

Passport 15000, 20000

Hardware Description

241-1501-200

Passport 15000, 20000

Hardware Description

Publication: 241-1501-200

Document status: Standard

Document version: 5.2S2

Document date: February 2004

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Printed in Canada

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Publication history

March 2004

5.2S2 Standard

General availability. Contains information on Passport 15000 and Passport 20000 for the PCR5.2 release.

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About this document

The information in this document describes the switch hardware parts and subassemblies for housing a Passport 15000 or 20000 in a Network Equipment Building System (NEBS) frame or equivalent mounting apparatus. The frame has product engineering code (PEC) NTRU04, and is also known as the PTE 2000.

The following topics are discussed in this section:

- “Who should read this document and why” (page 27)
- “What you need to know” (page 27)
- “What’s new in this document” (page 28)
- “Related documents” (page 34)
- “How to get more help” (page 35)

Who should read this document and why

This document is intended for use by:

- hardware maintenance personnel
- hardware installation personnel
- network planners
- network engineers

What you need to know

You should be familiar with fundamental data communications and basic electronic concepts and terms. You can acquire product knowledge by reading *241-5701-030 Passport 7400, 15000, 20000 Overview*.

Only information specific to the Passport 15000 or 20000 hardware is contained in this guide.



WARNING

Risk of radio interference

Passport 15000 is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

What's new in this document

The following features were added to this document:

- “Structural changes” (page 31)
- “16-port OC-3/STM-1 POS and ATM FP with PEC NTHW44” (page 33)
- “An additional version of the lower and upper cooling units” (page 33)
- “Enclosing a NEBS 2000 frame with doors and side panels” (page 34)
- “Voice services processor 3 with optical TDM interface (2pOC3ChSmIrVsp3)” (page 34)
- “Y-protection for dual 16-port OC-3/STM-1 POS and ATM FPs” (page 34)

Other changes made to this document include the following:

- changed the requirements for matching BIMs to a BIP version in “Combined BIM pairs in a BIP” (page 60)
- added the direction of airflow in a shelf-based Passport 15000 or 20000 in “Environmental control equipment” (page 129)
- in “Air filters” (page 133) re-emphasized that they must be replaced and included a reference to the NTP that indicates when and how to replace them

- in “100BaseT Ethernet cable assembly” (page 204) added note emphasizing that in order to meet EMC requirements, minimum grade of Ethernet cabling for a NTHW10 (2pGPDsk FP) card is a Category 5 shielded twisted pair (STP).
- clarified the cable information in “CP cables” (page 153) and added the figures “CP2 Ethernet cable NT0460” (page 156) and “CP2 Ethernet crossover cable NT0477 with RJ-45 connectors and ferrite bead” (page 157)
- for a “4-port Gigabit Ethernet FP” (page 205) -- 4pGe or NTHW49:
 - indicated the port LEDs in the figure “Faceplate of a 4-port Gigabit Ethernet FP with PEC NTHW49” (page 206)
 - updated the cable information in “4-port Gigabit Ethernet cable assemblies” (page 206)
 - added “SFP modules for an NTHW49” (page 208)
 - added “Custom-making an LC cable assembly for an NTHW49” (page 207) from “SFP optical module” (page 288)
 - moved the section “Status LEDs of the Ethernet ports on an NTHW49” (page 359) into the section “Status LEDs of a CP or an FP card” (page 356) and renamed it “Status LEDs of the Ethernet ports on an NTHW49” (page 359)
 - updated the description of LED behavior in “Status LEDs of the Ethernet ports on an NTHW49” (page 359)
- updated the figure “Faceplate of a 16-port OC-3/STM-1 ATM FP with LC connectors with PEC NTHW31” (page 232) to correct the orientation of the Rx and Tx ports
- corrected the status of port 4 (P4) in the figures “Faceplate of a CP3 with PEC NTHW06 or NTHW08” (page 151) and “Faceplate of a VPN extender card with PEC NTHW30” (page 270)
- updating the figures “The LC cable assembly with duplex connectors and duplex cables” (page 235) and “An example duplex LC-to-LC cable assembly” (page 277) to change the length of cable neck and connector
- added the figure “An extended cable management bracket for the right side of a NEBS 2000 frame” (page 323)

