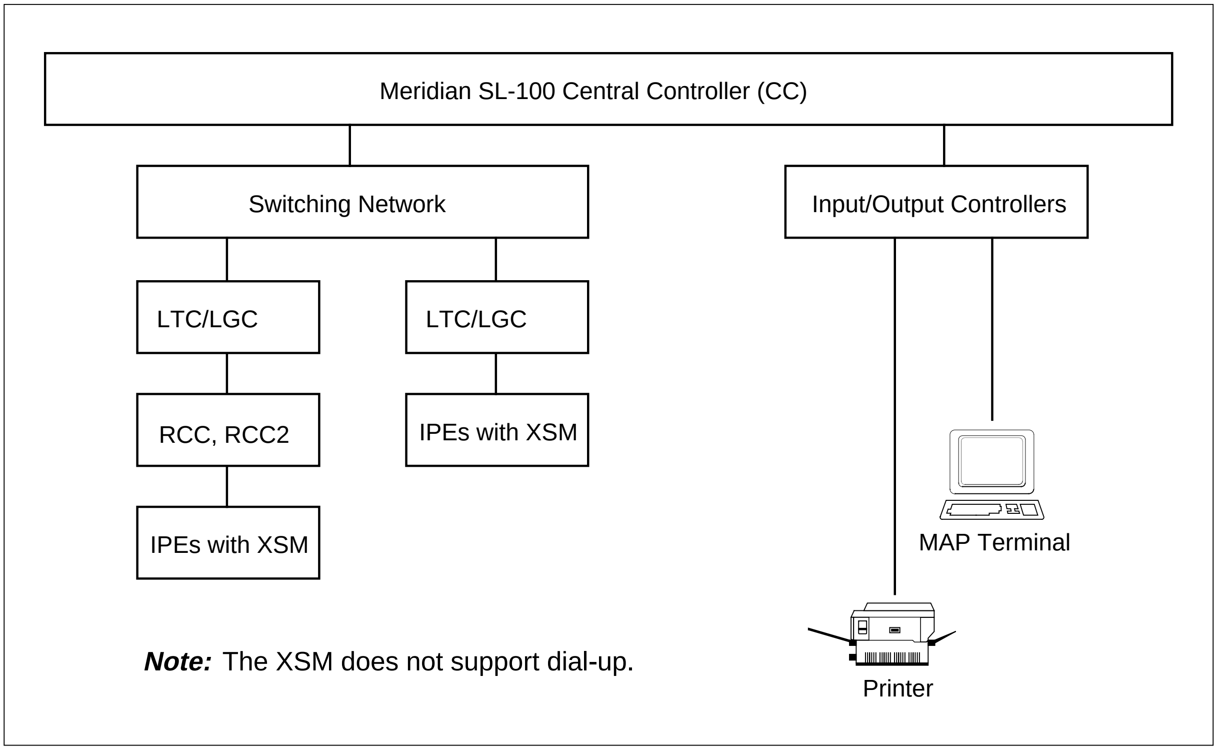
> ***Note:*** If the datalink between the SL-100 and a master XSM is unavailable, the CC cannot determine any status information or fault reports from that XSM and any of its slaves. Software to support the datalink on the SL-100 has not been introduced.

The XSM also performs the serial communication link between the master and slave XSMs in other columns. If a fault is detected, the XSM displays alarm Light Emitting Diodes (LEDs) on the top column cabinet. The XSM trips the column circuit breakers or activates the tripping signals (for dc systems) when the column exceeds the high-temperature threshold. The XSM alarms the Power Fail Transfer (PFT) unit to activate the system line transfer when required or when faults are detected.

> ***Note:*** The PFT card performs a transfer of lines to outside lines directly, bypassing the IPE line card. The PFT card is not supported in the SL-100 environment, but an XSM may still report information for them, in some instances. Status messages for PFT cards are “Transferred" or “Not Transferred". The SL-100 CC ignores reports concerning PFT card status.

The following figure shows the XSM configuration in the SL-100 environment.

Figure 2-8 XSM configuration in SL-100 environment



XSM functionality

The XSM feature functionality consists of the datalink interface, XSM configurations and XSM maintenance interface. The SL-100 IPE also supports an alternative to XSM, described in the “XSM alternative" section.

XSM configurations

The XSM circuit pack is located in the IPE column pedestal. Each IPE column (IPEC) consists of a stack of up to four IPE modules, numbered from 0 to 3 (bottom to top). IPE modules are numbered according to their physical locations in an IPEC. One master XSM supports up to 64 columns, including itself. Thus, one master XSM can support up to 256 IPE modules.

An XSM identification code (XSMID) from 0 to 63 is assigned by setting the DIP switches on the XSMs. Number 0 is always associated with the master XSM and the slaves are numbered from 1 to 63.

XSM alternative

For those IPE configurations equipped with XSMs, but do not have RS-232-C connections to the IOCs, the SL-100 system provides an alarm system that consists of hardware devices and software modules for detecting and reporting (by both visual and audible alarms) equipment faults. The hardware comprises various circuit packs that provide signal scan points and signal distribution points. The alarm software serves as an interface between the alarm hardware and the external alarms man-machine interface.

It is beyond the scope of this document to describe exactly how the SL-100 alarm system can be used as an alternative to the XSM for IPE configurations. However, for more information, refer to the *Alarm System Description*, 297-1001-122, the *External Devices Maintenance Guide*, 297-1001-593, and the *Commands Reference Manual*, 297-1001-822.

3 Provisioning an IPEC

This section includes information on the required and provisionable equipment for an intelligent peripheral equipment column (IPEC). Additional information is provided for the provisioning of individual IPE modules. This section also illustrates the Meridian SL-100 cabinet lineup and describes the IPE in remote switching centers (RSC).

The following table lists the equipment required for an IPEC, giving quantity, product engineering code (PEC), and description.

Table 1 Required equipment for an IPEC

Qty	PEC	Description
1	NT7D00BA	Top cap
1		Pedestal assembly-contains the following:
	NT7D09CA	pedestal DC
	NT7D67CB	power distribution unit DC
	NT8D22AC	extended system monitor (XSM)
	NT8D46AL	extended system monitor serial link cable
with 1	NT8D52DD	pedestal blower unit DC
1 -4		IPE module assembly-contains the following:
	NT7D07BA or	enhanced controller card
	NT7D07AC	controller card
	NT6D40BA	PE power supply DC
	NT8D37EC	IPE module DC
	NT8D81AA	tip and ring cables (16 per module)

The following table lists the required equipment for an IPE module.

Table 2 Required equipment for an IPE module

Qty	PEC	Description
1		IPE module assembly:
	NT7D07BA	enhanced controller card
	or	controller card
	NT7D07AC	PE power supply DC
	NT6D40AB	IPE module DC
	NT8D37EC	tip and ring cables (16)
	NT8D81AA	
2	NT8D92AB	controller to I/O cable
	NTNX36DR	Cable that connects the MCTM, MCTM-I, MCRM, MCRM-S, MNET, and MLNK to the IPE. ***Note:*** MCTM, MCRM, MNET, and MLNK have been manufacture discontinued but are still supported in the field.

The following table lists the provisionable equipment for an IPE module and the line cards used.

Table 3 Provisionable equipment for an IPE module (Sheet 1 of 2)

Qty	PEC	Description
	NT8D02	DLC-16 port IVD Digital Line Card
	NT8D03	16 port analog line card
	NT8D09	MLC-16 port analog (500/2500) with Message Waiting feature
	NT5D11	LTI-24 port analog T-1 interface card ***Note:*** Occupies 2 consecutive slots-cannot be installed in slot 7 or 15
	NT5D51	Meridian Integrated Conference Bridge (MICBII)
	NTQR02AA	Meridian HomeOffice II (MHOII Release 2)

Table 3 Provisionable equipment for an IPE module (Sheet 2 of 2)

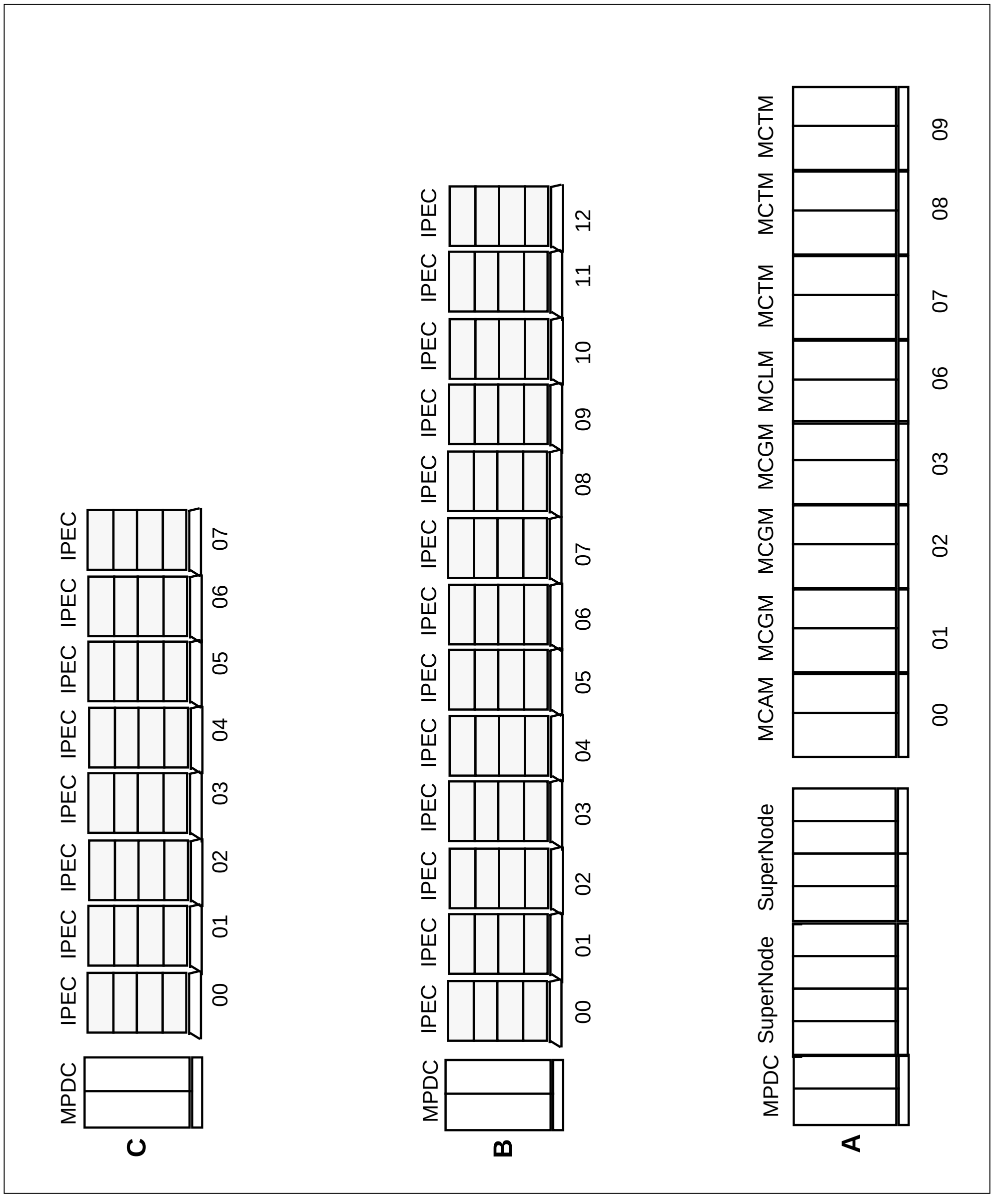
Qty	PEC	Description
	NT8D64BA, BB, BC, BD, or BF	mounting and bracing kit ***Note:*** See the “Mounting and bracing kits" section for specific information about the type mounting or bracing kit to use for a particular installation.
1	NT6D42CD	ringing generator ***Note:*** One for each IPE shelf is required with ALC and MLC configurations (500/2500 sets).
1	NT8D49AA or	expansion kit
	NT8D49AB	expansion kit ***Note:*** One kit for each module added after first column.
2-8	NT9D18AA	module side cover ***Note:*** Two for each module. Maximum of eight panels for each IPEC lineup configuration.
2-8	NT9D15AA	Module Front/rear Cover ***Note:*** Two for each module. Maximum of eight panels for each IPEC lineup configuration.

Cabinet lineup

The IPE module constitutes a separate lineup and is not attached to the standard cabinet SL-100 bays. The IPE can be configured with the Meridian SuperNode (Option 211) cabinet lineup.

The following figure illustrates an IPEC lineup for the SL-100. As shown, a Meridian power distribution cabinet (MPDC) provides an external -48 V dc power supply, either to the IPEC lineup or to a SuperNode system.

Figure 1 Meridian SL-100 cabinet lineup with IPEC



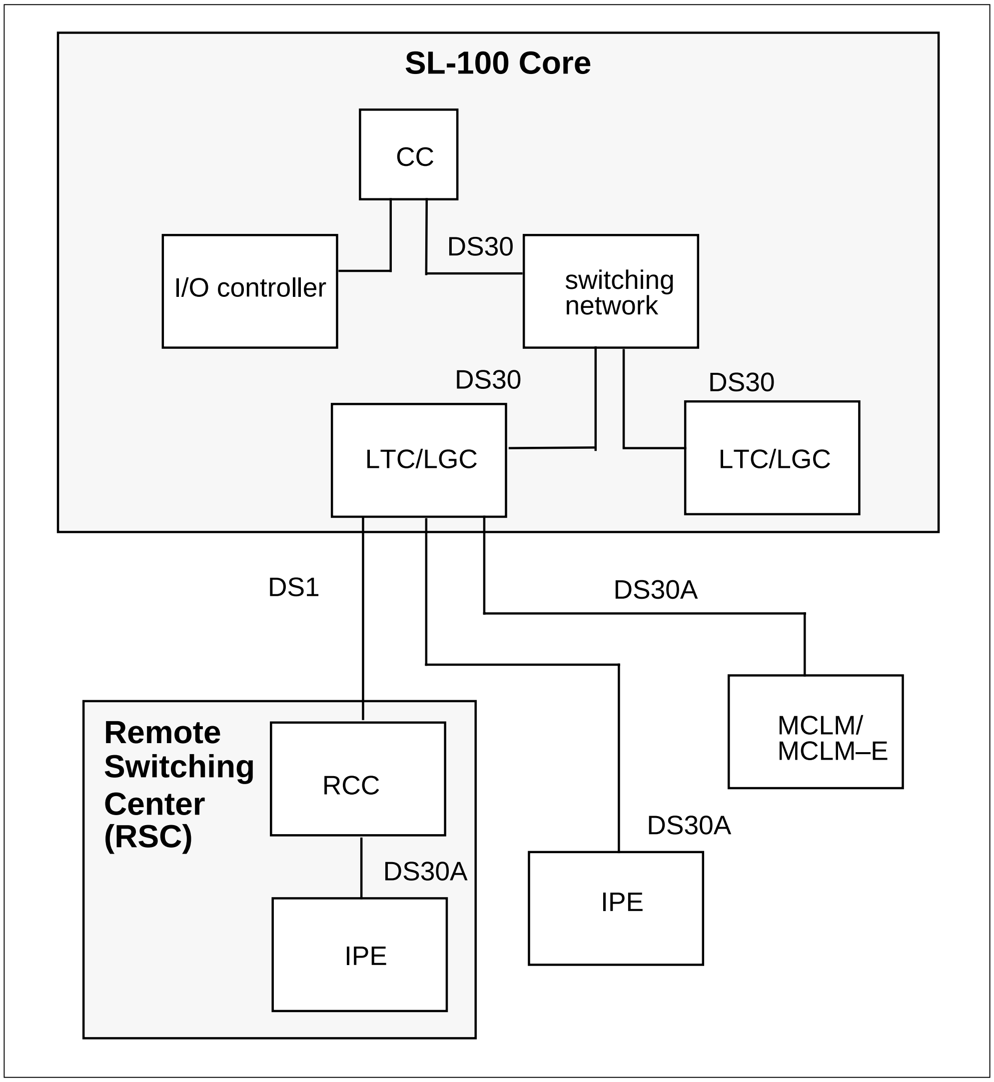
Note: MCAM has been manufacture discontinued but is still supported in the field.

IPE in remote switching center (RSC)

A line group controller and line trunk controller (LGC/LTC) provides low-level call processing functions such as switchhook supervision, A/B bit supervision, digit collection, and tone generation. It has interface cards to support DS1 and DS30A lines. An LTC can support any combination of a local IPE shelf, remote cluster controller (RCC), or remote cluster controller 2 (RCC2). An RCC is basically a remote LTC that performs the same functions as a local LTC, but with emergency standalone (ESA) and intraswitching capability for remote applications. It interfaces to the local LTC by DS1 links.

The figure that follows shows the interfaces of IPEs (one IPE is in a remote switching center) to the LTC/LGC controller.

Figure 2 IPE in remote switching center (RSC)



IPE with Meridian Cabinet Remote Module - SONET

The Meridian cabinet remote module-SONET (MCRM-S), along with the IPE, serves as the dual cabinet start-up for applications requiring non-ISDN lines. The dual cabinet design supports external interfaces for DS1. The power distribution panel (PDP) in the bottom of the MCRM-S can power the IPE. Powering the IPE off of the MCRM-S eliminates the need for another power cabinet at the remote location. The PDP can power two or three fully configured IPE columns. Figure "Provisioning an IPEC" on page -13 shows an example of a remote configuration with an MCRM-S and two fully configured IPE columns. Figure "Provisioning an IPEC" on page -14 shows a block diagram of the link between an MCRM-S and other remotes, including the IPE.

Refer to *Commercial Systems Translations Guide*, or the *Defense Switched Network Translations Guide*, for additional information on the MCRM-S and its applications.

Figure 3 Typical MCRM-S/IPE remote configuration

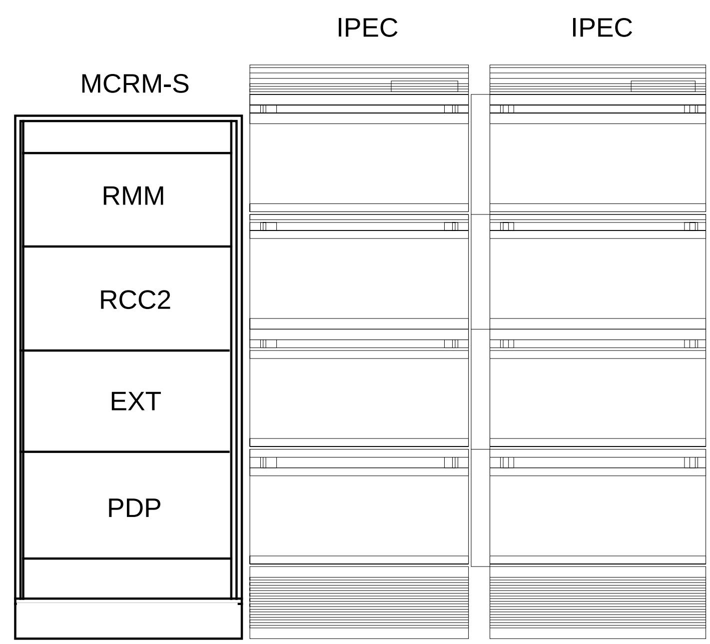
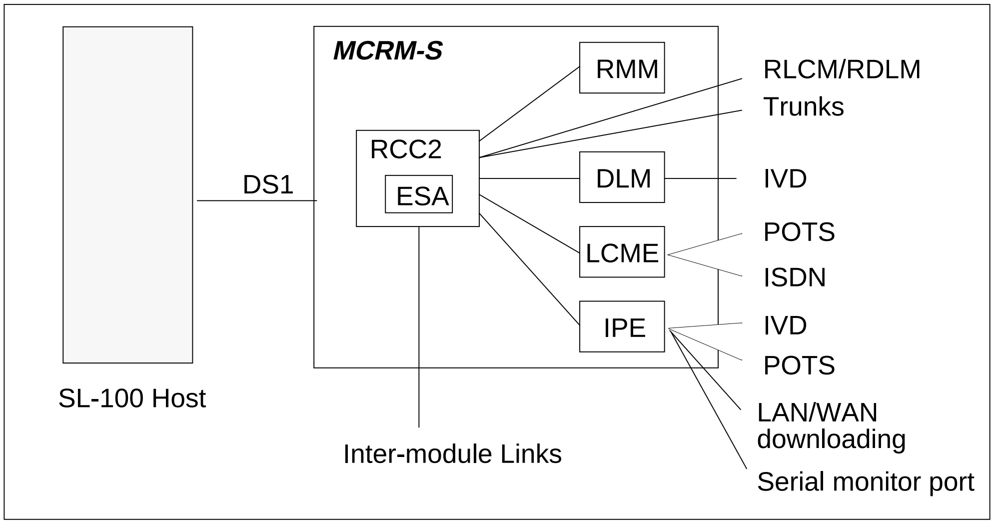


Figure 4 Connection between MCRM-S and remote nodes



Mounting and bracing kits

In some cases, floor mounting or bracing kits are required for extra stability. Installations on raised computer floors do not require mounting kits. However, in earthquake risk areas, cube bracing is required. See the “Installation in earthquake risk areas" section.