- adding the PECs of SFP optical modules for NTHW44 cards to the table “FP cards, SFP modules, and termination panels” (page 370)
- changed the compliance dates in “Optical module compliances” (page 290) for IEEE802 and IEC part 1040
- updated “Cables and cable management” (page 315) to distinguish the hardware that manages low, high, and very high densities of fiber and coax cabling
 - updated “Basic cable management brackets for low-density cabling” (page 316)
 - added “Cable management brackets for high-density cabling” (page 319)
 - renamed “Increasing cable management with extended brackets” to “Very high-density cable management brackets” (page 321)
- added the package number of multiple air filters to the tables
 - “Spare parts kit NTQS29AA for a Passport 15000” (page 375)
 - “Spare parts kit NTQS29AB for a Passport 15000” (page 376)
 - “Cooling unit parts for the AA versions” (page 378)
 - “Cooling unit parts for the AB versions” (page 379)
- added the table “Spare parts kit NTQS29AA for a Passport 15000” (page 375)
- added the software name (card type) to each FP description throughout the document
- amended the figure “Faceplate of a CP3 with PEC NTHW06 or NTHW08” (page 151) to reflect the deletion of the unused P4 port from the faceplate in the latest version of this hardware, and the correction of the PEC from NTHRW06 to NTHW06 in this figure’s title
- for the P0 Ethernet port cable assemblies, added the statement in the table “Prefabricated CP cable assemblies” (page 154) that although STP Ethernet cabling is shipped with the CP3 card, the minimum shielding requirement is for UTP cabling

- amended the section “Status LEDs of a CP” (page 357) to give more detail about the LED behaviour of the P0 Ethernet port on the NTHW06 and NTHW08 CP3 cards
- added the spare parts kits as the following tables:
 - “Spare parts kit NTQH29AA for a Passport 20000” (page 376)
 - “Spare parts kit NTQH29AB for a Passport 20000” (page 377)
 - “Spare parts kit NTQH29AC for a Passport 20000” (page 377)
 - “Spare parts kit NTQH29AD for a Passport 20000” (page 378)

Structural changes

This document was restructured as follows to improve the usability of the information.

- moved these sections from this document to 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*:
 - feature-specific function processor (FP) information
 - clocking, configuration, and line rate
 - standards compliance information
- added “Passport 15000 or 20000 equipment status” (page 48)
- added “Hardware parts that can be replaced or upgraded” (page 49)
- added “BIMs distributing power to PIMs” (page 56)
- updated “Hardware for connecting power input cables to the BIP” (page 75)
- updated “Function of the BIP backplane power input connections” (page 74)
- updated “Using an optional power-and-ground assembly” (page 76)
- added “Grounding the Passport and interworking equipment” (page 85)
- updated “Alarm/BITS module” (page 114)
- added “Connecting a Passport to another node” (page 142)
- added “High-density cable management brackets” (page 320)

- added these sections from 241-1501-210 *Passport 15000, 20000 Hardware Installation Guide*:
 - “CP cables” (page 153)
 - “Timing cable specifications for the DS1 circuit” (page 123)
 - “Assigning sparing panel connections for 2-port DS3C TDM FPs” (page 164)
 - “Assigning sparing panel connections for 4-port DS3 FPs” (page 171)
 - “Assigning sparing panel connections for a 12-port DS3 or E3 FP” (page 192)
 - “Assigning sparing panel connections for 32-port E1 TDM FPs” (page 213)
 - “Timing cable specifications for the E1 balanced circuit” (page 123)
 - “Timing cable specifications for the E1 unbalanced circuit” (page 124)
 - “Location of specific FP cables in a bundle” (page 328)
 - “Preparing OC or STM fiber distribution cables” (page 331)
 - “LC fiber cables and connectors” (page 332)
 - “MT-RJ fiber cables and connectors” (page 333)
 - “Preparing coax distribution cables” (page 335)
 - “Preparing control port cables” (page 338)
 - “Handling alarm cables” (page 340)
 - “Prefabricated DS3 or E3 cable assemblies” (page 340)
- added these sections from 241-1501-215 *Passport 15000, 20000 Hardware Maintenance Guide*:
 - “Using status indicator LEDs and sounds” (page 343)
 - “Fabric LED behavior is different from FPs” (page 104)
 - “Fabric replacement can affect traffic” (page 104)
 - “Fabric replacement can affect system cooling” (page 105)