Installations in non-earthquake risk areas

For installations on concrete floors in non-earthquake risk areas, the standard concrete floor mounting kit (NT8D64BF) is required. This kit can be used with either the newer (ac/dc) global pedestal or the older pedestal with the NT7D10 dc-powered power distribution unit (PDU).

Installation in earthquake risk areas

For installations on concrete floors in earthquake risk areas, the seismic concrete floor mounting kit (NT8D64BE) is required. For installations on raised computer floors, the following cube bracing kits are required:

- IPECs with two modules require cube bracing kit NT8D64CA
- IPECs with three modules require cube bracing kit NT8D64CB
- IPECs with three modules require cube bracing kit NT8D64CC
- existing installations of two or three modules require cube bracing expansion kit NT8D64CD when one additional module is added

Note: These kits require the newer ac/dc global pedestal.

4 Cabling specifications

This section provides an overview of the cabling requirements for the Intelligent Peripheral Equipment Column (IPEC). It includes connections to external power sources, internal power distribution, Extended System Monitor (XSM) alarms cabling, switchboard cabling, ground cabling, and cabling card cage modules.

Power cable requirements

An IPEC is powered by an external -48 V dc power supply. The Meridian Power Distribution Center (MPDC) provides dc power to the IPE lineup, which is separate from the standard SL-100 cabinet lineup. Power feeder cables (#6 AWG wire) between the MPDC and the IPEC must not exceed 52 feet.

Terminating equipment power feeders and returns

Terminating equipment power feeders and returns for the IPEC and for the Meridian Power Distribution Center (MPDC) are described and illustrated below.

IPEC

Direct current (dc) power for the pedestal (NT7D09CA) provides circuit protection of 30 amps for BAT0 and BAT1 feeds and 30 amps for BAT2 and BAT3 feeds (see "Direct current power distribution" on page 4-2).

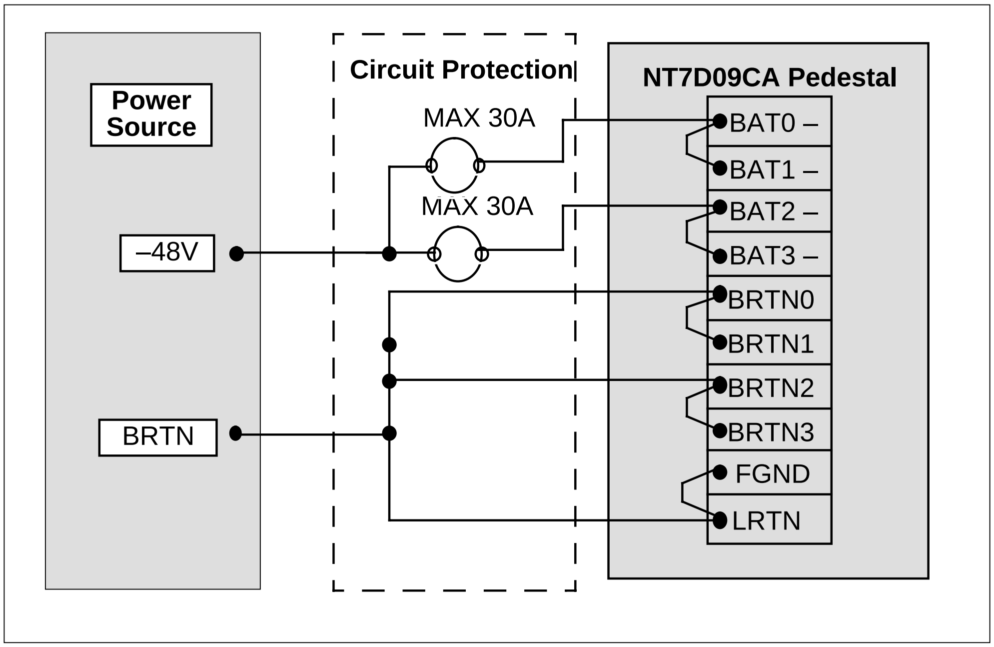
The -BAT (-48 V dc cable) wiring from the MPDC connects to terminal block TB1 in the bottom of the pedestal. One #6 AWG wire feeds -48 V dc to two IPEs, a total of two wires for BAT connections (see "Terminal Block Harness (TB1) wiring diagram" on page 4-3).

- IPE 0 and IPE 1 are connected to BAT 0/1 (-48 V dc[A])
- IPE 2 and IPE 3 are connected to BAT 2/3 (-48 V dc[B])

The BAT RTN (48 V dc cable) wiring from the MPDC connects to terminal block TB1 in the bottom of the pedestal. One #6 AWG wire feeds +48 V dc to two IPEs, a total of two wires for BAT RTN connections (see "Terminal Block Harness (TB1) wiring diagram" on page 4-3).

- IPE 0 and IPE 1 are connected to BAT RTN 0/1 (BR[A])
- IPE 2 and IPE 3 are connected to BAT RTN 2/3 (BR[B])

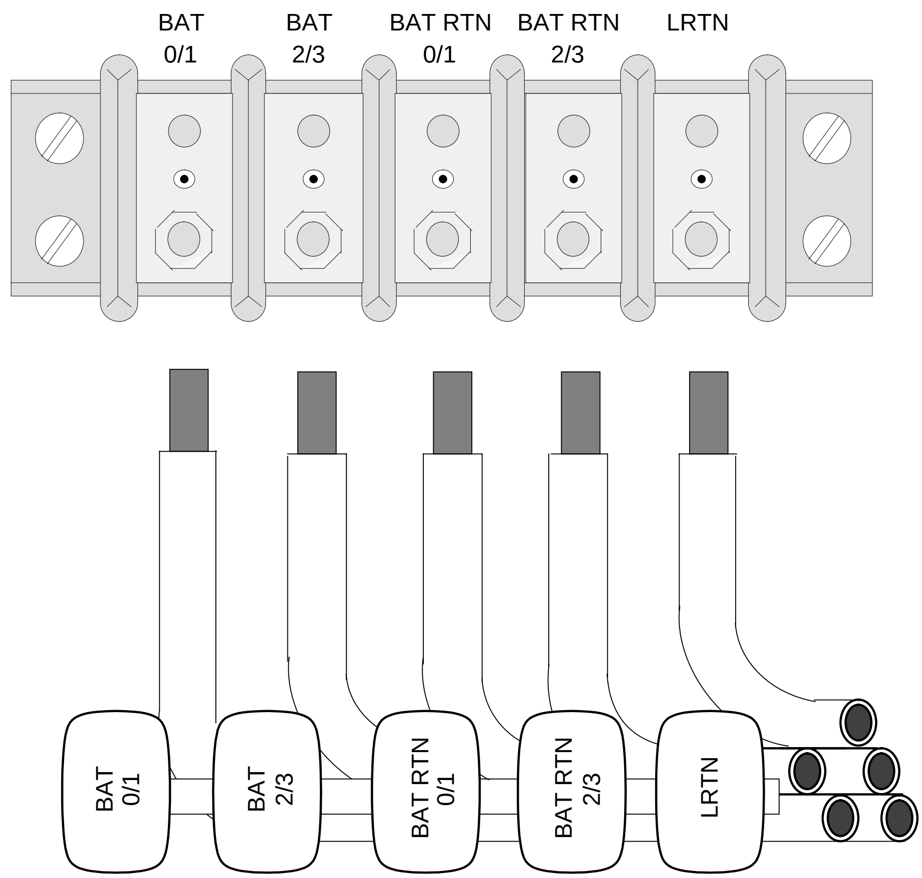
Figure 1 Direct current power distribution



MPDC

The combination of power cable identification and cabinet position defines connection at the Meridian Power Distribution Cabinet (MPDC). Cables with (A) suffix connect to the A-feed of the MPDC and cables with (B) suffix connect to the B-feed. Shelves 0 and 1 always terminate to the A-feed while shelves 2 and 3 always terminate to the B-feed.

Figure 2 Terminal Block Harness (TB1) wiring diagram



Field-made connections to PDC with #6 AWG cable

The following table describes cable designations for the IPEC and the MPDC.

Table 1 Cabling for the IPEC and MPDC **(Sheet 1 of 2)**

Cable Designation	IPEC Position	MPDC Connection
-48 V dc (A)	XX	Fuse 00 on A fuse panel
-48 V dc (B)	XX	Fuse 00 on B fuse panel
BR (A)	XX	Position 00 on row A of BRTN plate
BR (B)	XX	Position 00 on row B of BRTN plate
-48 V dc (A)	YY	Fuse (NEXT or LAST) on A fuse panel

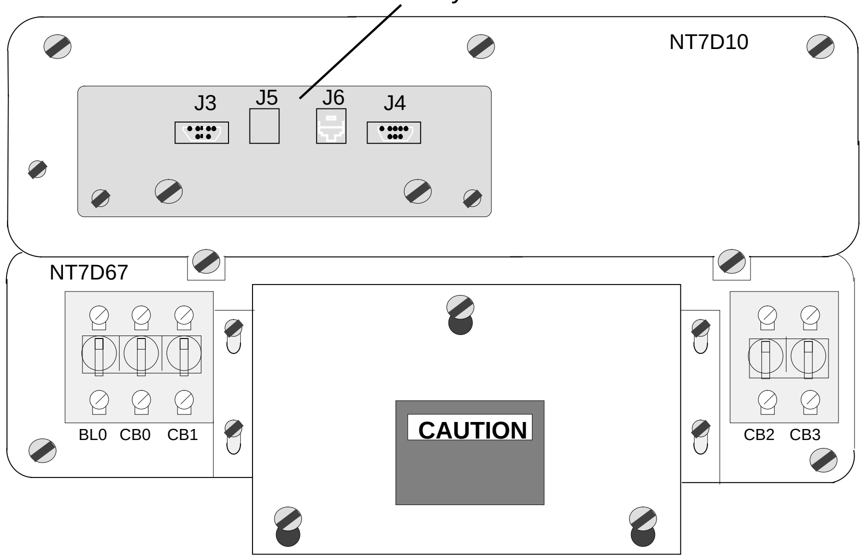
Table 1 Cabling for the IPEC and MPDC **(Sheet 2 of 2)**

Cable Designation	IPEC Position	MPDC Connection
-48 V dc (B)	YY	Fuse (NEXT or LAST) on B fuse panel
BR (A)	YY	Position (NEXT or LAST) on row A of BRTN plate
BR (B)	YY	Position (NEXT or LAST) on row B of BRTN plate

Alarm cable requirements

Cabling of the Extended System Monitor (XSM, NT8D22) when two or more IPECs are configured together is described and illustrated in this subsection. The XSM is located inside the rear of each IPEC pedestal (see figure "Location of the Extended System Monitor (XSM)" on page 4-4).

Figure 3 Location of the Extended System Monitor (XSM)



One XSM, usually in the first IPEC, is designated as the master system monitor. All other XSMs located in the remaining columns are designated as slave system monitors. DIP switches (also called option switches) are set in the XSM to establish the master/slave relationship.

Cabling for XSM alarms

For multi-column installations with adjacent columns, the master XSM is connected with an NT8D46AL cable from connector J6 to connector J5 on the XSM of the adjacent column.

In multi-column installations where the columns are not adjacent, the XSM is connected with an NT8D46AL or NT8D46AP cable from connector J6 to connector J5.

The following tables list the terminating sequence and color assignments for XSM cables.

Table 4-2 Pin assignments for NT8D46FH (J3 external alarm cable)

Pin number	Color	Designation at MDF
1	BL/WT	REMALMA
2	OR/WT	REMALMB
3	GR/WT	NA
4	BR/WT	NA
5	SL/WT	NA
6	BL/RD	NA
7	WT/BL	Not used
8	WT/OR	Not used
9	WT/GR	GND

Table 4-3 Pin assignments for NT8D46AL and NT8D46AP (J5 /J6 XSM) (Sheet 1 of 2)

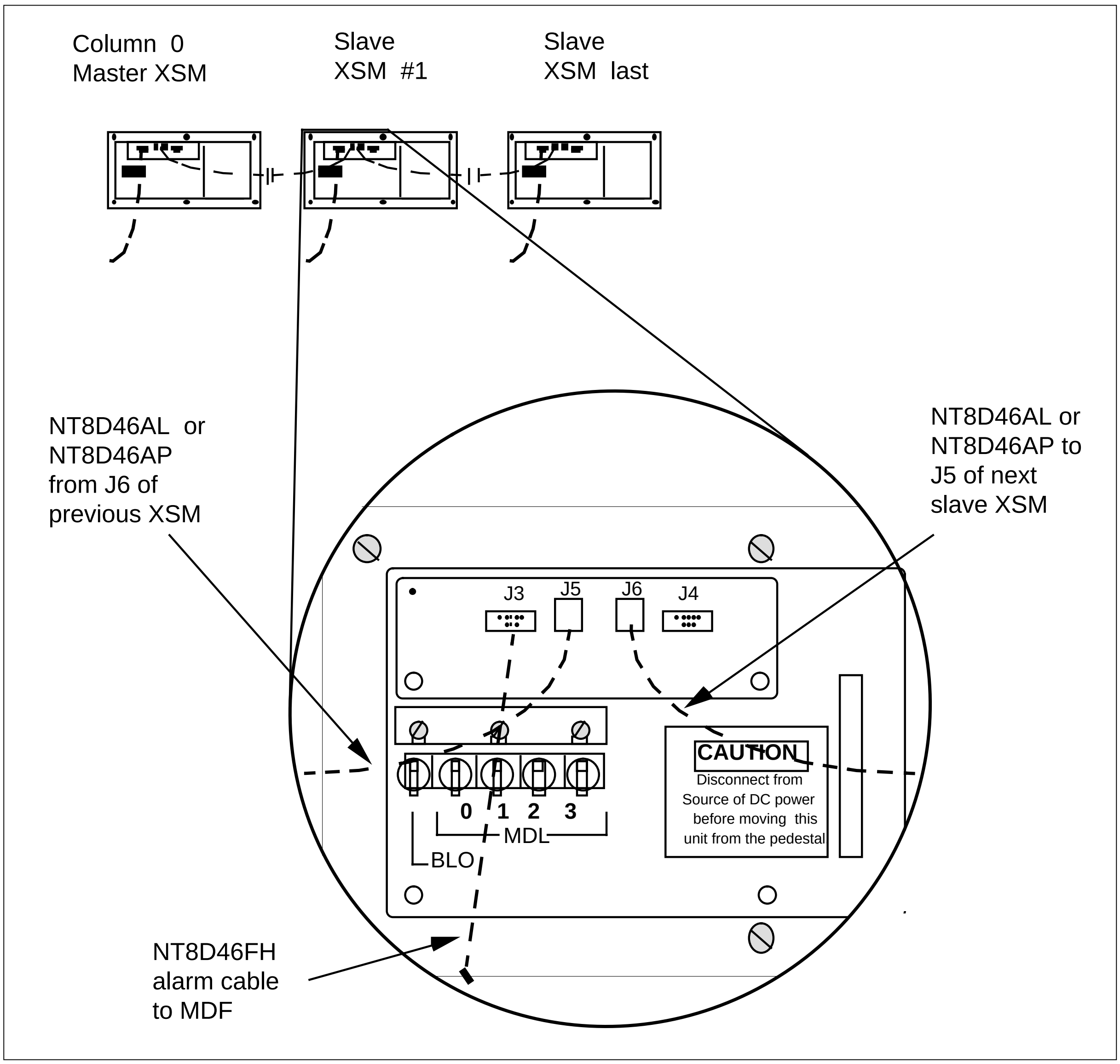
Pin number	Color	Designation
1	BL/WT	DCON 0
2	OR/WT	DCON 1
3	GR/WT	DCON 2
4	BR/WT	DCON 3
5	SL/WT	Alarm
6	BL/RD	Not used
7	WT/BL	Trip

Table 4-3 Pin assignments for NT8D46AL and NT8D46AP (J5 /J6 XSM) (Sheet 2 of 2)

Pin number	Color	Designation
8	WT/OR	Not used
9	WT/GR	Not used

Figure 4, "Cabling specifications" on page -1 Figure 4, "XSM connections for multi-column systems" on page 4-6 provides a detailed illustration of the XSM connections for multi-column systems.

Figure 4-4 XSM connections for multi-column systems



Setting XSM option DIP switches

Each XSM is equipped with option DIP switches that indicate whether the XSM is a master or slave, the number (address) of the column in which it is located, and other options.

To set or reset the switches, remove the rear grill, disconnect cables to J3, J5, and J6 (if necessary), loosen the two retaining screws securing the XSM to the PDU, and remove the XSM circuit pack. The switches are located on the component side of the assembly.

The following tables describe the XSM switch settings:

- "XSM SW1 option settings (master or slave)" on page 4-7 describes the switch settings for SW1 on the XSM (master or slave).
- "XSM SW2 option settings (master only)" on page 4-8 describes the switch settings for SW2 on a master XSM.
- "XSM SW2 option settings (slave only)" on page 4-8 describes the switch settings for SW2 on slave XSMs.
- "XSM SW3 option settings" on page 4-9 shows the switch settings for SW3 on the XSM (master or slave).

Note: For the option switch settings to record the number of slaves connected to an XSM, refer to table "Settings for total number of slaves - SW 2 on master XSM" on page 4-9 and table "Settings for slave address - SW2 on slave XSM" on page 4-12. If the XSM being configured is a master, use table "Settings for total number of slaves - SW 2 on master XSM" on page 4-9; if it is configured as a slave, use table "Settings for slave address - SW2 on slave XSM" on page 4-12.

Table 4-4 XSM SW1 option settings (master or slave) (Sheet 1 of 2)

SW1 DIP Switch	Meaning of Setting(ON = 0 OFF = 1)	Bit Position:
Switch 1	(XSM is not in the same IPEC as the CC)	1-ON
Switch 2	(IPECs only contain IPE modules)	2-OFF
Switch 3	(IPEC power is from DC source)	3-ON
Switch 4	*(Not used)*	4-ON

Table 4-4 XSM SW1 option settings (master or slave) (Sheet 2 of 2)

SW1 DIP Switch	Meaning of Setting(ON = 0 OFF = 1)	Bit Position:
Switch 5	*(Not used)*	5-ON
Switch 6	*(Not used)*	6-ON
Switch 7	(IPECs only contain IPE modules)	7-ON
Switch 8	(IPECs only contain IPE modules)	1-ON

Table 4-5 XSM SW2 option settings (master only)

SW2 DIP Switch	Meaning of Setting(ON = 0 OFF = 1)	Bit Position:
Switch 1	Master XSM	1-ON
Switch 1	IPECs only contain IPE modules	2-ON
Switch 3	Switches 3 through 8 contain a binary value of the number of slaves connected. Position 8 is the least significant bit and the rightmost switch (see Table 4-7).	3-X
Switch 4		4-X
Switch 5		5-X
Switch 6		6-X
Switch 7		7-X
Switch 8		1-X

Table 4-6 XSM SW2 option settings (slave only) (Sheet 1 of 2)

SW2 DIP Switch	Meaning of Setting(ON = 0 OFF = 1)	Bit Position:
Switch 1	Slave XSM	1-OFF
Switch 1	IPECs only contain IPE modules	2-ON

Table 4-6 XSM SW2 option settings (slave only) (Sheet 2 of 2)

SW2 DIP Switch	Meaning of Setting(ON = 0 OFF = 1)	Bit Position:
Switch 3	Switches 3 through 8 contain a binary value of the number of slaves connected. Position 8 is the least significant bit and the rightmost switch (see Table 4-Table 8, "Settings for total number of slaves - SW 2 on master XSM" on page 4-9).	3-X
Switch 4		4-X
Switch 5		5-X
Switch 6		6-X
Switch 7		7-X
Switch 8		1-X

Table 4-7 XSM SW3 option settings

SW3 DIP Switch	Meaning of Setting	Bit Position:
Switches 1 - 4	Master XSM	1 through 4-On
Switches 1 - 4	Slave XSM	1 through 4-Off

Table 4-8 Settings for total number of slaves - SW 2 on master XSM (Sheet 1 of 4)

Number of slave units	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
0	On	On	On	On	On	On
1	On	On	On	On	On	Off
2	On	On	On	On	Off	On
3	On	On	On	On	Off	Off
4	On	On	On	Off	On	On
5	On	On	On	Off	On	Off
6	On	On	On	Off	Off	On
7	On	On	On	Off	Off	Off
8	On	On	Off	On	On	On
9	On	On	Off	On	On	Off

Table 4-8 Settings for total number of slaves - SW 2 on master XSM (Sheet 2 of 4)

Number of slave units	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
10	On	On	Off	On	Off	On
11	On	On	Off	On	Off	Off
12	On	On	Off	Off	On	On
13	On	On	Off	Off	On	Off
14	On	On	Off	Off	Off	On
15	On	On	Off	Off	Off	Off
16	On	Off	On	On	On	On
17	On	Off	On	On	On	Off
18	On	Off	On	On	Off	On
19	On	Off	On	On	Off	Off
20	On	Off	On	Off	On	On
21	On	Off	On	Off	On	Off
22	On	Off	On	Off	Off	On
23	On	Off	On	Off	Off	Off
24	On	Off	Off	On	On	On
25	On	Off	Off	On	On	Off
26	On	Off	Off	On	Off	On
27	On	Off	Off	On	Off	Off
28	On	Off	Off	Off	On	On
29	On	Off	Off	Off	On	Off
30	On	Off	Off	Off	Off	On
31	On	Off	Off	Off	Off	Off
32	Off	On	On	On	On	On
33	Off	On	On	On	On	Off

Table 4-8 Settings for total number of slaves - SW 2 on master XSM (Sheet 3 of 4)

Number of slave units	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
34	Off	On	On	On	Off	On
35	Off	On	On	On	Off	Off
36	Off	On	On	Off	On	On
37	Off	On	On	Off	On	Off
38	Off	On	On	Off	Off	On
39	Off	On	On	Off	Off	Off
40	Off	On	Off	On	On	On
41	Off	On	Off	On	On	Off
42	Off	On	Off	On	Off	On
43	Off	On	Off	On	Off	Off
44	Off	On	Off	Off	On	On
45	Off	On	Off	Off	On	Off
47	Off	On	Off	Off	Off	Off
48	Off	Off	On	On	On	On
49	Off	Off	On	On	On	Off
50	Off	Off	On	On	Off	On
51	Off	Off	On	On	Off	Off
52	Off	Off	On	Off	On	On
53	Off	Off	On	Off	On	Off
54	Off	Off	On	Off	Off	On
55	Off	Off	On	Off	Off	Off
56	Off	Off	Off	On	On	On
57	Off	Off	Off	On	On	Off
58	Off	Off	Off	On	Off	On

Table 4-8 Settings for total number of slaves - SW 2 on master XSM (Sheet 4 of 4)

Number of slave units	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
59	Off	Off	On	Off	Off	Off
60	Off	Off	Off	Off	On	On
61	Off	Off	Off	Off	On	Off
62	Off	Off	Off	Off	Off	On
63	Off	Off	Off	Off	Off	Off

Table 4-9 Settings for slave address - SW2 on slave XSM (Sheet 1 of 3)

Slave unit	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
1	On	On	On	On	On	Off
2	On	On	On	On	Off	On
3	On	On	On	On	Off	Off
4	On	On	On	Off	On	On
5	On	On	On	Off	On	Off
6	On	On	On	Off	Off	On
7	On	On	On	Off	Off	Off
8	On	On	Off	On	On	On
9	On	On	Off	On	On	Off
10	On	On	Off	On	Off	On
11	On	On	Off	On	Off	Off
12	On	On	Off	Off	On	On
13	On	On	Off	Off	On	Off
14	On	On	Off	Off	Off	On
15	On	On	Off	Off	Off	Off

Table 4-9 Settings for slave address - SW2 on slave XSM (Sheet 2 of 3)

Slave unit	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
16	On	Off	On	On	On	On
17	On	Off	On	On	On	Off
18	On	Off	On	On	Off	On
19	On	Off	On	On	Off	Off
20	On	Off	On	Off	On	On
21	On	Off	On	Off	On	Off
22	On	Off	On	Off	Off	On
23	On	Off	On	Off	Off	Off
24	On	Off	Off	On	On	On
25	On	Off	Off	On	On	Off
26	On	Off	Off	On	Off	On
27	On	Off	Off	On	Off	Off
28	On	Off	Off	Off	On	On
29	On	Off	Off	Off	On	Off
30	On	Off	Off	Off	Off	On
31	On	Off	Off	Off	Off	Off
32	Off	On	On	On	On	On
33	Off	On	On	On	On	Off
34	Off	On	On	On	Off	On
35	Off	On	On	On	Off	Off
36	Off	On	On	Off	On	On
37	Off	On	On	Off	On	Off
38	Off	On	On	Off	Off	On
39	Off	On	On	Off	Off	Off
40	Off	On	Off	On	On	On

Table 4-9 Settings for slave address - SW2 on slave XSM (Sheet 3 of 3)

Slave unit	Switch position:					
	3	**4**	**5**	**6**	**7**	**8**
41	Off	On	Off	On	On	Off
42	Off	On	Off	On	Off	On
43	Off	On	Off	On	Off	Off
44	Off	On	Off	Off	On	On
45	Off	On	Off	Off	On	Off
47	Off	On	Off	Off	Off	Off
48	Off	Off	On	On	On	On
49	Off	Off	On	On	On	Off
50	Off	Off	On	On	Off	On
51	Off	Off	On	On	Off	Off
52	Off	Off	On	Off	On	On
53	Off	Off	On	Off	On	Off
54	Off	Off	On	Off	Off	On
55	Off	Off	On	Off	Off	Off
56	Off	Off	Off	On	On	On
57	Off	Off	Off	On	On	Off
58	Off	Off	Off	On	Off	On
59	Off	Off	Off	On	Off	Off
60	Off	Off	Off	Off	On	On
61	Off	Off	Off	Off	On	Off
62	Off	Off	Off	Off	Off	On
63	Off	Off	Off	Off	Off	Off

Switchboard cabling requirements

Cabling for the IPE must meet the requirements specified in the sections that follow.

DS30A links

The DS30A cable between the Meridian Cabinetized Trunk Module (MCTM) and the IPEC must not be longer than 45 feet. The shield of the DS30A cable is terminated at both ends by the connector hoods to the CHASGND (chassis ground). For overhead cabling applications, a replacement rear grill must be ordered. The Top Cap Rear Grill (PO699851) allows overhead cable entry to the IPEC.

IPE to MCTM, MCRM, MNET, and MLNK

The IPE is connected to the Meridian Cabinet Trunk Module (MCTM) or Meridian Cabinet Trunk Module ISDN (MCTM-I), Meridian Cabinet Remote Module (MCRM) or Meridian Cabinet Remote Module Sonet (MCRM-S), Meridian Network Controller Module (MNET), and Meridian Cabinet Link Module (MLNK) by an NTNX36DR cable. One cable is required for two to four links and two cables for five to six links. (MNET and MLNK cabinets apply to the Meridian SL-100 Compact system.)

> ***Note 1:*** MCTM, MCRM, MNET, and MLNK have been manufacture discontinued but are still supported in the field.
>
> ***Note 2:*** The Meridian Cabinetized Trunk Module ISDN (MCTM-I) will be referred to as MCTM throughout the remainder of this document.

One cable is connected to connector J2 on the Electromagnetic Interference (EMI) cable duct of the IPEC for each module and the second NTNX36DR cable is connected to connector J3 on the bulkhead of the IPEC.

The NTNX36DR connects to the EMI cable ducts of the MCTM, MCRM/MCRM-S, MNET, and MLNK cabinets, respectively.

The following table shows cable PEC and MCTM, MCRM, MNET, MLINK connectivity for 6-port cables and bulkhead connections.

Table 4-10 Port Cables and Bulkhead Connections (Sheet 1 of 2)

Cable PEC	Connector Designation
NTNX1750	P00-P11
NTNX3305	0P0
NTNX3307	1P0
NTNX3313	0P1
NTNX3314	0P2
NTNX3315	0P3

Table 4-10 Port Cables and Bulkhead Connections (Sheet 2 of 2)

Cable PEC	Connector Designation
NTXN3319	1P1
NTNX3320	1P2
NTXN3321	1P3

The following table shows cable connectivity for 4-port cables and bulkhead connections.

Table 4-11 Port Cables and Bulkhead Connections

Cable PEC	Connector Designation
NTNX1750	P00-P11
NTNX3306	0P4
NTNX3308	1P4
NTNX3316	0P5
NTNX3317	0P6
NTNX3318	0P7
NTXN3322	1P5
NTNX3323	1P6
NTXN3324	1P7

> ***Note:*** The 6-port cables listed in "Port Cables and Bulkhead Connections" on page 4-15 can be used in addition to the 4-port cables listed in the preceding table.

Ethernet Connection from NT7D07BA controller card

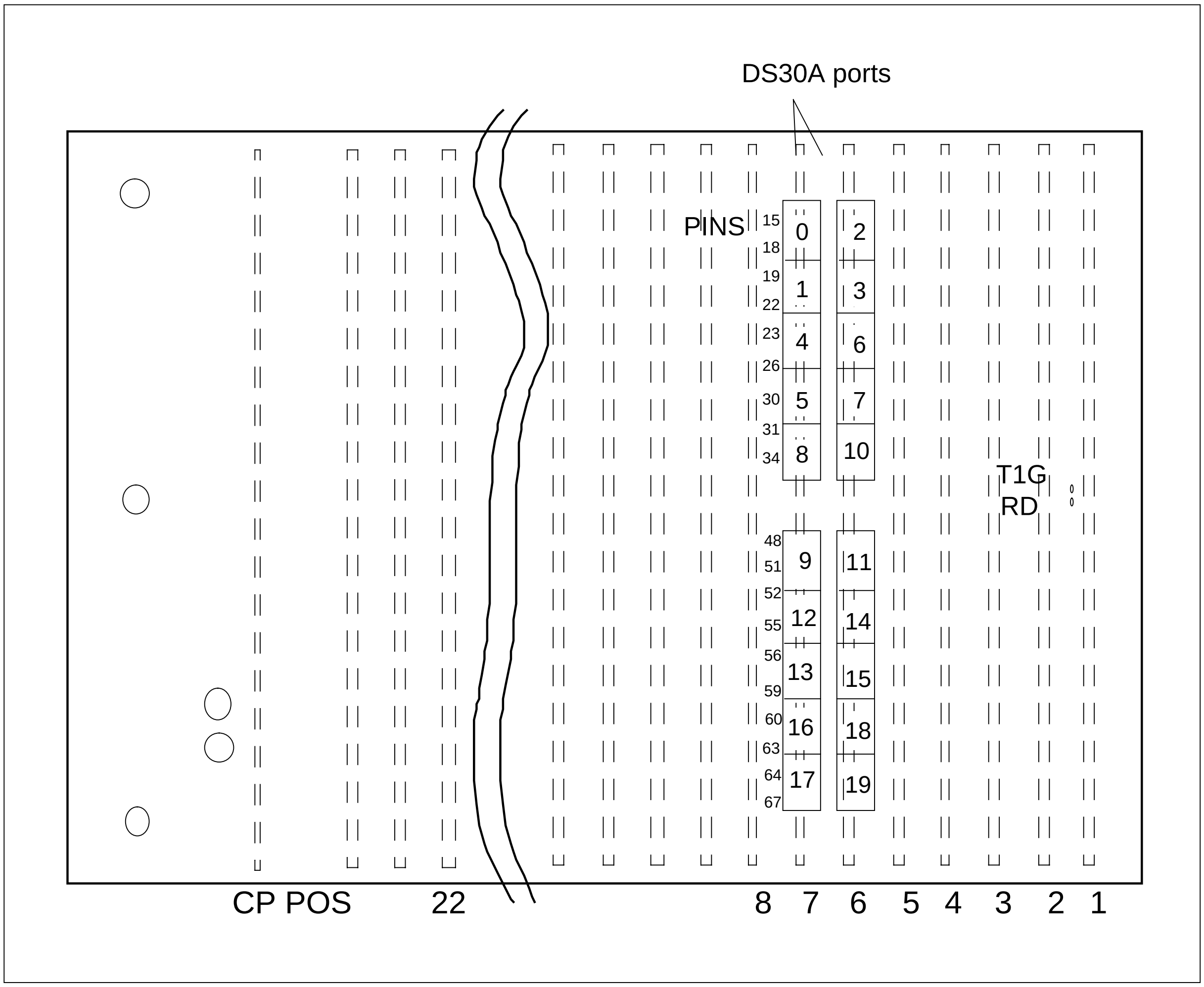
The Ethernet connection to the LAN or WAN is from the front of the NT7D07BA controller card to the back of the bulkhead and then to the J4 connector. The NT5D45AA cable is installed with the IPE shelves when delivered to the site. Customers upgrading NT7D07AC to NT7D07BA will have a cable and bulkhead connector shipped together. Installers will then connect their LAN to the bulkhead of the IPE shelf.

Main Distribution Frame (MDF) cabling

Tip and ring connections are cabled from the IPE modules to the connectors on the EMI cable duct. Twelve NTNX36AT cables are connected from the IPE EMI cable duct to the MDF.

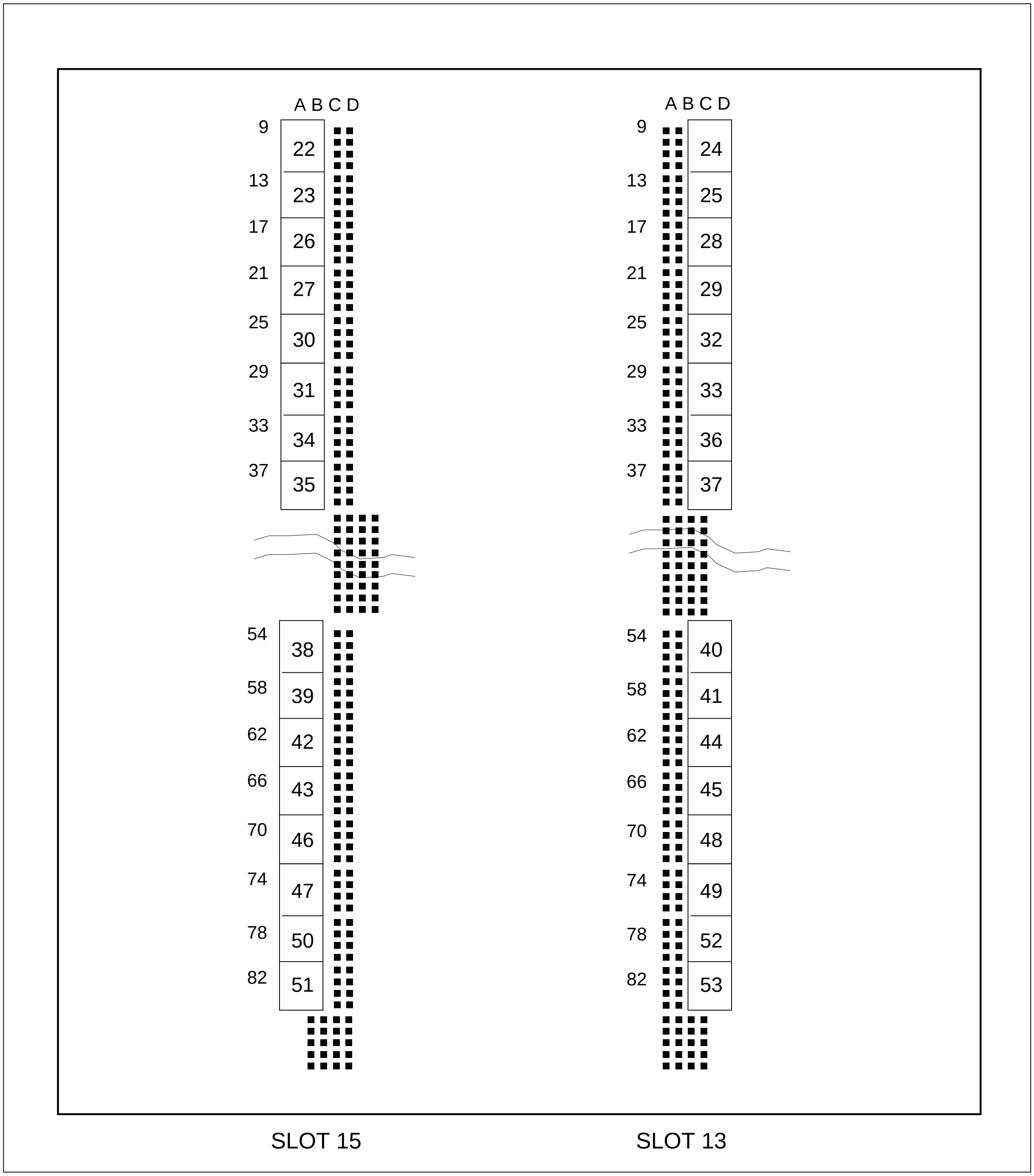
The following figure illustrates the MCTM DS30A port locations.

Figure 4-5 MCTM shelf backplane 20 DS30A port location



The following figure illutrates the MCRM-S DS30A port locations.

Figure 6 MCRM-S shelf backplane 32 DS30A port location



The following table describes the DS30A port locations on MCTM shelf backplane.

Table 4-12 DS30A port locations on MCTM, MCRM, MNET, and MLNK shelf backplane

Port	Position	Pins
0	7	15, 16, 17, 18
1	7	19, 20, 21, 22
2	6	15, 16, 17, 18
3	6	19, 20, 21, 22
4	7	23, 24, 25, 26
5	7	27, 28, 29, 30
6	6	23, 24, 25, 26
7	6	27, 28, 29, 30
8	7	31, 32, 33, 34
9	7	48, 49, 50, 51
10	6	31, 32, 33, 34
11	6	48, 49, 50, 51
12	7	52, 53, 54, 55
13	7	56, 57, 58, 59
14	6	52, 53, 54, 55
15	6	56, 57, 58, 59
16	7	60, 61, 62, 63
17	7	64, 65, 66, 67
18	6	60, 61, 62, 63
19	6	64, 65, 66, 67

Table 4, "Cabling specifications" on page -1 Table 13, "IPE DS-30A port connections" on page 4-20 lists the connectors of the internal cable that correspond to the IPE DS30A links.

Table 4-13 IPE DS-30A port connections

Cable Connector	IPE Port
A	0
B	1
C	2
D	3
E	4
F	5

The following table describes the DS30A port locations on MCRM-S shelf backplane.

Table 4-14 DS30A port locations on MCRM-S shelf backplane (Sheet 1 of 2)

Port	Card Slot	Pins	
22	13	9, 10, 11, 12	A, B
23	13	13, 14, 15, 16	A, B
24	15	9, 10, 11, 12	C, D
25	15	13, 14, 15, 16	C, D
26	13	17, 18, 19, 20	A, B
27	13	21, 22, 23, 24	A, B
28	15	17, 18, 19, 20	C, D
29	15	21, 22, 23, 24	C, D
30	13	25, 26, 27, 28	A, B
31	13	29, 30, 31, 32	A, B
32	15	25, 26, 27, 28	C, D
33	15	29, 30, 31, 32	C, D
34	13	33, 34, 35, 36	A, B

Table 4-14 DS30A port locations on MCRM-S shelf backplane (Sheet 2 of 2)

Port	Card Slot	Pins	
35	13	37, 38, 39, 40	A, B
36	15	33, 34, 35, 36	C, D
37	15	37, 38, 39, 40	C, D
38	13	54, 55, 56, 57	A, B
39	13	58, 59, 60, 61	A, B
40	15	54, 55, 56, 57	C, D
41	15	58, 59, 60, 61	C, D
42	13	62, 63, 64, 65	A, B
43	13	66, 67, 68, 69	A, B
44	15	62, 63, 64, 65	C, D
45	15	66, 67, 68, 69	C, D
46	13	70, 71, 72, 73	A, B
47	13	74, 75, 76, 77	A, B
48	15	70, 71, 72, 73	C, D
49	15	74, 75, 76, 77	C, D
50	13	78, 79, 80, 81	A, B
51	13	82, 83, 84, 85	A, B
52	15	78, 79, 80, 81	C, D
53	15	82, 83, 84, 85	C, D

Ground cabling

The frame ground cabling and the logic return cabling are described and illustrated in this subsection.