- “Fabric replacement may need a firmware upgrade” (page 106)
- “Field replaceable units” (page 367)
- edited introductory sections of each FP to improve consistency
- compressed all occurrences of control processor to CP and function processor to FP, except for the first occurrence in each chapter
- deleted “Clocking behaviors of processor cards”
- deleted “Upgrading or downgrading processor cards”

16-port OC-3/STM-1 POS and ATM FP with PEC NTHW44

The function processor (FP) 16-port OC-3/STM-1 packet over SONET (POS) and asynchronous transfer mode (ATM) with product engineering code (PEC) NTHW44 and software name 16pOC3PosAtm is added to the list of available FPs. This document is updated by:

- adding “16-port OC-3/STM-1 POS and ATM FP” (page 238), which includes a figure of its faceplate and a description of its interfacing cable assemblies
- adding the PEC to the table “FP cards, SFP modules, and termination panels” (page 370)

An additional version of the lower and upper cooling units

An additional version of the lower (rear) and upper (front) cooling units is available. The following distinguish one version from the other:

- updated the section “Cooling units” (page 126)
- added the table “Spare parts kit NTQS29AB for a Passport 15000” (page 376)
- updated the table “Cooling unit parts” to become “Cooling unit parts for the AA versions” (page 378)
- added the table “Cooling unit parts for the AB versions” (page 379)

Enclosing a NEBS 2000 frame with doors and side panels

A NEBS 2000 frame can be enclosed by adding doors to the front and rear of the frame using the hardware kit NTQS37AA or NTQS37AB and by adding the side panels and hardware from the kit NTPX4050. These changes are made to this document:

- “NEBS 2000 frame enclosure” (page 137)
- added the hardware kit numbers to the table “Frame accessories and other filler hardware” (page 381)

Voice services processor 3 with optical TDM interface (2pOC3ChSmIrvsp3)

The following sections were added or updated for this feature.

- “Control and function processors” (page 141)
- “Voice services processor 3 with optical TDM interface (VSP3-o) FP” (page 283)
- “Faceplate of a VSP3-o FP card with PEC NTHW77” (page 284)
- “VSP3-o FP line connections” (page 284)
- “VSP3-o FP cable assembly” (page 285)
- “VSP3-o FP optical interface characteristics” (page 285)
- “VSP3-o FP sparing” (page 287)

Y-protection for dual 16-port OC-3/STM-1 POS and ATM FPs

The following sections were added or updated this feature.

- “Cable assemblies for an NTHW44” (page 240)
- “Specifications for Y-splitter cable assemblies for Y-protection” (page 246)
- “Status LEDs of an FP” (page 358) to indicate that cards with Y-protection have the same LED behavior as cards with LAPS

Related documents

See the following documents for related information:

- 241-5701-001 *Passport 7400, 15000, 20000 Documentation Guide*

- 241-5701-002 *Passport 7400, 15000, 20000 Using New Task-based Documentation*
- 241-5701-005 *Passport 7400, 15000, 20000 List of Terms*
- 241-5701-030 *Passport 7400, 15000, 20000 Overview*
- 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*
- 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*
- 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*
- 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*
- 241-7401-200 *Passport 7400 Hardware Description*
- 167-9021-102 *Advanced Power Systems MFA150 Modular Front Access Power System Description, Operation and Maintenance User Manual*
- 167-9021-133 *Advanced Power Systems MFA150 Modular Front Access Power System Detailed Installation Guidelines and Procedures Manual*

How to get more help

For information on training, problem reporting, and technical support, see the “Nortel Networks support services” section in the *product overview document*.

Chapter 1

Introducing Passport 15000 or 20000 hardware

This section provides the following information as an introduction to the Passport 15000 or 20000:

- “Passport 15000 overview” (page 37)
- “Passport 20000 overview” (page 42)
- “Passport 15000 and 20000 switch architecture” (page 44)
- “Frame assembly overview” (page 46)
- “Breaker interface panel overview” (page 46)
- “Shelf assembly overview” (page 46)
- “Control and function processors overview” (page 47)
- “Cables and cable management overview” (page 48)
- “Peripheral interworking equipment” (page 48)
- “Passport 15000 or 20000 equipment status” (page 48)
- “Hardware parts that can be replaced or upgraded” (page 49)

Where appropriate, each of the topics listed above provides a cross-reference to the section or sections where more detailed information is located.