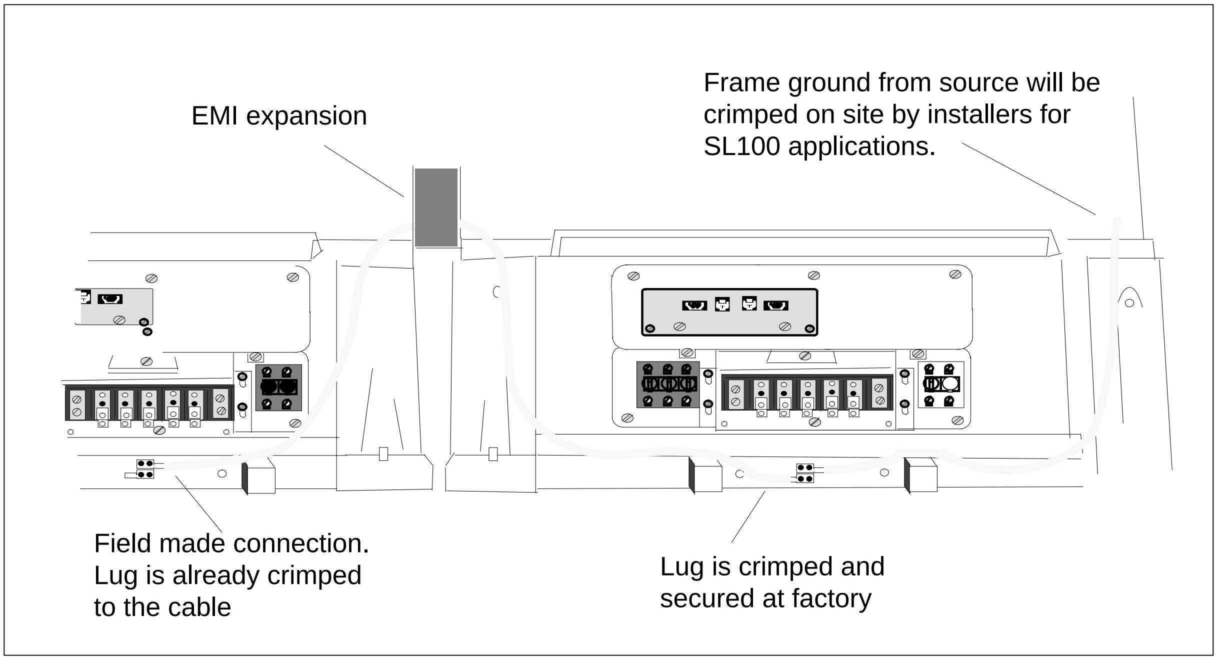
Frame Ground (FGND) cabling

The Frame Ground (FGND) cabling connects a #6 AWG wire between the ground source, typically the Frame Ground Equalizer (FGE) or Single Point Ground (SPG), and the ground lug on the rear of the first IPEC. Ground lugs from each pedestal are connected together in a daisy-chain arrangement using

#6 AWG wire. The FGND cable connects the SPG/FGE to the FGND stud located in the MPDC.

The following figure illustrates the ground wire connection for multiple cabinet and column lineup.

Figure 4-7 Ground wire connection for multiple cabinet and column lineup

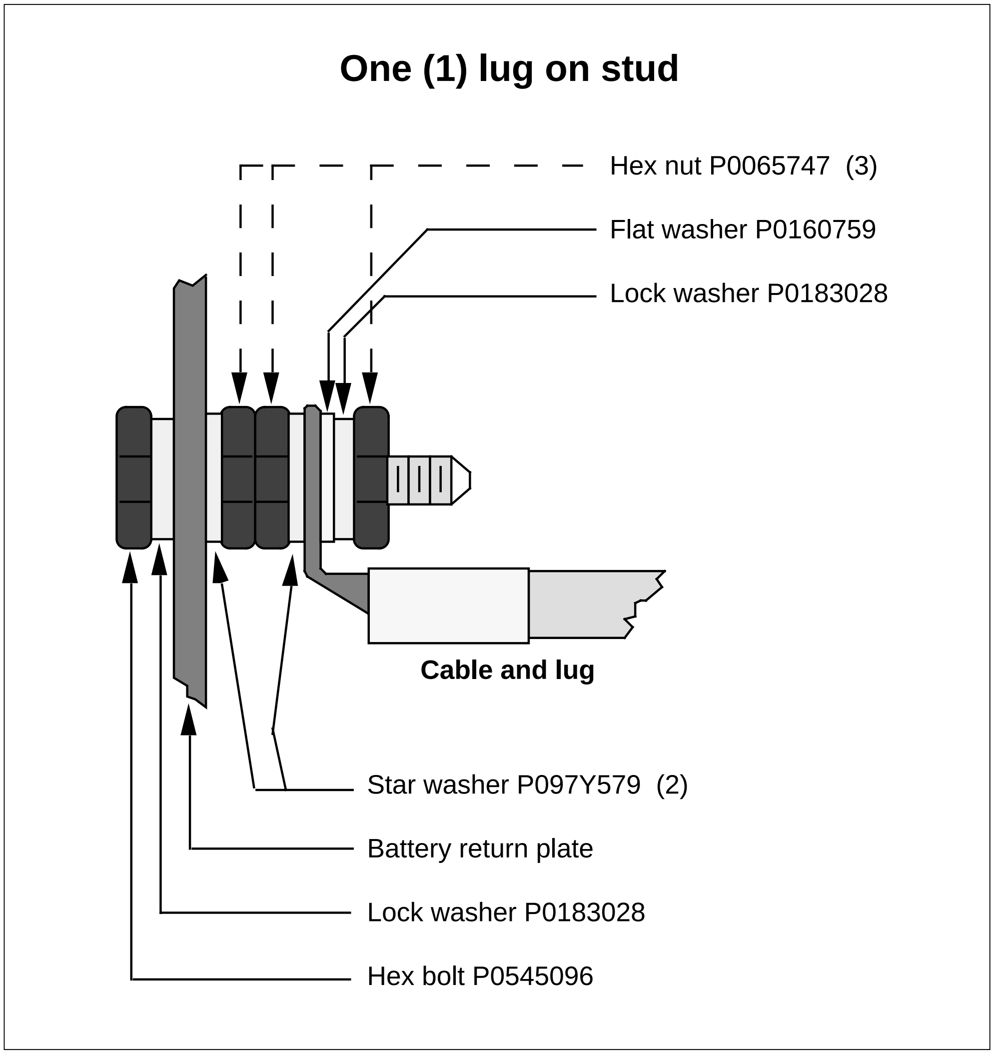


Logic return cabling

All IPECs have home run logic return cables connected to the MPDC battery return plate.

The following figure illustrates the connection between the logic return cable and battery return plate.

Figure 8 Connecting logic return cable to battery return plate



Cabling card cage modules to the cross-connect terminal

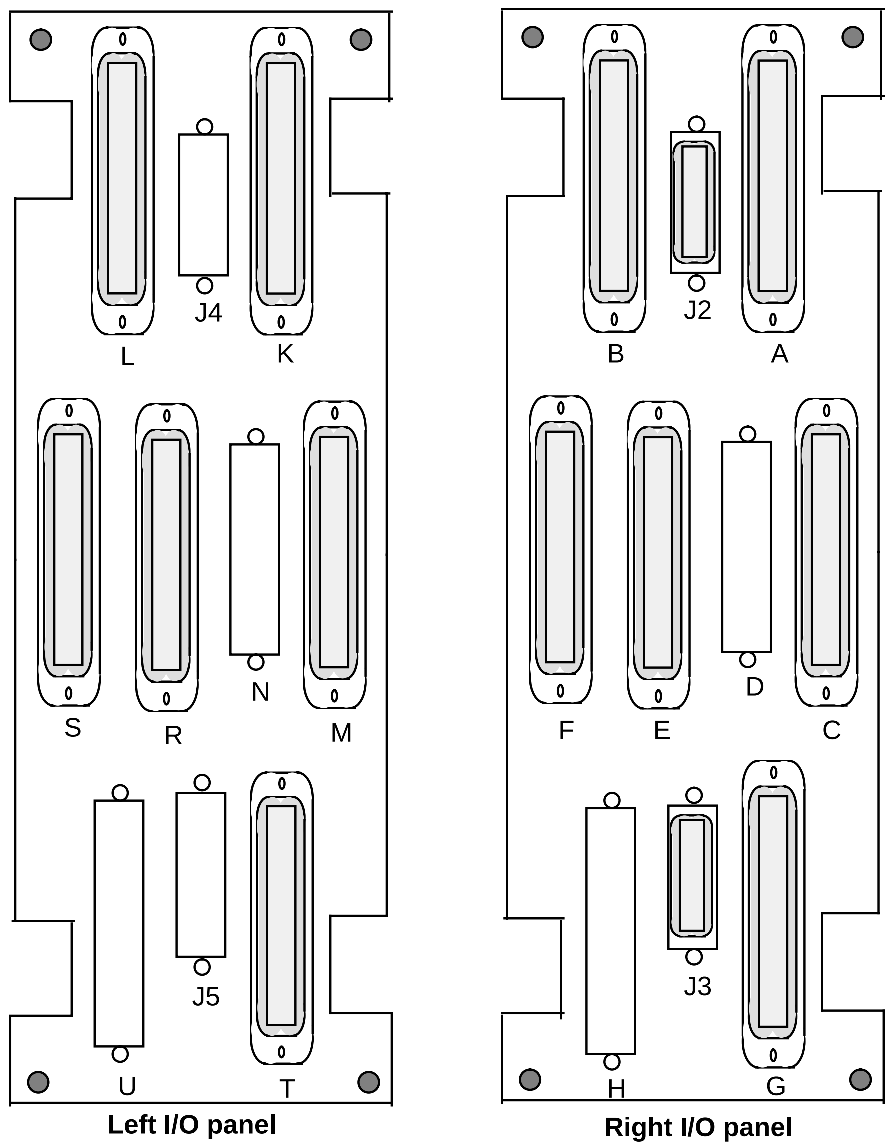
Each cardcage (NT8D37) module is equipped with a series of connectors mounted on the I/O panel at the rear of the module that extends the pins from the peripheral equipment card slots in the module. These I/O connectors are connected to the cross-connect terminal with NE-A25B type cables.

Figure "IPE input/output panels" on page 4-25 illustrates the left and right I/O connector panels on the rear of the IPE module. Cables D, H, N, and U are not used in the standard 12-cable configuration for the backplane in the NT8D37 IPE module. However, those cables are used in the expanded 16-cable configuration. Figure "NT8D37 backplane cable designations (standard configuration)" on page 4-26 shows the backplane cable designations for the 12-cable standard configuration. Figure "NT8D37 backplane cable designations (expanded configuration)" on page 4-26 shows cable designations for the expanded configuration.

Cabling for each segment can be expanded using one NT8D81AA Cable/Filter Assembly. Cabling for the entire backplane can be expanded using four of the cable/filter assemblies.

> ***Note:*** Backplane slots 0, 4, 8, and 12 (for cables A, E, K, and R) are already fully cabled for 24 pairs, so no change is required to those slots.

Figure 9 IPE input/output panels



Note: Connectors D, H, N, and U are used in the 16-cable, expanded backplane configuration.

Figure 4-10 NT8D37 backplane cable designations (standard configuration)

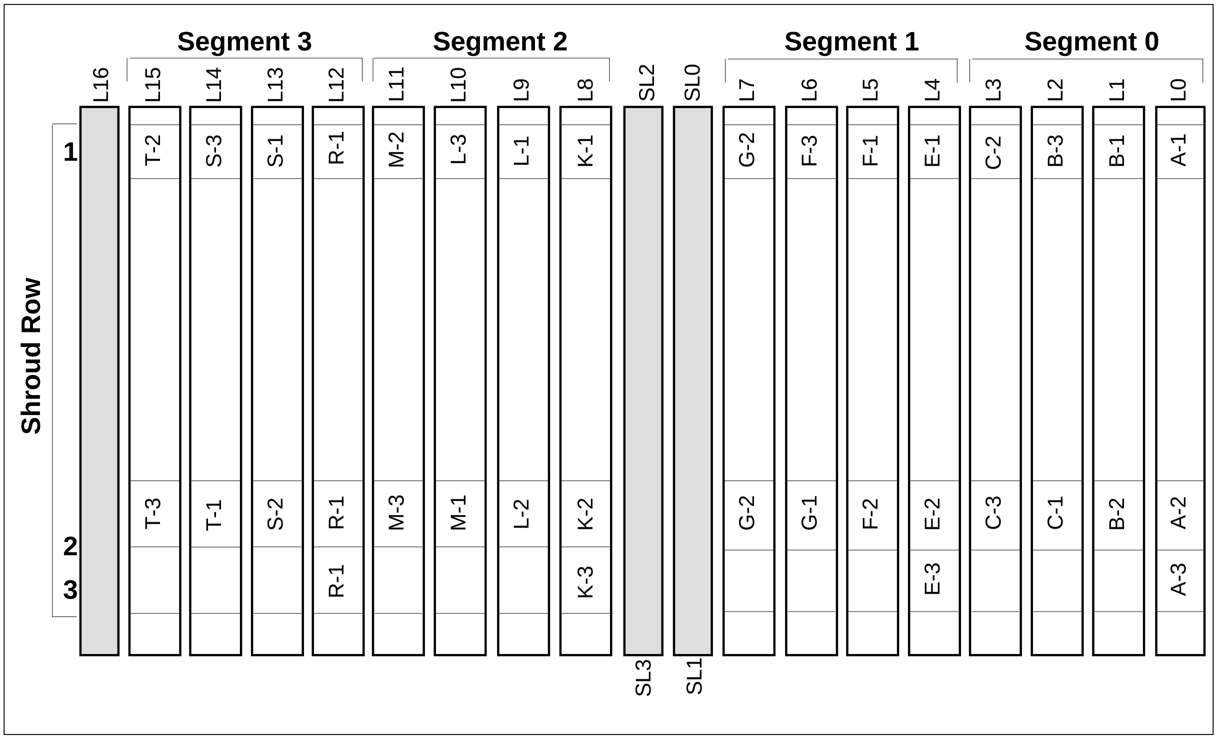
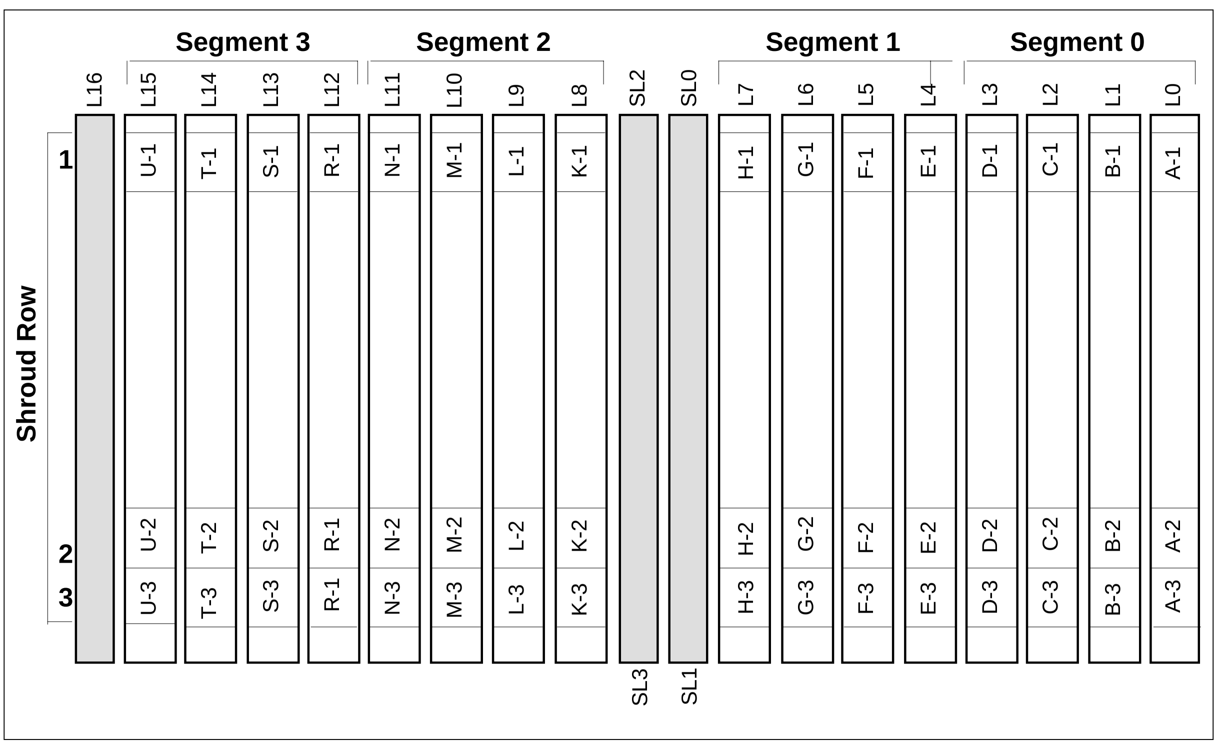


Figure 4-11 NT8D37 backplane cable designations (expanded configuration)



The three tables that follow list the line card pair-terminations for 16-cable expanded configuration.

Table 15 Line card pair-terminations for input/output panel connectors A, E, K, and R **(Sheet 1 of 2)**

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**A**	**E**	**K**	**R**	**Unit No. 16/card**
1T	26	W-BL					0
1R	1	BL-W					
2T	27	W-O					1
2R	2	O-W					
3T	28	W-G					2
3R	3	G-W					
4T	29	W-BR					3
4R	4	BR-W					
5T	30	W-S					4
5R	5	S-W					
6T	31	R-BL	S	S	S	S	5
6R	6	BL-R					
7T	32	R-O	L	L	L	L	6
7R	7	O-R					
8T	33	R-G	O	O	O	O	7
8R	8	G-R					
9T	34	R-BR	T	T	T	T	8
9R	9	BR-R					
10T	35	R-S					9
10R	10	S-R					
11T	36	BK-BL	0	4	8	12	10
11R	11	BL-BK					
12T	37	BK-O					11
12R	12	O-BK					

Table 15 Line card pair-terminations for input/output panel connectors A, E, K, and R **(Sheet 2 of 2)**

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**A**	**E**	**K**	**R**	**Unit No. 16/card**
13T	38	BK-G					12
13R	13	G-BK					
14T	39	BK-BR					13
14R	14	BR-BK					
15T	40	BK-S					14
15R	15	S-BK					
16T	41	Y-BL					15
16R	16	BL-Y					

Table 16 Line card pair-terminations for input/output panel connectors B, F, L, and S **(Sheet 1 of 3)**

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**B**	**F**	**L**	**S**	**Unit No. 16/card**
1T	26	W-BL					0
1R	1	BL-W					
2T	27	W-O					1
2R	2	O-W					
3T	28	W-G					2
3R	3	G-W					
4T	29	W-BR					3
4R	4	BR-W					
5T	30	W-S					4
5R	5	S-W					
6T	31	R-BL	S	S	S	S	5
6R	6	BL-R					

Table 16 Line card pair-terminations for input/output panel connectors B, F, L, and S **(Sheet 2 of 3)**

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**B**	**F**	**L**	**S**	**Unit No. 16/card**
7T	32	R-O	L	L	L	L	6
7R	7	O-R					
8T	33	R-G	O	O	O	O	7
8R	8	G-R					
9T	34	R-BR	T	T	T	T	8
9R	9	BR-R					
10T	35	R-S					9
10R	10	S-R					
11T	36	BK-BL	1	5	9	13	10
11R	11	BL-BK					
12T	37	BK-O					11
12R	12	O-BK					
13T	38	BK-G					12
13R	13	G-BK					
14T	39	BK-BR					13
14R	14	BR-BK					
15T	40	BK-S					14
15R	15	S-BK					
16T	41	Y-BL					15
16R	16	BL-Y					
17T	42	Y-O	S	S	S	S	0
17R	17	O-Y					
18T	43	Y-G	L	L	L	L	1
18R	18	G-Y					
19T	44	Y-BR	O	O	O	O	2
19R	19	BR-Y					

Table 16 Line card pair-terminations for input/output panel connectors B, F, L, and S **(Sheet 3 of 3)**

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**B**	**F**	**L**	**S**	**Unit No. 16/card**
20T	45	Y-S	T	T	T	T	3
20R	20	S-Y					
21T	46	V-BL					4
21R	21	BL-V					
22T	47	V-O	2	6	10	14	5
22R	22	O-V					
23T	48	V-G					6
23R	23	G-V					
24T	49	V-BR					7
24R	24	BR-V					
25R	50	V-S					Spare
25T	25	S-V					

Table 4-17 Line card pair-terminations for input/output panel connectors C, M, G, and T (Sheet 1 of 3)

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**C**	**M**	**G**	**T**	**Unit No. 16/card**
1T	26	W-BL	S	S	S	S	8
1R	1	BL-W					
2T	27	W-O	L	L	L	L	9
2R	2	O-W					
3T	28	W-G	O	O	O	O	10
3R	3	G-W					
4T	29	W-BR	T	T	T	T	11
4R	4	BR-W					

Table 4-17 Line card pair-terminations for input/output panel connectors C, M, G, and T (Sheet 2 of 3)

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**C**	**M**	**G**	**T**	**Unit No. 16/card**
5T	30	W-S					12
5R	5	S-W					
6T	31	R-BL	2	6	10	14	13
6R	6	BL-R					
7T	32	R-O					14
7R	7	O-R					
8T	33	R-G					15
8R	8	G-R					
9T	34	R-BR	S	S	S	S	0
9R	9	BR-R					
10T	35	R-S	L	L	L	L	1
10R	10	S-R					
11T	36	BK-B	O	O	O	O	2
11R	11	LBL-BK					
12T	37	BK-O	T	T	T	T	3
12R	12	O-BK					
13T	38	BK-G					4
13R	13	G-BK					
14T	39	BK-BR	3	7	11	15	5
14R	14	BR-BK					
15T	40	BK-S					6
15R	15	S-BK					
16T	41	Y-BL					7
16R	16	BL-Y					
17T	42	Y-O	S	S	S	S	8
17R	17	O-Y					

Table 4-17 Line card pair-terminations for input/output panel connectors C, M, G, and T (Sheet 3 of 3)

			I/O Panel Connector				
Pair	**Pins**	**Pair color**	**C**	**M**	**G**	**T**	**Unit No. 16/card**
18T	43	Y-G	L	L	L	L	9
18R	18	G-Y					
19T	44	Y-BR	O	O	O	O	10
19R	19	BR-Y					
20T	45	Y-S	T	T	T	T	11
20R	20	S-Y					
21T	46	V-BL					12
21R	21	BL-V					
22T	47	V-O	3	7	11	15	13
22R	22	O-V					
23T	48	V-G					14
23R	23	G-V					
24T	49	V-BR					15
24R	24	BR-V					
25R	50	V-S					Spare
25T	25	S-V					

Table 18 Line card pair-terminations with backplane cable expansion (segments 0 and 1) (Sheet 1 of 3)

			I/O Panel Connector								
Pair	**Pins**	**Pair color**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Unit No. 16/card**
1T	26	W-BL									0
1R	1	BL-W									
2T	27	W-O									1
2R	2	O-W									

Table 18 Line card pair-terminations with backplane cable expansion (segments 0 and 1) (Sheet 2 of 3)

I/O Panel Connector											
Pair	**Pins**	**Pair color**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Unit No. 16/card**
3T	28	W-G									2
3R	3	G-W									
4T	29	W-BR									3
4R	4	BR-W									
5T	30	W-S									4
5R	5	S-W									
6T	31	R-BL	S	S	S	S	S	S	S	S	5
6R	6	BL-R									
7T	32	R-O	L	L	L	L	L	L	L	L	6
7R	7	O-R									
8T	33	R-G	O	O	O	O	O	O	O	O	7
8R	8	G-R									
9T	34	R-BR	T	T	T	T	T	T	T	T	8
9R	9	BR-R									
10T	35	R-S									9
10R	10	S-R									
11T	36	BK-BL	0	1	2	3	4	5	6	7	10
11R	11	BL-BK									
12T	37	BK-O									11
12R	12	O-BK									
13T	38	BK-G									12
13R	13	G-BK									
14T	39	BK-BR									13
14R	14	BR-BK									
15T	40	BK-S									14
15R	15	S-BK									

Table 18 Line card pair-terminations with backplane cable expansion (segments 0 and 1) (Sheet 3 of 3)

I/O Panel Connector											
Pair	**Pins**	**Pair color**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Unit No. 16/card**
16T	41	Y-BL									15
16R	16	BL-Y									
17T	42	Y-O	S	S	S	S	S	S	S	S	16
17R	17	O-Y									
18T	43	Y-G	L	L	L	L	L	L	L	L	17
18R	18	G-Y									
19T	44	Y-BR	O	O	O	O	O	O	O	O	18
19R	19	BR-Y									
20T	45	Y-S	T	T	T	T	T	T	T	T	19
20R	20	S-Y									
21T	46	V-BL									20
21R	21	BL-V									
22T	47	V-O	0	1	2	3	4	5	6	7	21
22R	22	O-V									
23T	48	V-G									22
23R	23	G-V									
24T	49	V-BR									23
24R	24	BR-V									
25R	50	V-S									Spare
25T	25	S-V									

Table 19 Line card pair-terminations with backplane cable expansion (segments 2 and 3) (Sheet 1 of 2)

I/O Panel Connector											
Pair	**Pins**	**Pair color**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Unit No. 16/card**
1T	26	W-BL									0
1R	1	BL-W									
2T	27	W-O									1
2R	2	O-W									
3T	28	W-G									2
3R	3	G-W									
4T	29	W-BR									3
4R	4	BR-W									
5T	30	W-S									4
5R	5	S-W									
6T	31	R-BL	S	S	S	S	S	S	S	S	5
6R	6	BL-R									
7T	32	R-O	L	L	L	L	L	L	L	L	6
7R	7	O-R									
8T	33	R-G	O	O	O	O	O	O	O	O	7
8R	8	G-R									
9T	34	R-BR	T	T	T	T	T	T	T	T	8
9R	9	BR-R									
10T	35	R-S									9
10R	10	S-R									
11T	36	BK-BL	8	9	10	11	12	13	14	15	10
11R	11	BL-BK									
12T	37	BK-O									11
12R	12	O-BK									
13T	38	BK-G									12
13R	13	G-BK									

Table 19 Line card pair-terminations with backplane cable expansion (segments 2 and 3) (Sheet 2 of 2)

I/O Panel Connector											
Pair	Pins	Pair color	A	B	C	D	E	F	G	H	Unit No. 16/card
14T	39	BK-BR									13
14R	14	BR-BK									
15T	40	BK-S									14
15R	15	S-BK									
16T	41	Y-BL									15
16R	16	BL-Y									
17T	42	Y-O	S	S	S	S	S	S	S	S	16
17R	17	O-Y									
18T	43	Y-G	L	L	L	L	L	L	L	L	17
18R	18	G-Y									
19T	44	Y-BR	O	O	O	O	O	O	O	O	18
19R	19	BR-Y									
20T	45	Y-S	T	T	T	T	T	T	T	T	19
20R	20	S-Y									
21T	46	V-BL									20
21R	21	BL-V									
22T	47	V-O	8	9	10	11	12	13	14	15	21
22R	22	O-V									
23T	48	V-G									22
23R	23	G-V									
24T	49	V-BR									23
24R	24	BR-V									
25R	50	V-S									Spare
25T	25	S-V									

5 Environmental specifications

Technical and environmental specifications for the Intelligent Peripheral Equipment (IPE) and its associated hardware include the following considerations:

- ambient temperature
- relative humidity
- power
- heat dissipation
- weights and dimensions

The following information describes these requirements.

Ambient temperature

Ambient temperature requirements for the IPE are specified in the table that follows.

Table 5-1 Ambient temperature requirements

Ambient Temperature	Minimum	Maximum
Recommended range: 59-86° F (15-30° C)	40° F (10° C)	113° F (45° C)

Note: The equipment must not be exposed to the maximum ambient temperature in excess of 48 continuous hours.

Circuit breaker status and faults

The Extended System Monitor (XSM) has control of its column's circuit breaker and can trip the breaker to prevent further damage if the column is overheating. Status of the circuit breaker is reported to the Central Controller (CC) as one of the following values:

- Circuit breaker activated
- Circuit breaker not activated

Each circuit breaker is powered independently. Therefore, activating the circuit breaker does not cause the XSM that activated it to lose power.

Column thermal unit status and faults

If the column thermal unit reaches excessively high temperatures, the circuit breaker is activated and the XSM notifies the SL-100 CC. Possible status and fault values for the thermal unit are:

- Temperature OK
- Overheat

Relative humidity

The recommended relative humidity is between 20% and 55%. The minimum relative humidity allowed is 20%; the maximum is 80%.

Power specifications

Power requirements

The dc power supply chosen must accept the calculated current drain and operate within the specifications given in the following table.

Table 5-2 Power requirements (dc)

Input	Pedestal	Battery
Maximum range (V dc)	-40.0 to -56.5	-42 to -56.5
Expected nominal voltage(with 24 stationary cells)		-52.08
Expected nominal voltage(with 23 sealed cells)		-51.75
Expected nominal voltage(with 24 sealed cells)		-54.00
Noise(maximum C message)		32 dBmC

Power consumption

The power cables enter the pedestal and connect to an internal terminal block located in the pedestal. From the pedestal, the dc voltage enters the Power Distribution Unit (PDU, NT7D67). The PDU has five circuit breakers, one for each of the four modules and one for the blowers. Module to module distribution provides individual dc power to each module. The current drain for the IPE column (IPEC) is 26 amps.

The following table lists the power consumption for IPE modules and circuit packs.

Table 3 Power consumption

Product Engineering Code	Description	Power (Watts)
NT8D37	IPE module	416
NT8D52	Blower unit	50
NT7D07	Controller card	32
NT8D02	Digital Line Card	24
NT8D03 (discontinued)	Analog Line Card	20
NT8D09	Analog Message Waiting Line Card	20
NT5D11	Line Side T-1 Interface Card	11.5

AC Powered IPE

An AC-powered IPE can only be configured as a remote IPE behind the Fiber IPE interface (FII) or the T1 IPE interface (TII) product. In the AC-powered systems, power components external to the IPE are not required. AC systems perform a single conversion from the AC input voltage to the DC voltages required by circuit cards in each module. Optional reserve power requires an uninterruptible power supply (UPS) and batteries.

Foreign voltage protection

Use extreme care when punching down or removing a pair in feeder closets that also house Centrex pairs and digital sets that are attached to the IPE. This could cause foreign voltage to be shorted to the IPE. In this case, the IPE resets itself and must be reloaded and returned to service manually. All punch down tools should be insulated to prevent accidental contact with any other pins, and pull jumpers off the main distribution frame before troubleshooting in feeder closets.

Heat dissipation

The following table describes the heat dissipation for an IPE module (NT8D37).

Table 5-4 Power/thermal load specifications summary

Equipment	Current	Power	Thermal load
IPE module (fully loaded).	6.5 Amps each	340 Watts each	1160 BTUs per hour
IPEC (includes four fully loaded IPE modules)	26 Amps (including pedestal)	1360 Watts each	4640 BTUs per hour

Note: Thermal load is given in British Thermal Units per hour (BTU/hour). Thermal load = [total power dissipation (watts)] * 3.4.

Weights and dimensions

A single IPE module fully loaded without a pedestal and top cap weighs approximately 130 lbs. An IPEC fully loaded with a pedestal and top cap weighs approximately 605 lbs.

The following table gives weight and footprint dimensions.

Table 5-5 IPE weight and footprint dimensions

Equipment	Weight	Dimension
Top cap	15 lbs (6.8 kg)	Width-31.5 in. (80.0 cm) Depth-22.0 in. (55.9 cm) Height-4.0 in. (10.1 cm)
IPE	130 lbs (58.9 kg) fully loaded50 lbs (22.7 kg) empty	Width-31.5 in. (80 cm) Depth-25.5 in. (64.4 cm) Height-17.0 in. (43.2 cm)
IPEC	605 lbs (274.4 kg) includes four modules	Width-32.0 in. (81.2 cm) Depth-26.0 in. (66.0 cm) Height-82.0 in (208.3 cm)
Pedestal	70 lbs (31.7 kg) full40 lbs (18.1 kg) empty	Width-32.0 in. (81.2 cm) Depth-26.0 in. (66.0 cm) Height-10.0 in. (25.7 cm)

6 Feature implementation

Downloading the IPE software

The Intelligent Peripheral Equipment (IPE) software can be downloaded using one of two methods:

- from MAP: Normal downloading of the IPE can be done by entering the LOADPM command. SL-100 customers can initiate the loading of peripheral program files into a posted IPE using the IPE level of the MAP workstation. The posted IPE Peripheral Module (PM) must be in the Manual Busy (ManB) state before a LOADPM command can be executed. Due to the high load size, download time has dramatically increased.
- from Switch Manager: Downloading from Switch Manager can be done through the ethernet port. Switch Manager will provide the EXPEC the information on where to retrieve the file (for example, DISKUT or an FTP server). The EXPEC will then retrieve the file through the EIU (if the file is in DISKUT), and provide the software load into flash memory. The customer can now set the ITOC table in the EXPEC to the load that will be put inservice. Loading is not necesary unless the flash load on the IPE card is corrupted. Removal of power will not affect the load in flash.

  Note: The new EXPEC, introduced in MSL11, requires a different load than the previous version of the XPEC. The load size has dramatically increased and will result in a longer download time if performed by the LOADPM command.

When the user needs to RTS the IPE they can now use the IPE menu command RTS FLASH. This command will cause the EXPEC card to return to service from flash memory and put the unit inservice.

Package replacements

- New order code for AS1065D (package for DC IPE shelf which uses NT7D07AC) is NTZB98BA (uses NT7D07BA)
- New order code for AS1065A (package for AC IPE shelf which uses NT7D07AC) is NTZB98AA (uses NT7D07BA)
- For upgrades from the NT7D07AC to the new NT7D07BA the order code is NTZB99AA. This order code includes the following:
  - — NT7D07BA IPE Controller Card
  - — NT5D45AA 3 ft ethernet cable
  - — NT5D46AA ethernet IPE bulkhead adapter

System responses

While the IPE is being loaded by the LOADPM command using the IPE level of MAP workstation, the progress of the loading is echoed on the MAP terminal. All responses displayed on the MAP terminal have concise descriptions to explain the result or problem to the user.

The following table gives some examples of IPE downloading responses.

Table 6-1 Examples of IPE downloading responses (Sheet 1 of 2)

Response	Response	Action To Be Taken
IPE ipe_number PASSED	The IPE software load has been successfully loaded from the SL-100 system.	None.
REQUEST INVALID: IPE ipe_number IS status	The IPE is in the incorrect state for loading.	The IPE must first be ManB before loading the IPE software.

Table 6-1 Examples of IPE downloading responses (Sheet 2 of 2)

Response	Response	Action To Be Taken
LOAD FILE NOT IN DIRECTORY	The system cannot find the location of the load file.	The load should reside on tape, disk, or SFDEV. MOUNT the tape that has the load file, then LIST the disk volume or LISTSF the SFDEV files. For descriptions of the MOUNT and LIST commands, refer to *Commands Reference Manual* (NTP 297-1001-822).
NO ACTION TAKEN	The command cannot be executed for a reason other than those given in the standard responses.	For Meridian SL-100s equipped with DDUs, refer to *Disk Maintenance Subsystem Reference Manual* (NTP 297-1001-526) and use the commands LISTVOL and DSKUT. For Meridian SL-100s equipped with magnetic tape drives, refer to *Commands Reference Manual* (NTP 297-1001-822) and use the commands MOUNT and LIST.

A PM181 Log Report is generated when an IPE software load is downloaded. The IPE should be returned to service after being loaded successfully to ensure that it is working effectively.

The two figures that follow illustrate examples of the MAP display before and after loading the IPE software, respectively.

Figure 1 MAP before IPE software load

```
          CM    MS    IOD   NET    PM    CCS   LNS   TRKS    EXT
           .     .     .     .            .     .     .       .

 IPE                             SysB    ManB    Offl    CBsy   ISTb   InSv
  0  QUIT     PM                   2       1      15       2      7     125
  2  POST_    IPE                  1       1       5       0      2      10
  3
  4           IPE Host  03  0   ManB
  5  TRNSL        Links_00S:    CSide 1
  6  TST_                                       1 1  1  1  1  1 1
  7  BSY_     Card:  0 1 2  3   4  5  6   7  8  9 0 1  2  3  4  5 6
  8  RTS_              . .. .   I  .  .   .  M  . M M  I  .  -  - -
  9  OFFL_
 10  LOADPM
 11  DISP_
 12  NEXT
 13
 14  QUERYPM
 15
 16
 17
 18

       Time: nn : nn>LOADPM loadname
```

Figure 2 MAP after IPE software load

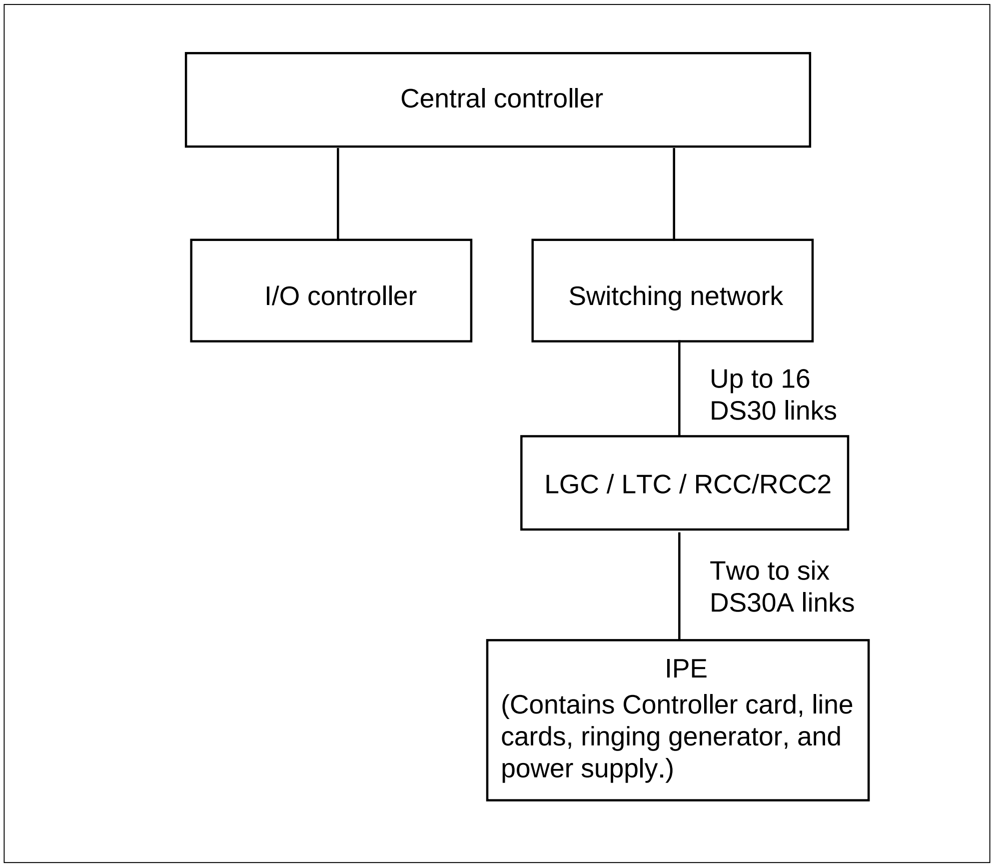
```
          CM    MS    IOD   NET    PM    CCS   LNS   TRKS    EXT
           .     .     .     .            .     .     .       .

 IPE                             SysB    ManB    Offl    CBsy   ISTb   InSv
  0  QUIT     PM                   2       1      15       2      7     125
  2  POST_    IPE                  1       1       5       0      2      10
  3
  4           IPE Host  03  0   ManB
  5  TRNSL        Links_00S:    CSide 1
  6  TST_                                       1 1  1  1  1  1 1
  7  BSY_     Card:  0 1 2  3   4  5  6   7  8  9 0 1  2  3  4  5 6
  8  RTS_              . .. .   I  .  .   .  M  . M M  I  .  -  - -
  9  OFFL_
 10  LOADPM   LoadPM loadname
 11  DISP_    IPE HOST 03 0 Passed
 12  NEXT
 13
 14  QUERYPM
 15
 16
 17
 18

       Time: nn : nn>
```

Controller card message translation

The Controller Card Message Translation feature receives DMSX format messages from the XPM (XMS-based Peripheral Module), such as a Line Group Controller (LGC), Line Trunk Controller (LTC), or Remote Cluster Controller (RCC), and sends DMSX format messages to the XPM. The controller card's Product Engineering Code (PEC) is NT7D07AC. It sends and receives DMSX format messages using the Common Channel Signaling Chip (S71). The DS30A link provides the interface between the XPM and the IPE modules in the SL-100 environment.