Passport 15000 overview

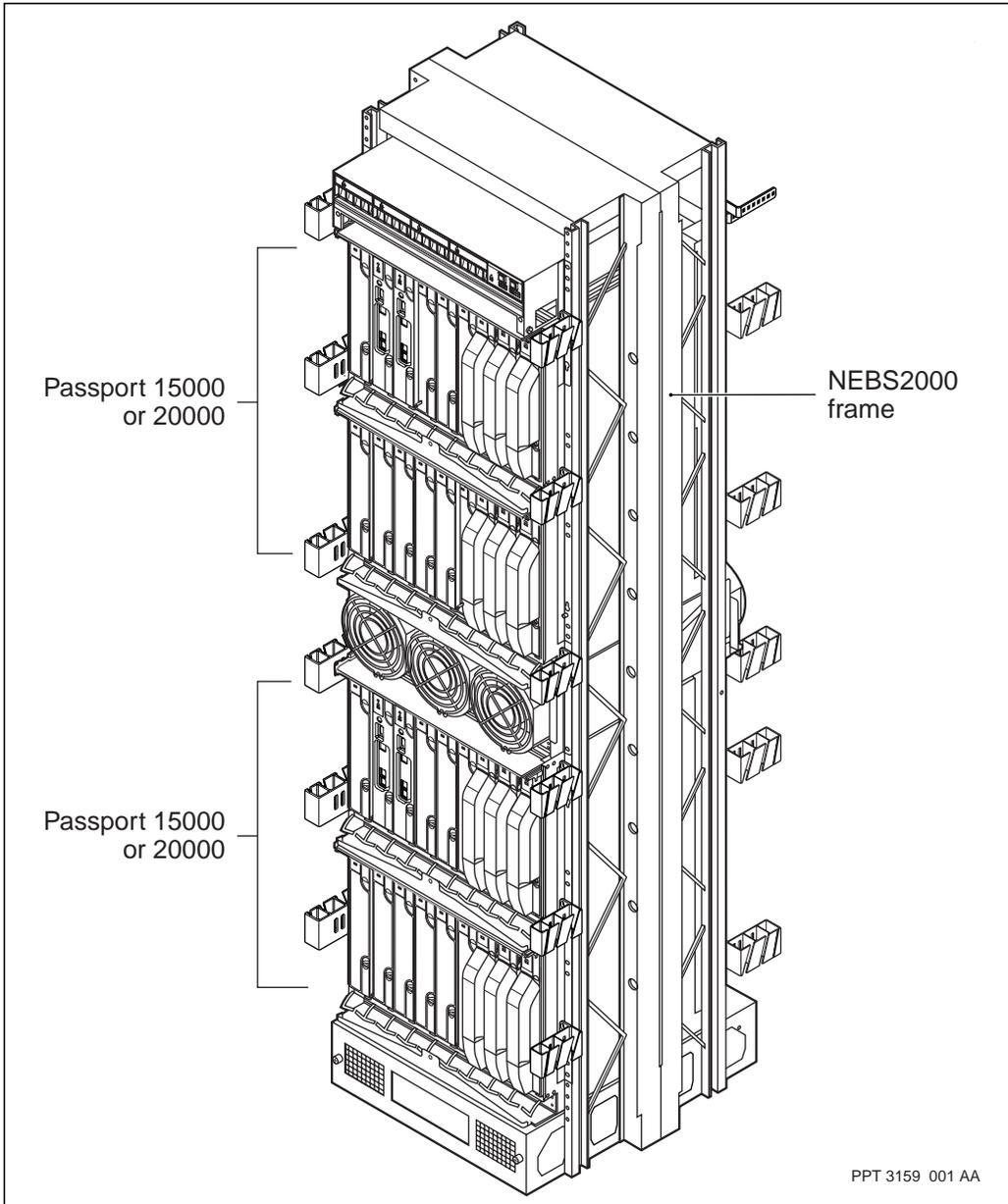
The Passport 15000 is a high-capacity ATM node which can act as a backbone or edge node to an ATM network.

The Passport 15000 supports electrical and optical interfaces with a variety of speeds from E3 up to STM-16 and from DS3 up to OC-48.