The following figure gives an example of the SL-100 system architecture.

Figure 3 Meridian SL-100 system architecture



The S71 is programmed to enable interrupts on its two transceivers. Both transceivers of the S71 are used, subject to the link open and close state of each. This feature supports transmission and reception of DMSX messages over one or both DMSX links simultaneously and handles error conditions.

The controller card also provides an overload control processing function that sends the XPM information regarding the state of the IPE messaging memory usage.

Messages to analog sets are translated from DMSX format to A10 format. Messages from analog sets are translated from A10 format to DMSX format and are sent to the XPM.

The following functions are performed by the controller card:

- manages DMSX format message sequencing on the controller card's C-side
- resets the IPE when a reset message is received
- transfers set messages to the sets
- routes maintenance messages and call processing messages to the appropriate processes
- translates messages from station sets into DMSX format
- routes messages from station sets to the XPM using DMSX protocol

This feature is required to provide the controller card with messaging capabilities with the XPMs through a DS30A link, using DMSX protocol and format. Messages over the DS30A link adhere to the DMSX protocol and have the following characteristics:

- byte oriented
- half-duplex
- handshaking is performed between communicating transceivers

The DMSX format adheres to the following structure:

- start of message - two bytes
- packet data
- Cyclic Redundancy Checking (CRC) - two bytes
- end of message - two bytes

Packet data encompasses destination and source task IDs, peripheral processor number, destination terminal ID, and data bytes that contain the actual messages.

Set messages are translated for the following types of line cards:

- Digital Line Card (DLC)
- Analog Line Card (ALC)
- Analog Message Waiting Line Card (MLC 500/2500 sets)

In the event of a transmission error, the controller card's S71 chip retries the transmission. If the second attempt fails, the S71 discards the buffer and pegs an error counter.

The following set messages are supported for analog sets:

- Ring ON and Ring OFF
- Message Waiting ON and Message Waiting OFF (MLC only)
- On-hook and Off-hook
- Digit 0 through 9 selected (500 sets only)
- Hookswitch Flash

Cutoff on Disconnect

The Cutoff on Disconnect (COD) feature provides a momentary interruption of battery voltage toward a 2500-type device when a distant party disconnects. The COD feature is useful if the 2500-type device attached to the SL-100 analog port is capable of tearing down a call that has been terminated by the distant end. Examples where the COD feature is useful are for modems, paging equipment, voice mails, and other automated equipment.

If an IPE analog port is configured in the SL-100 database with the COD feature, it provides re-originate dial tone to the 2500 device upon distant-end disconnect, but no interruption of battery voltage. The IPE analog line card is not configured with a relay in series with each 2500 port.

Hardware and software requirements

The COD feature requires the Cutoff on Disconnect Controller Model CDC-12 hardware manufactured by third-party vendor Telecom Strategies, Inc. (TSI). The CDC-12 hardware provides the momentary interruption of battery voltage toward a 2500-type device when a distant party disconnects. This feature also requires patch WEC05 to support the COD feature datafill.

Auto recovery DLM/IPEs

The Auto Recovery DLM/IPE feature implements the conversion of the DLM and IPE peripherals to use the System Recovery Controller (SRC) in order to coordinate automatic recovery activities.

The SRC is software that acts as a high-level intelligence to coordinate the work and optimize the system resources necessary for automatic recovery following system restarts and degradations.

The most visible functionality gained from this feature, with respect to the IPE, is the ability to automatically broadcast-load groups of IPE peripherals. Before this feature, broadcast-loading was only possible by use of manual commands.

The implementation for both DLM and IPE is the same with the exception of where the units themselves are involved. A DLM node consists of two units, while the IPE node consists only of a single unit (the IPE node itself). Therefore, the IPE interacts with the SRC and its utilities as a node, while the recovery for the DLM occurs for the entire DLM node and the two individual units.

IPE units are grouped with other IPE units for broadcast-loading by the following criteria:

- load-file name
- C-side Extended Peripheral Module (XPM) node type
  - Remote Cluster Controller (RCC), Remote Cluster Controller (RCC2)
  - Line Group Controller (LGC), ISDN Line Group Controller (LGCI), Line Trunk Controller (LTC), and ISDN Line Trunk Controller (LTCI)

The system maintains these static groups automatically over time as datafill changes. The SRC builds dynamic groups (subgroups) of these static groups as needed during recovery activities.

As an example of static grouping, the system puts two DLMs or IPEs that have the same load-file name, but subtend different C-side XPM node types into different groups.

Interaction

This section describes the interactions between the IPE Auto Recovery feature and other functionalities.

The SRC coordinates the broadcast-loading of each member of the group. It also monitors and controls the number of concurrent PM loading tasks. Manual intervention through the MAP terminal can override any recovery activity. Only the ABTK and BUSY commands (with the Force option) permit manual intervention on the IPE. When used, the user is notified and prompted to continue.

For more information about features, refer to the *Commercial Systems Feature Description Manual* or the *DSN Feature Description Manual*. For more information about the DLM Auto Recovery feature, refer to the *Digital Line Module (DLM) Reference Manual*.

Overload control support

Overload control support is a term used to describe a method of controlling message flow to and from the IPE. The objective of overload control is to provide continued processing of calls at maximum capacity during peak traffic periods.

At times of peak traffic, an IPE may run out of memory buffers first because the processor of an IPE is data store constrained rather than real time constrained. Work that arrives in the IPE sometimes needs to be queued up before it can be processed. However, the data store available for these queues is limited. When traffic peaks, the messaging load generated may overflow the available message buffers for call processing. Without overload controls, this shortage of resources in the IPE during overload may cause arbitrary or universal degradations in service. If the overload reaches an extreme, the IPE may become unstable and drop activity. Therefore, overload controls are necessary for an IPE to reduce the possibility of running out of message buffers and maintaining the stability of the IPE during overload.

Objectives

The purpose of this feature is to provide overload control for IPEs. The goals are to:

- provide best possible performance and maintain as high a throughput as possible to an overloaded IPE
- prevent a minor overload condition from sustaining and causing an overloaded IPE to become unstable
- attempt to bring an overloaded IPE out of an overload situation as soon as possible
- provide an overload control system for IPEs that imposes only minimal data store and real time impact on overloaded IPEs (resources are critical during overload)
- report overload condition and loss of messages to central controller (CC)

To meet these objectives, the overload control for IPEs is composed of the following components:

- overload protection
- overload indicators

The functionalities of these components, overload protection, and overload indicators are described next.

Overload protection

The key to overload protection is to regulate the message flow between an IPE and its host XPM to achieve the first four objectives of this feature.

The preventive measure is a one-step approach: origination shedding. The origination shedding is a strategy to postpone processing new calls sent from an overloaded peripheral to prevent the use of any more resources on new calls. The resources saved are reserved for calls in progress.

This task is performed by the XPM instead of the IPE due to the lack of call processing information such as call processing state of a terminal and the insufficient data store to handle complex overload control queuing structures in the IPE. On the other hand, the XPM does not have these two deficiencies. The XPM is limited by real time rather than address space.

In addition, a sophisticated flow control system in the XPM already exists for manipulating call processing messages according to call priorities. The flow control system automatically provides progress message favoring, a system in which preference is given to calls in progress over new calls.

Therefore, by knowing whether an IPE is overloaded together with the existing knowledge of the call processing state of each terminal, the XPM can control the flow of work from and to the IPE intelligently. The origination shedding is, therefore, also called origination flow control.

The IPE is responsible for informing the host XPM when the origination flow control needs to be applied. Each origination message that is sent to the host XPM contains a load state indicator. This indicator is filled in with the information on the current load state. After receiving the flow task message, the XPM examines and interprets the load state indicator to determine the available call processing data store left in the IPE.

If the load state indicator of an IPE reaches or goes beyond the predefined overload level, the following actions are carried out in its host XPM:

- The IPE is overloaded and its internal state is set to In-Service Trouble (ISTB).
- The host XPM does not immediately process any new incoming line origination messages conveyed from the overloaded IPE. The XPM queues up these new messages.
- The host XPM places the queued line origination messages to another appropriate queue under the Guaranteed Dial Tone (GDT) system of the flow control. These messages are placed continuously at the back of the queue until the IPE is out of overload state.

These line origination messages are not handled until the corresponding IPE load is reduced.

When the IPE is no longer in a high load condition, the next message sent from the IPE to its host XPM indicates normal traffic condition in the load state indicator fields. However, the IPE may not transfer any flow task message after it comes out of overload. In this case, the GDT audit in the XPM, which runs every three seconds, returns an overload IPE back to In-Service (INSV) state (the internal state only) if there have been no messages from the IPE for the past 3 seconds.

At times of high peak traffic load, the overload control for IPEs regulates the flow of messages between the overloaded IPE and its host XPM. The IPE is focused on processing work that is less time consuming and work that has higher priority such as termination messages. Therefore, the IPE can have a rapid recovery from the overload level to a stable condition by regaining its data store.

Overload indicators

When an IPE goes into overload, it is very important to inform operating company personnel about the current situation. If the peripheral has been under-engineered, appropriate actions may be taken to reduce the work load that is being presented to this overloaded IPE.

The overload indication is given in the three forms: MAP display, logs, and operational measurements. Descriptions of these follow.

MAP display

The Query PM (QUERYPM) command with the Fault (FLT) option at the IPE level of the MAP terminal displays a posted IPE with fault conditions caused by an overload situation.

The figure that follows gives an example of the QUERY command with the FLT option. For more information on the QUERYPM command at the IPE level, see Chapter “Software maintenance and diagnostics". Refer also to the *Commands Reference Manual* (NTP 297-1001-822).

Figure 4 Overload example of QUERYPM with FLT option

```
           CM    MS    IOD   NET    PM    CCS   LNS   TRKS    EXT
            .     .     .     .    2LTC    .     .     .       .

IPE                              SysB   ManB   Offl   CBsy  ISTb  InSv
 0  QUIT     PM                    4      0     15      2     7    125
 2  POST_    IPE                   1      0      5      0     2     10
 3
 4           IPE Host  03  0   ISTb
 5  TRNSL        Links_00S:    CSide 1
 6  TST_                                      1 1  1  1  1  1 1
 7  BSY_     Card:  0 1 2  3  4 5  6  7  8  9 0 1  2  3  4  5 6
 8  RTS_
 9  OFFL_
10  LOADPM
11  DISP_
12  NEXT     QUERYPM FLT
13           IPE Node Inservice Troubles exist
14  QUERYPM
15           PM Overloaded
16
17
18

      Time: nn : nn>QUERYPM FLT
```

Logs

Because there is only one level of overload control for IPEs, the protection may not be sufficient to prevent an IPE from running out of data store. If any new messages from the host XPM or from the P-side of the IPE arrive during this state, these messages may be discarded. If this occurs, the IPE sends an exception report to inform the central controller (CC) through the XPM about the number of messages that have been lost between the XPM and the IPE and between the IPE and the P-side of the IPE at a predefined time interval (5 minutes).

The order of the PM logs during an overload cycle is given below.

- A PM180 log is generated to indicate that the IPE has just entered overload with the number of lost messages.
- A PM128 log is generated to indicate the change of IPE state from INSV to ISTB when an IPE enters overload. This action only applies if the current state is INSV and if there are no other situations that may affect the IPE to change from INSV to ISTB.
- A PM180 log is generated to display the number of lost messages for an overloaded IPE on a predefined time basis until the number is clear (zero) within the last period.
- A PM180 log is generated when the IPE is out of the overload condition.
- Finally, a PM106 log is generated to indicate the change of IPE state from (in-service trouble) ISTb to (in-service) InSv when the IPE is out of overload. This action only applies if the current state is ISTb and if there are no other situations in the IPE that may keep the IPE to be ISTb.

The following figure shows an example of PM106, PM128, and PM180 logs.

Figure 5 Examples of PM106, PM128, and PM180 logs

```
*PM180 MAY 16 09:15:53 5575 TBL  PM SW EXCEPTION REPORT
  IPE HOST 01 1
  IPE enters Overload: C-Side DMSX lost msg: 154
  P-Side lost msg: 12   Seq: 1

*PM128 MAY 16 09:13:53 5574 TBL  ISTB IPE HOST 01 1
  Node  : ISTB (PM Overloaded) From InSv

*PM106 MAY 16 09:25:09 5808 RTS  IPE HOST 01 1
  Node  : InSv From ISTb
          ISTb Cleared (PM Overloaded)
```

Note: The display of the logs shown in Figure 5 is only used to show the type of information given in the associated logs. The contents or the formats of the actual logs may vary.

Operational Measurements (OMs)

The OM group PMOVLD is an existing OM group that consists of Origination Denied (PORGDENY) and Termination Denied (PTRMDENY) fields. The PORGDENY and PTRMDENY provide information on originations and terminations that are denied in either the CC or the XPM during overload on an individual peripheral basis, respectively. However, the PTRMDENY is defined but is not fully implemented and used while the PORGDENY provides origination shedding statistics to improve existing systems and identify new peripheral overload conditions.

This feature introduces each IPE peripheral as one of the keys to OM group PMOVLD. The PORGDENY OM message that contains the PORGDENY OMs of the peripherals is sent every 3 minutes from the XPM to the CC. The PORGDENY for an IPE peripheral is pegged under various internal flow control denial conditions manipulated by the XPM flow control system.

These internal conditions include:

- shedding stale messages in various queues
- exceeding the maximum allowable number of messages for an originating or terminating terminal
- shedding old origination messages for the new originations
- losing originations because the resources are completely used up by terminations
- losing call processing messages due to unavailability of resources for queuing new work

This feature extends the existing OMSHOW CI command by allowing a MAP terminal on a switch to have immediate display of information on origination denial tuples in OM group PMOVLD on an individual IPE basis.

The following figure shows examples of OM group PMOVLD.

Figure 6 Examples of OM group PMOVLD

```
>OMSHOW PMOVLD ACTIVE

     PORGDENY  PTRMDENY

 15       2  0    IPE HOST 00  3
 16       3  0    IPE HOST 99  3
```

Active Registers of an OM group PMOVLD

```
>OMSHOW PMOVLD HOLDING

     PORGDENY  PTRMDENY

 15       5  0    IPE HOST 00  3
 16       10 0    IPE HOST 99  3
```

Holding Registers of an OM group PMOVLD

System initialization functions

The following initializations and functions reside in random access memory (RAM).

Operating system initialization

The operating system defines the configuration table, provides procedures for handling processor exceptions and invokes the start-up procedure.

Application software initialization

The applications software consists of a number of interdependent processes and data structures. This function activates the processes, creates interprocess communication paths and initializes the contents of the data structures.

IPE initialization

When turning on the power for the IPE, the controller card enters a power-up diagnostic mode and a series of self tests are executed. Test results appear on the hexadecimal display (see the “Display functions" section).

The first two tests are considered essential for controller card operation. Failure to execute either of these tests causes a restart of the power-up diagnostics. After successful completion of the first two tests, the remaining diagnostic tests are executed.

The following table describes the controller card diagnostic tests executed.

Table 6-2 Controller card diagnostic tests (Sheet 1 of 3)

70D07AC Test #	Description	7D07BA Test #	Description
1	CPU test	1	SRAM test
2	CPU memory stack test	2	Sanity Timer test
3	RAM test	3	MPU Exception Test
4	R72 N-P switching control memory test	4	Periodic Interrupt Timer test
5	R72 P-N switching control memory test	5	SMC1 test
6	R72 NIVD buffer test	6	SCC1 test
7	R72 XIVD buffer test	7	SCC2 test
8	A31 #1 configuration memory test	8	SCC3 test
9	A31 #1 internal TXVM memory test	9	EEPROM test
A	A31 #1 internal context memory test (phase 1)	10	R72 N-P switching control memory test
B	A 31 #1 internal context memory test (phase 2)	11	R72 P-N switching control memory test
C	A 31 #1 external buffer test	12	R72 NIVD buffer test
D	A 31 #1 external FIFO test	13	R72 XIVD buffer test
E	A 31 #2 configuration memory test	14	A31 #1configuration memory test
F	A 31 #2 internal TXVM memory test	15	A31 #1 internal TXVM memory test
10	A31 #2 internal context memory test (phase 1)	16	A31 #1 internal context memory test (phase 1)
11	A31 #2 internal context memory test (phase 2)	17	A31 #1 internal context memory test (phase 2)

Table 6-2 Controller card diagnostic tests (Sheet 2 of 3)

70D07AC Test #	Description	7D07BA Test #	Description
12	A31 #2 external buffer test	18	A31 #1 external buffer test
13	A31 #2 external FIFO test	19	A31 #1 external FIFO test
14	W72 peripheral side loopback using A31 #1	20	A31 #2 configuration memory test
15	W72 peripheral side loopback using A31 #2	21	A31 #2 internal TXVM memory test
16	S71 peripheral side continuity test	22	A31 #2 internal context memory test (phase 1)
17	S71 network side continuity test	23	A31 #2 internal context memory test (phase 2)
18	S71 register test	24	A31 #2 external buffer test
19	S71 simultaneous packet transmission test	25	A31 #2 external FIFO test
1A	R72 P-N quiet code register test	26	N02 peripheral side loopback test using A31 #1
1B	R72 N-P quite code register test	27	N02 peripheral side loopback test using A31 #2
1C	R72 XIVD loopback buffer test	28	S71 peripheral side continuity test
1D	Sanity timer test	29	S71 network side continuity test
1E	EPROM checksum	30	S71 register test
1F	DUART test	31	S71 simultaneous packet transmission test
20	EEPROM	32	R72 P-N quiet code register test
		33	R72 N-P quiet code register test

Table 6-2 Controller card diagnostic tests (Sheet 3 of 3)

70D07AC Test #	Description	7D07BA Test #	Description
		34	R72 XIVD loopback buffer test
		35	Ethernet Transceiver loopback test
		36	Software load checksum test

Note: On the 7D07Ac, test #17 network side continuity test requires a working DS30A (8-kHz frame pulse and a 5.12-MHz clock) to be connected to port 0 to pass; otherwise, it cannot execute and reports a failed condition.

Clock synchronization

After power up diagnostics have been executed, the controller card attempts to synchronize with one of two network clocks. When lock is established, the hexadecimal display indicates C0 or C1 for a successful lock to port 0 or 1, respectively (see the “Display functions" section).

When an unlock condition occurs, the controller card attempts a hitless switch-over to the other clock source. If a lock cannot be established the hexadecimal display continuously indicates CF (clock failure) until a lock can be established.

After CF is indicated and lock re-established, the controller card reinitializes all peripheral devices. There are a maximum of six physical DS30 links to the IPE numbered 0 through 5. Links 0, 1, 2, and 3 are cabled together with clock and frame for port 0. Links 4 and 5 are cabled together with clock and frame for port 4.

System communications

Dual messaging channel support

The IPE shelf is connected to the XPM (LGC/LTC/RCC) using a minimum of two DS30A links. The first channel of the first two links is reserved for messaging between the XPM and IPE. The controller card firmware supports simultaneous messaging on both channels. If one messaging channel is disabled by the XPM (Link Disable command) or link failure, then the controller card switches to a single channel mode and routes all messages over the remaining active messaging channel.

Sanity timer

Expiration of the sanity timer causes a hard reset of the processor and an exception report to the XPM, except for cases where diagnostics are executing on the sanity timer. Message link 0 is channel 0 of DS30 link 0 and message link 1 is channel 0 for DS30 link 1.

Diagnostics

Upon receipt of an out-of-service test message, the IPE performs a comprehensive diagnostic test on the controller card circuit pack. The test results appear on the hexadecimal display (see the “Display functions" section).

The table that follows presents a list of controller card tests that are a subset of the power up diagnostics. These tests are used for destructive and non-destructive out-of-service tests. They may also be called individually by software.

> ***Note:*** Test #17 in the following table requires a working DS30A (8-kHz frame pulse and a 5.12-MHz clock) to be connected to port 0 to pass. Otherwise, it cannot execute and reports a failed condition.

Table 6-3 Controller card subset tests (Sheet 1 of 2)

Heading	Heading
3	RAM test (not applicable for nondestructive tests)
4	R72 N - P switching control memory test
5	R72 P - N switching control memory test
6	R72 NIVD buffer test
7	R72 XIVD buffer test
8	A31 #1 configuration memory test
9	A31 #1 internal TXVM memory test
A	A31 #1 internal context memory test (phase 1)
B	A31 #1 internal context memory test (phase 2)
C	A31 #1 external buffer test
D	A31 #1 external FIFO test
E	A31 #2 configuration memory test
F	A31 #2 internal TXVM memory test

Table 6-3 Controller card subset tests (Sheet 2 of 2)

Heading	Heading
10	A31 #2 internal context memory test (phase 1)
11	A31 #2 internal context memory test (phase 2)
12	A31 #2 external buffer test
13	A31 #2 external FIFO test
14	W72 peripheral side loopback using A31 #1
15	W72 peripheral side loopback using A31 #2
16	S71 peripheral side continuity test
17	S71 network side continuity test
18	S71 register test
19	S71 simultaneous packet transmission test
1A	R72 P - N quiet code register test
1B	R72 N - P quiet code register test
1C	R72 XIVD loopback buffer test
1D	Sanity timer test
1E	EPROM checksum
1F	DUART test
20	EEPROM access
21	Program store checksum (not applicable for destructive tests)

Routine maintenance functions

BSY messages

BSY messages are used to logically disable equipment so that it no longer participates in call processing. In the IPE, BSY messages refer to one of three types of equipment specified below. This function responds to and acts upon all three types of BSY messages.

- controller card
- line cards
- terminals

RTS messages

Return To Service (RTS) messages are used to logically enable equipment so that it may participate in call processing. In the IPE, RTS messages refer to one of three types of equipment specified below. This function responds to and acts upon all three types of BSY messages.

- controller card
- line cards
- terminals

TEST messages

TEST messages are used to isolate faults in the IPE. In the IPE, two comprehensive tests are available: an in-service test and an out-of-service test. This function responds to and acts upon both types of TEST messages.

Link status messages

Link status messages are used to control the operation of the C-side DS30A links. In the IPE, the links can either be enabled or disabled. This function responds to and acts upon both types of link status messages.

Configuration messages

Configuration messages are used to set up the operational parameters of the equipment. In the IPE, configuration messages refer to either line cards or terminals. This function responds to and acts upon both types of configuration messages.

QUERY messages

QUERY messages are used to determine the configuration of the equipment. In the IPE, QUERY messages return the loadname, line card configuration, and various maintenance statistics. This function responds to acts upon these QUERY messages.

Display functions on NTD07AC

Light Emitting Diode (LED) control

A single red LED is provided on the controller card faceplate. The LED turns on when the card is out-of-service and turns off when the card is in-service.

Hexadecimal display

A two-digit hexadecimal display is provided on the controller card faceplate to display card status and diagnostic test results. The following are the display combinations that are possible while the firmware has control of program execution.

- The four decimal points are turned on when firmware has control of program execution.
- Upon power up, all segments of the digit display are lit for one second and then turn off.
- During diagnostics, one of the codes shown in table Table 9 is displayed:
- If the sanity timer test passes the D0 for the power up diagnostics, the hexadecimal display is blank. This is caused by the sanity timer when the board is reset.
- The test number of each power up or out-of-service test that fails is displayed for one second.
- C0 is displayed if clock is synchronized to port 0. C1 is displayed if clock is synchronized to port 1. CF (clock failure) is displayed if lock cannot be established with either port.
- E1 indicates RESET message received.
- E2 indicates STATUS message received.
- E3 indicates TEST message received.
- E4 indicates LOAD message received.
- E5 indicates LOAD_CHK message received.
- E6 indicates RUN message received.

Table 6-4 Diagnostic test codes and descriptions

Test	Description
D0	Power up diagnostics
D1	Destructive out-of-service diagnostics
D2	Nondestructive out-of-service diagnostics

Display functions on NTD07BA

The 4-digit LLED display on the faceplate of the controller card provides status of the card while it is performing several functions. The following are the display messages utilized (refer to table "Diagnostic test codes and descriptions" on page 6-21 for test code descriptions):

- C0 indicates clock 0 synchronization
- C1 indicates clock 1 synchronization
- CF indicates clock failure or no established clocking
- RST indicates Reset message received
- STAT indicates STATUS message received
- TEST indicates TEST message received
- LOAD indicates LOAD message received (IPE is being loaded)
- LCHK indicates LOAD_CHECK message received
- RUN indicates RUN message received
- LERR indicates error occurs while loading the software load
- RERR indicates error occurs while trying to run from DRAM
- SW indicates software takes over from firmware

Background maintenance functions

Equipment auditing

In general, equipment is audited periodically to detect unexpected changes in operational status. This function audits each line card and terminal at least once every 15 seconds.

Hexadecimal display control

The controller card has a two-digit hexadecimal display mounted on its faceplate. This function handles all output directed to this display from other processes.

Watchdog timer setting

The ability to recover from catastrophic failures is very important. The controller card has a watchdog timer circuit that resets the board automatically if it is not cleared periodically by the applications software. This function clears the watchdog timer on a regular basis. If the watchdog times out, a catastrophic software failure is assumed and the controller card is reset.

Phase lock loop switching

The IPE must be synchronized to the C-side communication links to communicate over them. The controller card has a phase lock loop circuit that accomplishes this synchronization. This function attempts to resynchronize the card if the phase lock loop loses sync with the C-side links.

7 Log and fault reports

XSM maintenance interface

There are several logs associated with Intelligent Peripheral Equipment (IPE). Some example fault reports are listed and described in this section, following an overview of the Extended System Monitor (XSM) maintenance interface as it pertains to log and fault reports.

XSM unsolicited fault reports

When a master XSM detects a fault in the IPE column (IPEC) that it monitors, or receives a fault message from one of its slaves during polling, a fault message is sent to the SL-100 Centeral Controller (CC). The XSM SLLNK interface receives the message from the Multi-Protocol Controller RS-232C port and routes the message to CC Peripheral Module (PM) maintenance for processing.

If the message is reporting a failure for one IPE within an IPEC (the source of the problem is identified in the message), that IPE is queried using conventional CC-PM messaging. If the IPE responds to the query message, a PM log is generated and the state of the IPE is changed to in-service troubled (ISTb).

For example, the following ISTb conditions can be displayed using the QUERYPM FLT command at the IPE level of the MAP display when ISTb is posted.

- Circuit breaker tripped
- Power supply fault
- Excessive column temperature
- Pedestal fan unit fault
- Top cap fan unit sensor fault

If, on the other hand, the IPE fails to responds, the IPE is marked system busy (SYSb) and PM logs are generated reporting the failure. If the message from the XSM is reporting a failure for all IPEs in an IPEC (such as circuit breaker activated), each IPE is queued for its status and each IPE is handled as if the failure occurred for each IPE individually.

XSM “fault cleared" reports

When a master or slave XSM detects that a previously reported fault condition has been cleared, a corresponding status change report is sent to the MSL-100

CC. If the cleared fault corresponds to one IPE within an IPEC and the IPE is currently ISTb, any ISTb conditions relating to the fault are cleared.

If the IPE is currently sysem busy (SYSb), the system attempts to return the unit to service. However, it is unlikely that system attempts to return the IPE to service will be successful, because most serious XSM-related faults cause power to be turned off for the IPE. This causes the loss of the IPE's software load. If this scenario occurs, operating company personnel must reload and return the unit to service. If the message from the XSM reports a cleared fault for an entire IPEC, each IPE is handled as if the fault was cleared for each IPE individually.

XSM periodic audits

During each master XSM's polling routine, each of its slaves is asked to report its current status. If faults are detected, the master XSM reports the problem as described in the above section. However, if no fault exists, an XSM does not send any messages to the CC. Thus, the CC has no way of knowing whether or not everything is working properly and an XSM has nothing to report, or whether communication has been lost between the CC and XSM.

As part of the regular audit cycle, each master XSM datafilled in the SL-100 is asked to report the status of itself and its slaves. If there is no response to the status request, an XSM log is generated stating that the master XSM reporting on that link is out of service.

If the master XSM responds and reports that one or more of its slaves is not responding, an XSM log pertaining to each failed slave is generated. If the master XSM reports failures within the IPEC it monitors, or if any of its slaves report failures, PM logs are output identifying the failures.

Because the status of each IPE is already being audited as part of the same PM audit cycle, no query messages are sent to IPEs in response to failures in the XSM audit portion.

Descriptions of log reports

The following pages describe the logs in the following order.

- LINE101
- PM102
- PM103
- PM104
- PM105
- PM106
- PM107

- PM116
- PM117
- PM128
- PM179
- PM180
- PM181
- PM189
- XSM100
- XSM101
- XSM102
- XSM103
- XSM104
- XSM105

Note: These logs can be generated for similar events or errors relating to other peripherals. Within the log text, the peripheral that generated the log is named. For a general description of these logs, see *Commercial Systems Log Reports Manual* or *Defense Switched Network Log Reports Manual*.

LINE101

Log report LINE101 is generated when a diagnostic test of line equipment fails. The test is performed when a manual request was made from the line test position (LTP) Maintenance and Administration Position (MAP) level, or when a system request was made in response to encountered trouble. A system initiated diagnostic test is preceded by a report with event type trouble (TBL), fault (FLT), or information (INFO).

The following is an example log report format:

```
LINE101 APR01 12:00:21 2112 FAIL LN_DIAG
LEN len DN dn
DIAGNOSTIC RESULT diagtxt
ACTION REQUIRED acttxt
CARD TYPE pec
```

The CARD TYPE appearing in the LINE101 log report includes the card PECs NT8D02AA, NT8D02AB, NT8D02CC, NT8D02EA, NT8D03AB, NT8D09AD, and NT8D09AJ. An example LINE101 log is shown below.

```
LINE101 APR01 12:00:21 2112 FAIL LN_DIAG
LEN HOST 03 0 14 24  DN 7811999
DIAGNOSTIC RESULT No Response from LTC
ACTION REQUIRED Chk periphls
```

```
CARD TYPE 8D02
```

PM102

Log PM102 is generated when the IPE makes a transition from the in-service (InSv) or ISTb state to the SysB state.

The following is an example report format:

```
PM102 APR25 08:19:42 3200 SYSB IPE HOST 00 3
Node:SysB (WAI recvd) From InSv
```

PM103

Log PM103 is generated when the IPE makes a transition from the manual busy (ManB) or SysB state to the offline (Offl) state.

The following is an example report format:

```
PM103 JAN30 13:31:59 3456 OFFL IPE HOST 00 3
Node:Offl   From ManB
```

PM104

Log PM104 is generated when an IPE shelf makes a transition from the Offl state to an unequipped (UnEq) state. This log is only generated if the IPE is posted at the MAP display when the state change occurs.

> ***Note:*** An IPE makes a transition to the UnEq state when it is deleted from Table IPEINV.

The following is an example report format:

```
PM104 JAN01 08:32:51 1181 UNEQ IPE HOST 00 3
Node:UnEq    From Offl
```

PM105

Log PM105 is generated when the IPE makes a transition from the InSv, ISTb, Offl or SysB state to the ManB state.

The following is an example report format:

```
PM105 JAN01 08:32:51 1181 MANB IPE HOST 00 3
Node:ManB    From Offl
```

PM106

Log PM106 is generated when the IPE makes a transition from the SysB, ManB or ISTb state to the InSv state, and a PM ISTb condition is cleared.

The following is an example report format:

```
PM106 mmmdd hh:mm:ss ssdd RTS pmid
Node :InSv From <previous IPE state>
<optional text>
```

The value of the optional text field indicates the reason for the ISTb state.

The following is an example report:

```
PM106 FEB01 21:50:00 2200 RTS IPE HOST 00 3
Node : InSv    From ISTb
        ISTb Cleared (Load File Mismatch)

PM106 AUG18 08:04:56 3406 RTS  IPE IPE0 00 0
Node  : InSv  From ISTb
        ISTb Cleared (XPEC Type Mismatch)
```

PM107

Log PM107 is generated when the IPE makes a transition from the InSv, SysB or ManB state to the CBsy state.

The following is an example report format:

```
PM107 JAN18 15:14:26 4405 CBSY IPE HOST 00 3
Node:CBsy    From InSv
```

PM116

Log PM116 is generated when a message is sent from the IPE to the CC indicating that a message error has been detected.

The following is an example report format:

```
PM116 FEB28 13:55:55 3442 INFO PP-REPORT-DUMP IPE HOST 00 3
hhhh   hhhh  hhhh   hhhh  hhhh  hhhh  hhhh    hhhh  hhhh
hhhh   hhhh  hhhh   hhhh  hhhh  hhhh  hhhh    hhhh  hhhh
```

PM117

Log PM117 is generated when there is trouble at the IPE. The reason for the trouble is described in the log text.

The following is an example report format:

```
PM117 JAN18 17:20:48 1097 TBL IPE HOST 00 3
VALUE:0.  REASON:No response  FROM PP
```

PM128

Log PM128 is generated when the IPE makes a transition from the InSv state to the ISTb state.

The following is an example report format:

```
PM128 mmmdd hh:mm:ss ssdd TBL ISTB pmid
Node : ISTb <reason text> From Insv
Unit 0 : ISTb <trouble info>
Unit 1 : InSvUnit0: MTCARB is <state>,
Unit1: MTCARB is <state>
```

The reason for the transition can be derived from the following table:

Table 7-1 7-PM128 field descriptions

Text value	Event description
Unit ISTb <reason text>	Indicates that a unit is in-sevice trouble because of reason indicated by <reason text>.
Unit ISTb	Indicates that a unit has changed to the in-service trouble state.
From InSv	Indicates that a unit has gone from in-service.
<reason text> From SysB	Indicates that the previous state of the node was sytsem-busy because of reason indicated by <reason text>.

The following is an example report:

```
PM128 JAN17 14:11:31 3300 ISTB IPE HOST 00 3
         Node:ISTb (CSlink OOS)
         ISTb Cleared (Load File Mismatch)

PM128 AUG18 08:25:18 0975 TBL  ISTB
         IPE IPE0 00 0
         Node  : ISTb (XPEC Type Mismatch) From InSv

PM128 AUG18 08:25:18 0975 TBL  ISTB
         IPE IPE0 00 0
         Node  : ISTb (IP Port Info Mismatch) From InSv
```

PM179

Log PM179 is generated when a message is sent from the IPE to the CC indicating a hardware exception has been detected.

The following is an example report format:

```
PM179 MAR12 15:40:27 0078 TBL PM HW EXCEPTION REPORT IPE HOST
00 3
Exception ID:02      Text: Bus Error
Status Register:2009 Program Counter: 00E00876
Special Status Register:            0110
```

```
Instruction Pipe Stage C:          FDD8
Instruction Pipe Stage B:          4280
Data Cycle Fault Address:          004018C9
Data Output Buffer:                0044D94B
```

PM180

Log PM180 is generated when a message is sent from the IPE to the CC indicating a software exception has occurred.

The following is an example report format:

```
PM180 JAN01 17:44:11 2005 TBL PM EXCEPTION REPORT IPE HOST 00 3
MTCE:Illegal Destination Rcvd Exception Class:11
                              Information Byte:0D
```

PM181

Log PM181 is generated when a diagnostic at the IPE fails, there is some information about the IPE to be logged, or when changes occur to the line card state.

PM 181 messages are also generated for the enhanced IPE controller (EXPEC). Logs for the EXPEC are generated under the following circumstances:

- when an MSL version message is sent to the IPE in association with a CM RESTART, CM SWACT, and IPE RTS to the IPE
- when a time-of-day message is sent to the IPE in association with a CM RSTART or IPE RTS
- when an IP address message is sent to the IPE in association with an IPE RTS

The following is an example report format:

```
<Office ID> PM181 <mmmdd hh:mm:ss ssdd> INFO PM SW Information
Report IPE <Frame> <Shelf><text>
```

The following is an example log report:

```
RMSLDSNXAY     PM181 AUG05 15:40:35 3000 INFO IPE IPE2 02 0
Node: InSv       Time and Date was Successfully Sent.
RMSLDSNXAY     PM181 AUG05 15:40:35 2900 INFO IPE IPE2 02 0
Node: InSv        Set IPE MSL Version Succeeded
RMSLDSNXAY     PM181 AUG05 15:40:34 2800 INFO IPE IPE2 02 0
Node: InSv            Set IPE IP Port Info Succeeded
```

PM189

Log 189 helps Nortel Networks personnel determine the cause for different switch events. It is generated when one of the following occurs:

- an error is detected in the load file during a Switch Manager directed software upgrade
- an error is detected in transferring a software load from Flash memory to executable memory during the performace of an IPE RTS operation
- an attempt to allocate buffer space in DRAM fails
- an attempt to allocate buffer space in SRAM fails
- an error is detected in programming a software load into Flash memory during a Switch Manager directed software upgrade
- an error is encountered in attempting to change the designated Flash boot load
- when an attempt is made to establish a connection to the IPE through its Ethernet port

The following is an example report format:

```
<Office ID>PM189<mmmdd hh:mm:ss ssdd>INFO PM SW Information
ReportIPE <Frame><Shelf><text>
```

The meaning of the text value can be derived from the following table:

Table 7-2 7-PM189 field descriptions (Sheet 1 of 2)

Text value	Event description
Flash boot load update	This log will be generated whenever the Switch Manager modifies the designated Flash boot load.
Flash boot load update failure	This log will be generated when an error is encountered in attempting to change the designated Flash boot load.
Corrupt load transferred	This log will be generated when an error is detected in the load file during a Switch Manager directed software upgrade.
Memory not initialized	This log will be generated when an error is detected in transferring a software load from Flash memory to executable memory during the performance of an IPE RTS operation.
DRAM write failure	This log will be generated when an attempt to write to DRAM fails.
SRAM write failure	This log will be generated when an attempt to write/read from SRAM fails.

Table 7-2 7-PM189 field descriptions (Sheet 2 of 2)

Text value	Event description
Flash memory failure	This log will be generated when an error is detected in programming a software load into Flash memory during a Switch Manager directed software upgrade.
User connection accepted/rejected	This log will be generated whenever the Switch Manager attempts to establish a connection to the IPE or disconnect from the IPE through its Ethernet port.

The following is an example log report:

```
RMSLDSNXAY       PM189 AUG05 15:48:10 7200 INFO PM SW
Information Report
         IPE IPE2 02 0
          User connection accepted.
         From IP Address: 47.32.128.173
RMSLDSNXAY       PM189 AUG05 15:48:10 7200 INFO PM SW
Information Report
         IPE IPE2 02 0
         User connection rejected.
         From IP Address: 47.32.128.173
RMSLDSNXAY       PM189 AUG05 15:46:51 6600 INFO PM SW
Information Report
         IPE IPE2 02 0
          User is disconnecting.
         From IP Address: 47.32.128.128
RMSLDSNX10BB       PM189 JAN27 18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          Flash Boot Load Update
RMSLDSNX10BB       PM189 JAN27 18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          Flash Boot Load Update Failure
RMSLDSNX10BB       PM189 JAN27 18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          Corrupt load transferred
RMSLDSNX10BB       PM189 JAN27 18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          Memory not initializedRMSLDSNX10BB       PM189 JAN27
18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          DRAM Write Failure (Out of Heap)
RMSLDSNX10BB       PM189 JAN27 18:54:50 6072 INFO PM SW
Information Report
         IPE IPE2 02 0
          SRAM Out of Memory Failure
```

XSM100

Log XSM100 is generated when the XSM maintenance task on the CC is unable to send a status inquiry message to the XSM due to the datalink being down. This log belongs to the optional subsystem XSMSUB.

The following is an example report format:

```
XSM100 mmmdd hh:mm:ss nnnn INFO XSM_DATA_REPORT
         <Report text here>
         DATALINK = <sllnk device name>
```

DATALINK indicates the datalink datafilled in Table SLLNKDEV associated with the destination master XSM.

The following is an example log report:

```
XSM100 JAN23 17:36:35 1234 INFO XSM_DATA_REPORT
   DATALINK IS DOWN.  FAILED TO SEND XSM MESSAGE.
   DATALINK = XSMLOOP1
```

Operating company personnel should take action to bring the datalink into service.