The Passport 15000 supports two types of timing source: building integrated timing supply (BITS) to the alarm/BITS module, and line timing to a fiber optic functional processor (FP). The Passport 15000 node can receive the external timing signal from BITS or line timing, and distribute either signal throughout the Passport 15000. That is, a Passport 15000 simultaneously supports a combination of BITS and line timing.

The figure “Two Passport 15000 switches or two Passport 20000 switches in a NEBS 2000 frame” (page 39) shows two switches (shelves) in one frame. The front view of a Passport 20000 is very similar to a Passport 15000.

Figure 1
Two Passport 15000 switches or two Passport 20000 switches in a NEBS 2000 frame



By combining a Passport 15000 with another Nortel Networks node or by upgrading plug-in cards or modules, different services, functionality, or capacities are provided. See the section “Passport 15000-VSS overview” (page 40).

Passport 15000-VSS overview

Passport 15000-VSS is an integrated edge and core multi-service node. Passport 15000-VSS offers low speed accessibility at the edge of a network and high speed switching at the core of a network. Passport 15000-VSS is a Passport 7400 packaged within a Passport 15000.

In addition to ATM, Passport 15000-VSS delivers a wide range of standard-based high-speed interfaces and services, including, frame relay, circuit emulation, voice, and IP. These interfaces provide a wide variety of access and trunking speeds from channelized DS0 to OC-48.

The figure “A Passport 15000-VSS in a NEBS 2000 frame” (page 41) shows the main parts and subassemblies of a Passport 15000-VSS in its frame.

Figure 2
A Passport 15000-VSS in a NEBS 2000 frame



PPT 2912 001 AA

Passport 20000 overview

The Passport 20000 Multiservice Switch is added to the Passport family of switches. It operates by the same Passport Carrier Release (PCR) software as the Passport 7000 series and the Passport 15000. The Passport 20000 provides the same functionality and services as a Passport 15000 except for significant hardware improvements, especially with higher shelf (user) capacity. The figure “Two Passport 15000 switches or two Passport 20000 switches in a NEBS 2000 frame” (page 39) shows two switches (shelves) in one frame. The front view of a Passport 20000 is very similar to a Passport 15000. The rear of the Passport 20000 is configured the same but has a different look.

Although the Passport 20000 shares much of the Passport 15000 hardware, the shelf assembly of the Passport 20000 has been re-designed with a scalable backplane, ship-in-place hardware, and different plug-ins. Because of the physical improvements that the shelf assembly provides, a Passport 15000 cannot be upgraded to a Passport 20000 by changing plug-in cards or modules. Processor cards from a Passport 15000 or 20000 can be shared, but a Passport 20000 is a separate shelf with its own software identity.

The plug-in modules and fabrics at the rear of the Passport 20000 switch are redesigned for improved capacity, performance, or usability. The modules include:

- the breaker interface modules (BIMs) with 25 A breakers
- the power interface modules (PIMs) with on/off LEDs
- a DS1 or a balanced E1 alarm/BITS module with an add-on balun cable assembly to make the E1 unbalanced
- the MAC address module
- two fabrics each with 70 Gbit/s usable shelf capacity (actual capacity is 112.6 Gbit/s each)

The backplane of the shelf assembly is designed to accommodate fabrics of different capacities and is scalable to 160 Gbit/s. The initial 112 Gbit/s fabrics continue to load-balance and load-share with 70 Gbit/s of shelf (user) capacity so that either fabric can take over the load of its mate and FP traffic is maintained.

The Passport 20000 supports all of the function processors (FPs) of a Passport 15000 that are compatible with the current Passport 20000 software and supports the following control processors (CPs), each with a building integrated timing supply (BITS) interface:

- NTHW06xx for a DS1 CP3
- NTHW08xx for an E1 CP3

The Passport 20000 can re-deploy FPs that were previously loaded with Passport Carrier Release (PCR) software 2.3 or later, and re-deploy CP3s with PCR 3.1 or later software provided the cards are migrated to the current PCR of the switch.

The shelf assembly of the Passport 20000 is designed to ship cards in place. This means that the control processor (CP3), function processor (FP), and fabric cards can be pre-loaded with software, placed in pre-determined slots (including filler cards), and shipped safely in a partially seated transportation position. Shipping in place means the cards can be powered up as soon as they are seated.