XSM101

Log XSM101 is generated for each SLLNK datalink the first time an XSM status inquiry message is successfully queued after the XSM100 condition is cleared. This log belongs to the optional subsystem XSMSUB.

The following is an example report format:

```
XSM101 mmmdd hh:mm:ss nnnn INFO XSM_DATA_REPORT

   <Report text here>

   DATALINK = <sllnk device name>
```

The following is an example log report:

```
XSM101 JAN23 17:52:05 1235 INFO XSM_DATA_REPORT
   DATALINK IS UP.  STATUS INQUIRY SENT.
   DATALINK = XSMLOOP1
```

XSM102

Log XSM102 is generated when the XSM input handler cannot process an incoming message due to free queue being exhausted. This log belongs to the optional subsystem XSMSUB.

The following is an example report format:

```
XSM102 mmmdd hh:mm:ss nnnn INFO XSM_DATA_REPORT
   <Report text here>
   DATALINK = <sllnk device name>
```

The following is an example log report:

```
XSM102 JAN23 18:02:25 1236 INFO XSM_DATA_REPORT
   NO FREE QUEUE. ONE INCOMING MESSAGE DISCARDED.
   DATALINK = XSMLOOP1
```

If the log appears frequently, notify design support. The loss of one incoming message is not of great concern. As the messages in the incoming queue are being processed, the free queue is replenished, thus clearing the condition. The messages received prior to this condition take precedence over the discarded message.

XSM103

Log XSM103 is generated when it is determined that an XSM is no longer reporting. This log belongs to optional subsystem XSMSUB.

The following is an example report format:

```
XSM103 mmmdd hh:mm:ss nnnn INFO XSM_FAIL_REPORT
   <Report text here>
   DATALINK = <sllnk device name>
   XSMID = <0 to 63>
```

DATALINK indicates the datalink datafilled in Table SLLNKDEV associated with the XSM. XSMID indicates the ID associated with the XSM.

The following is an example log report:

```
XSM103 FEB05 14:15:22 1234 INFO XSM_FAIL_REPORT
   No audit response from master XSM
   DATALINK = XSMLOOP1
   XSMID = 0
```

Check the status of the XSM and the datalink.

XSM104

Log XSM104 is generated when the CC receives a report that the XSM is now working properly. This log belongs to optional subsystem XSMSUB.

The following is an example report format:

```
XSM104 mmmdd hh:mm:ss nnnn INFO XSM_STAT_REPORT
   <Report text here>
   DATALINK = <sllnk device name>
   XSMID = <0 to 63>
```

DATALINK indicates the datalink datafilled in Table SLLNKDEV associated with the XSM. XSMID indicates the ID associated with the XSM.

The following is an example log report:

```
XSM104 FEB05 14:30:22 1234 INFO XSM_STAT_REPORT
   Communication with slave XSM reestablished
   DATALINK = XSMLOOP2
   XSMID = 4
```

XSM105

Log XSM105 is generated when the CC receives a report from an XSM, and CC XSM and IPE data corresponding to the report are invalid or missing (possibly due to incorrect or missing XSM datafill in Table IPEINV). This log belongs to optional subsystem XSMSUB.

The following is an example report format:

```
XSM105 mmmdd hh:mm:ss nnnn INFO XSM_STAT_REPORT
   <Report text here>
   DATALINK = <sllnk device name>
   XSMID = <0 to 63>
   MODULEID = <0 to 3>
```

DATALINK indicates the datalink datafilled in Table SLLNKDEV associated with the XSM. XSMID indicates the ID associated with the XSM.

The following is an example log report:

```
XSM105 FEB05 22:30:04 1234 INFO XSM_STAT_REPORT
   Invalid or missing data for this XSM/IPE
   DATALINK = XSMLOOP3
   XSMID = 6
   MODULEID = 2
```

Use the XSMSHOW command to verify datafill.

8 Software maintenance and diagnostics

This section includes subsections that describe the following maintenance functions:

- maintenance state indicators
- circuit card state indicators
- command Interpreter (CI) commands
- IPE maintenance
- peripheral maintenance
- line card maintenance
- facility maintenance (includes Automatic Line Testing, bad line maintenance, and interpreting diagnostic test responses)

Maintenance state indicators

The Intelligent Peripheral Equipment (IPE) is a single-unit, single-shelf peripheral node. A maximum of four single-unit IPEs are housed in one IPE column (IPEC). The four IPEs in the IPEC are numbered from bottom to top with ascending numerical values 0 through 3 assigned to each shelf.

As with Line Concentrating Modules (LCMs) and Digital Line Modules (DLMs), IPEs are assigned site names to fully identify them. The assignment of site names is controlled by entries in the SITE Table. Refer to *Commercial Systems Customer Data Schema* or *Defense Switched Network Customer Data Schema* for detailed information.

Each IPEC is identified by a discrimination number in the range 0 through 127. This number plus the shelf number of the IPE in the IPEC (0 through 3) are the parameters used with the POST command. The site name, with the IPEC number and shelf number, are also the key to the new IPE inventory table IPEINV.

An IPE has a maximum of six DS30A C-side links to its controlling Line Trunk Controller (LTC), Remote Cluster Controller (RCC), Remote Cluster Controller 2 (RCC2), and Line Group Controller (LGC). C-side links are numbered in the range 0 through 5. At the associated Extended Peripheral Module (XPM), where these links are P-side, the links are identified using the range 0 through 19, covering all 20 links to a number of peripherals or trunks.

For maintenance purposes, each circuit on the IPE is identified by a circuit number that depends on the card type and a line subgroup number in the range 0 through 15. This corresponds to the line card slot on the IPE shelf where the circuit resides.

IPE maintenance state indicators on the MAP display are essentially the same as those defined for other SL-100 peripherals (see the following table).

Table 8-1 Maintenance state indicators

IPE Node State	Code	Description
System Busy	SysB	PMs are automatically removed from service by system maintenance.
Manual Busy	ManB	PMs are manually removed from service by command BSY to allow testing and other manual maintenance action.
Offline	Offl	PMs are not acted upon by system maintenance and must be returned to service manually.
Central Side Busy	CBsy	PMs connected to the network are unable to communicate with CC because the network or the links used to carry messages between the PM and the P-side of the network are unavailable.
In-Service Trouble	ISTb	PMs are still in service but flagged by system maintenance because of one of the following situations: • a minor error condition occurred • the PM failed a minor audit test • the load is not listed in the corresponding data table Call processing service is not affected.
In-Service	InSv	PMs are in service and available to support any intended process.

An IPE may be placed in the In-service Trouble (ISTb) state for any of the following reasons:

- mismatch between load specified in Table IPEINV and the actual software load in the IPE
- one of the message links to the IPE is out of service (OOS)

- an IPE card is in manual busy (ManB), system busy (SysB), or in-service trouble (ISTb) state
- speech link OOS (1 or more)
- overload condition
- self test failure
- ringing generator failure

Circuit card state indicators

On the IPE MAP display, the following symbols are used to indicate line card states.

Table 2 MAP display symbols

Symbol	Meaning
•	In-service
I	In-Service Trouble
M	Manual Busy
O	Offline
S	System Busy
—	Unequipped

Command Interpreter (CI) commands

The Command Interpreter is a Support Operating System (SOS) component that functions as the main interface between the SL-100 system and the user. The physical interface is provided through the MAP terminal.

Its principal roles are:

- to read lines entered by the user
- to break each line into recognizable units
- to analyze the units
- to recognize command item numbers on the input lines
- to invoke these commands

Accessing NPMDIR

To access the NPMDIR directory from the CI environment, enter the following command at the Command Interpreter (CI) prompt on the MAP terminal:

MAPCI;MTC;PM

To exit from the NPMDIR directory and return to the CI environment, enter the following command at the CI prompt on the MAP terminal:

>QUIT ALL

9 Hardware maintenance tools

This chapter contains discusses hardware maintenance tools, including circuit card features (self tests and LED indicators) and Extended System Monitor (XSM) indicators (power supply failure, temperature alarms).

The hardware features that help perform maintenance tasks include:

- Circuit card features that perform self-tests, indicate status, and minimize adverse affects on call processing.
- XSM indicators that identify power and temperature faults.

Circuit card features

Circuit card features include self tests and visible indicators (LEDs).

Self tests

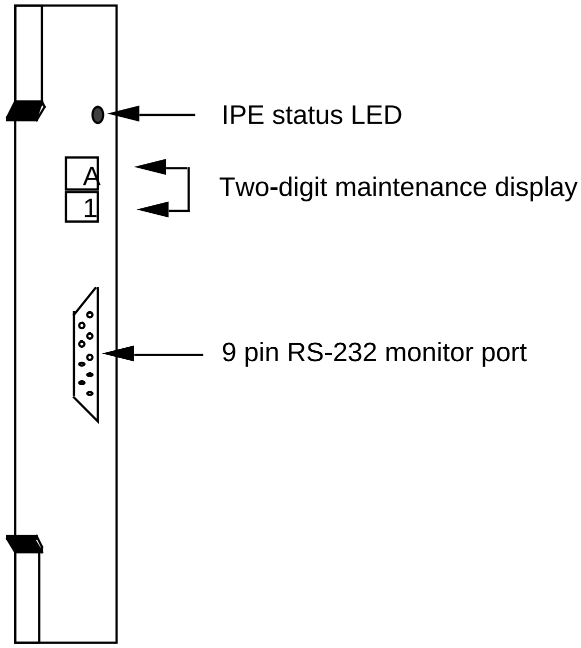
A self test checks to see that a card is working correctly. Many cards perform self tests on power-up. A self test can also be forced on a card through software commands. The results of a self test generally show whether there is a problem with the card.

Visible indicators (LEDs)

All cards have one or more LEDs on the faceplate. The LED gives a visual indication of the status of the card or of a unit on a card.

The following figure illustrates the location of the LED on the faceplate of an IPE controller card.

Figure 1 Location of LED on faceplate



When installing intelligent peripheral cards, watch the status LED for an indication of card status. If the self test passes successfully, the LED flashes and remains lit until the card is returned to service. If the self test fails, the LED lights steadily and remains lit.

When a *green* LED is steadily lit, it indicates that the card is operating normally. When a *red* LED is steadily lit, it indicates that the card, or a unit on the card, is disabled.

> ***Note:*** The shape of the LED (round or square) does not indicate a difference in function.

The following table gives two examples of LED indications.

Table 9-1 Sample LED Indications

Type of card	LED color	Status
Common equipment power supply	green	LED lit = operation normal
Digital line card	red	LED lit = disabled

XSM indicators

System Options 211 are equipped with the Extended System Monitor (XSM, NT8D22AC). This XSM monitors power supply failures from these sources:

- Power supply
- Ringing generator

The XSM also monitors for temperature alarms from these sources:

- Fan unit or blower unit
- Column temperature sensors

In multiple-column systems, there is one master XSM and multiple slave XSMs. A switch setting on each XSM defines the card as the master or as a slave.

If a fault is detected, the XSM does the following.

- Displays alarm LED on the top column cabinet
- Alarms the Power Fail Transfer Unit to activate the system line transfer.
- Activates the tripping signals for a DC system when the column exceeds the high temperature threshold

There are two types of module power supplies:

- Peripheral equipment power supply
- Ringing generator

The XSM handles complete or partial failures in a module power supply as follows:

- If output voltage is higher than the threshold for +5 volts, the affected power supply shuts down, the column LED lights, and scan points activate alarms.
- If output voltage is higher than the threshold for other than +5 volts, power for only that voltage shuts down in the effected power supply, the column LED lights, and scan points activate alarms.
- If output voltage is lower than the threshold for any voltage, power for only that voltage shuts down in the effected power supply, the column LED lights, and scan points activate alarms.
- If input voltage is lower than the threshold, the effected power supply shuts down then recovers when the input level recovers.

To help pinpoint a power supply problem, the master XSM identifies:

- the column with the fault (XSM 0-63).
- the module (0-3) in that column.

Temperature alarms

Each column in System Options 111-211 is cooled by a blower unit in the pedestal.

All IPECs are equipped with the Extended System Monitor (XSM, NT8D22AC). The XSM generates an alarm if the air leaving the column exceeds 55*o* C (131*o* F). This thermal alarm may indicate a loss of air conditioning in the room, loss of ventilation in the column, or a problem with the blower unit.

If the temperature reaches 70*o* C, an alarm causes XSM to trip the power circuit breakers to the column.

10 Appendix Operational measurements

There are seven Operational Measurement (OM) groups whose values are directly affected by an IPE. These OM groups contain information on how the IPE and its loops perform.

The Circuit Diagnostics Run group, PMCCTDG, pegs diagnostics that run on a line off of an IPE.

The Circuit Diagnostics Fail group, PMCCTFL, pegs faults that occur after the diagnostic is run on a line off of an IPE.

For more detailed information on operational measurements, refer to the *Commercial Systems Operational Measurements Reference Manual* or *Defense Switched Network Operational Measurements Reference Manual*.

Table 10-1 Operational measurements

OM Group	Description
PM	One tuple for each peripheral module. The measurements kept relate to the performance of the peripheral.
PMTYP	One tuple for each peripheral type. The measurements kept relate to the performance of peripherals of a given type, collectively.
LMD	One tuple for each loop or line peripheral. The measurements kept are related to call processing.
ENG640M1 TRA125M1 TRA125M2 TRA250M1	Measure Subscriber Line Usage (SLU). Each of these scan a selected set of loops or lines at a selected scan interval. There is a table corresponding to each of these OMs, where the loops or lines to be scanned are listed. These tables are: ENG640I1, TRA125I1, TRA125I2, and TRA250I1. An entry in another table (OFCVAR) determines the scan rate for each OM. There is only one tuple per OM group. These measurements reflect the usage of the set of loops listed in the table corresponding to the OM, scanned at the rate specified in the OFCVAR table.

11 Appendix Installation awareness

This chapter describes a possible over-voltage condition that would most likely occur during installation and cutover of the IPE. However, care should also be taken during routine maintenance functions to prevent this situation.

Short circuit on ring side of digital line

If a short circuit condition occurs on the ring side of the digital line, the power converter on the Intelligent Peripheral Equipment (IPE) resets. The reset of the power converter is an FCC and UL safety protection requirement.

The short circuit condition shuts down the power converter to the IPE module and require a peripheral download. Please note that, although the reload process takes only a few minutes, the IPE audit performed every 10 minutes could cause a total of 15 minutes downtime from the time of discovery to the time of completed reload.

How to avoid a short circuit condition

To avoid a short circuit condition, care should be used when using punch down and wire wrapping tools. These tools should be insulated to prevent accidental shorting of the ring side of the digital line. Additionally, jumpers should be pulled off of the main distribution frame before troubleshooting in the feeder closets.

List of terms

ACD
automatic call distribution

ADO
add option

ALC
analog line card

ALT
Automatic Line Testing

ASR
Automatic Set Relocation

AUL
Automatic Line

AWG
American Wire Gauge

BCS
Batch Change Supplement

BSY
Busy

BTU
British Thermal Units

CC
Central Controller

CCC
Central Control Complex

CDC
Customer Data Change

CF
Clock Failure

CHASGND
: Chassis Ground

CI
: Command Interpreter

CKLN
: Change Key-set LEN

CPI
: Call Progress Indicator

CPU
: Central Processing Unit

CRC
: Cyclic Redundancy Check

C-side
: Central Controller side

DCD
: Digital Carrier Detect

DEO
: Delete Option

DIP
: Dual Inline Pole

DISCTO
: Disconnect Time Out

DLC
: Digital Line Card

DLH
: Distributed Line Hunting

DLM
: Digital Line Module

DN
: Directory Number

DNH
: Directory Number Hunt

DTA
data

DTC
Digital Trunk Controller

DTE
Data Terminal Equipment

DU
Data Unit

DUART
Dual Universal Asynchronous Receiver Transmitter

EEPROM
Electrically Erasable Programmable Read-Only Memory

EPROM
Erasable Programmable Read-Only Memory

ESA
Emergency Stand Alone

FGE
Frame Ground Equalizer

FGND
Frame Ground

FH
Fast High

FIFO
First-In, First-Out

FII
fiber IPE interface

FL
Fast Low

GDT
Guaranteed Dial Tone

HASU
Hardware Assigned, Software Unassigned

HEX
: Hexadecimal

HIPE
: Host Intelligent Peripheral Equipment

IBN
: Integrated Business Network

ICI
: Incoming Call Identifier

IDL
: Idle

InSv
: In Service

I/O
: Input/Output

IOC
: Input/Output Controller

IPE
: Intelligent Peripheral Equipment

IPEC
: Intelligent Peripheral Equipment Column

ISTb
: In Service Trouble

IVD
: Integrated Voice and Data

LCC
: Line Class Code

LCD
: Liquid Crystal Display

LCM
: Line Concentrating Module

LED
: Light-Emitting Diode

LEN
Line Equipment Number

LGC
See line group controller

line group controller (LGC)
A peripheral module that connects DS30 links from the network to line concentrating modules.

LNS
lines maintenance subsystem

LSB
Least Significant Bit

LSG
Line Subgroup

LTC
Line Trunk Controller

LTI
Line Side T-1 Interface Card

LTP
Line Test Position

MADO
Meridian Asynchronous Data Option

ManB
Manual Busy

MCA
Meridian Communications Adapter

MCDM
Meridian Cabinet Digital Module

MCDR
Meridian Cabinet Digital Remote

MCLM
Meridian Cabinet Line Module

MCRM (manufacture discontinued)
Meridian Cabinet Remote Module

MCRM-S
Meridian Cabinet Remote Module Sonet

MCTM (manufacture discontinued)
Meridian Cabinet Trunk Module

MCTM-I
Meridian Cabinet Trunk Module ISDN

MDF
Main Distribution Frame

MDT
Meridian Digital Telephone

MLC
Analog Message Waiting Line Card

MLH
Multi-Line Hunt

MLNK (manufacture discontinued)
Meridian Cabinet Link Module

MMT
Meridian Modular Telephone

MNET (manufacture discontinued)
Meridian Cabinet Network Module

MPC
Multi-Protocol Controller

MPDA
Meridian Programmable Data Adapter

MPDC
Meridian Power Distribution Cabinet

MSB
Most Significant Bit

MSL-100
Meridian SL-100

NCOS
Network Class Of Service

N - P
Network to Peripheral

OM
Operational Measurement

OOS
Out Of Service

PCDM
Packaged Core Digital Module

PCM
Pulse Code Modulation

PCP
Printed Circuit Pack

PDN
Primary Directory Number

PDU
Power Distribution Unit

PEC
See product engineering code.

PEPS
Peripheral Equipment Power Supply

PM
Peripheral Module

P - N
Peripheral to Network

PP
Peripheral Processor

product engineering code (PEC)
An eight-character unique identifier for each marketable hardware item manufactured by Nortel Networks.

P-side
peripheral-side

QLEN
Query Line Equipment Number

QTD
Query Time and Date

RAG
Ring Again

RAM
Random Access Memory

RCC
See remote cluster controller.

remote cluster controller (RCC)
A dual-shelf peripheral module that provides a master controller for all units at the remote switching center and is, in turn, controlled by the host line trunk controller.

RMM
remote maintenance module

ROM
read-only memory

RSC
remote switching center

RTS
return to service

SH
slow high

SL
slow low

SLU
subscriber line usage

SPB
special billing

SPG
single point ground

SysB
system busy

TADO
touch asynchronous data option

TII
T1 IPE interface

TSG
telephone security group

TTT
transmission test trunk

TTU
transmission test unit

TXVM
transmit valid memory

UEM
universal equipment module

UnEq
unequipped

XBERT
bit error rate test

XIVD
peripheral integrated voice and data

XPM
XSM-based Peripheral Module

XSM
extended system monitor

Meridian SuperNode

Meridian SL-100

Intelligent Peripheral Equipment (IPE) Reference Manual

Information is subject to change without notice. Nortel Networks reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant.

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense. Allowing this equipment to be operated in such a manner as to not provide for proper answer supervision is a violation of Part 68 of the FCC Rules, Docket No. 89-114, 55FR46066.

The MSL-100 system is certified by the Canadian Standards Association (CSA) with the Nationally Recognized Testing Laboratory (NRTL).

This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe A respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

YEAR 2000 READINESS DISCLOSURE

This information was originally published prior to October 19,1998. The foregoing legend applies retroactively in accordance with the U.S. Year 2000 Information and Readiness Act and on an ongoing basis.

Publication number: 555-4001-129
Product release: MSL14
Document release: Standard 08.01
Date: November 2000

NORTEL NETWORKS™