The Passport 20000 supports all the optional hardware, software functionality, and software services that a Passport 15000 has except there is no equivalent Passport 15000-VSS.

The planning and setup criteria in 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* are the same as the Passport 15000. Some of the methods of installing modules change slightly.

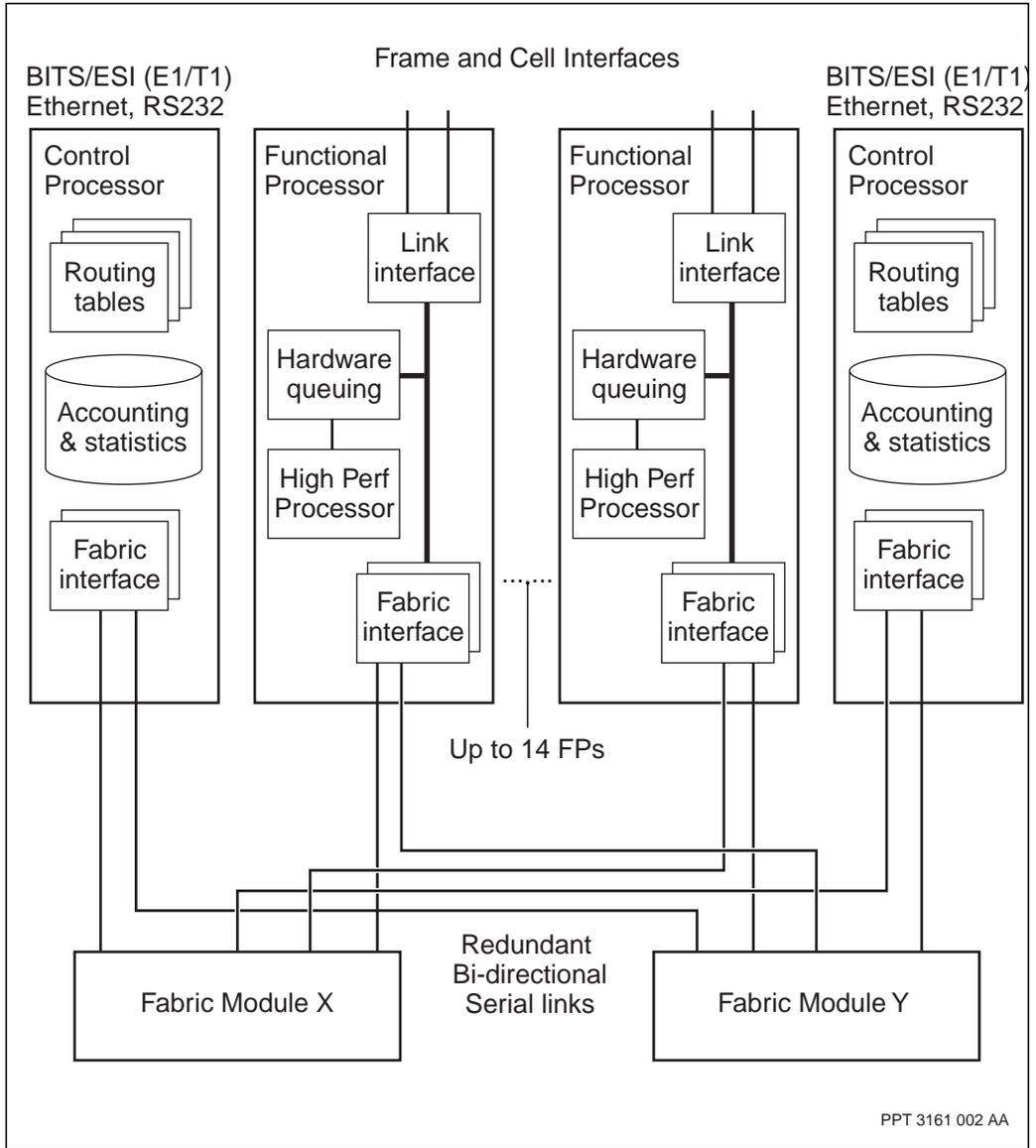
For a detailed description of what a card or module does or how it differs in the Passport 20000, see the appropriate section in this document.

For the procedures to initially install and maintain a Passport 15000 or 20000, refer to 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Passport 15000 and 20000 switch architecture

Passport 15000 and 20000 switch architecture uses an input/output buffered cross bar switching fabric with hardware support for both cell-based and frame-based services. The fabric is implemented with redundant serial links to a central 16 bi-directional port fabric module as shown in the figure “Passport 15000 and 20000 switch architecture” (page 45).

Figure 3
Passport 15000 and 20000 switch architecture



Frame assembly overview

One or two Passport 15000 or 20000 switches (not a combination) can be housed in a single frame assembly that is compliant with the network equipment building system (NEBS).

A single Passport 15000 or 20000 can be installed in a mounting apparatus other than a NEBS 2000 frame. See *241-1501-205 Passport 15000, 20000 Site Requirements and Preparation Guide* for the criteria of using a different mounting apparatus.

For more information on the dimensions and footprint of the frames, refer to *241-1501-205 Passport 15000, 20000 Site Requirements and Preparation Guide*.

Breaker interface panel overview

The main function of the breaker interface panel (BIP) is to provide single or dual (redundant) dc power and frame level alarm indications to one or two Passport 15000 or 20000 switches in a frame assembly.

See “Breaker interface panel” (page 51) for a detailed description of the subassemblies and parts of the BIP.

Shelf assembly overview

The Passport 15000 or 20000 shelf assembly houses most of the parts which make up a single Passport 15000 or 20000 switch, including the switching fabrics, backplane, control and function processor cards, alarm/BITS termination, power interfaces, and the MAC address module.

For a Passport 20000 that is shipped already installed in a NEBS 2000 frame, all cards and modules that plug into the shelf assembly are shipped in place. The modules at the rear of the shelf assembly are fully seated. The control and function processor cards and the fabric cards are partially installed but unseated in a transportation position. The transportation position prevents damage to the backplane connectors and pins from vibrations during shipping. The cards are also shipped in their appropriate slots and with the PCR software already loaded.

See “Shelf assembly” (page 87) for a detailed description of the parts in a Passport 15000 or 20000 shelf.

Control and function processors overview

Control processors (CP) and function processors (FP) are the processing elements for performing and managing Passport 15000 or 20000 functions. In most cases, the software providing a service is split into control and function parts. In general, the control part runs on the CP; the function part runs on the FP. This results in

- more efficient data flow since the FP does not do resource-consuming non-data-path processing
- more efficient memory resources for data transmission

See “Control and function processors” (page 141) for detailed information about each processor card available with Passport 15000 or 20000. For information about the various services supported by specific Passport FPs see 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*.

Upgrading processor cards

You can upgrade or downgrade a processor card (CP or FP) from one version to another. Upgrading means to replace an existing processor card with another card of the same type but offering more services. Downgrading means to replace an existing processor card with another card from a previous release with less services. The following list briefly describes the various types of upgrades:

- hot-swapping means to replace a card while it is still active
- line timing
- spared means upgrading a card when it is locked and its spared card has taken over service
- unspared means upgrading a card when it not spared

For more information on upgrading and downgrading, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Cables and cable management overview

Cable management hardware for the Passport 15000 or 20000 and frame assembly consists of hardware subassemblies for protecting, routing, securing cables (copper, fiber, and system interconnect cables), and managing cable slack.

See “Cables and cable management” (page 315) for detailed information about Passport 15000 or 20000 cables and cable management.

Peripheral interworking equipment

Peripheral equipment is any non-Passport equipment that can be connected to a Passport 15000 or 20000 to provide additional functionality, service, capability, or performance. Nortel Networks supports specific peripheral equipment to interwork with a Passport 15000 or 20000. The peripheral equipment includes:

- an EdgeLink mux by Telco Systems
- an external hardware alarm (for example, an end-of-aisle lamp)
- an MFA150 system of ac rectifiers by Astec Advanced power Systems
- a multiport aggregate device by Nortel Networks
- a Shasta 5000 switch by Nortel Networks

Information about the installation or operation of the equipment is included in the Passport 15000 or 20000 suite of hardware documents. Where the information appears depends on what tasks are involved in getting the equipment installed, cabled, and tested. Refer to the table of contents to locate your task.

Passport 15000 or 20000 equipment status

Each operating unit of hardware for a Passport 15000 or 20000 has status LEDs to indicate what it is doing. The patterns of LED behavior per unit of hardware are described in “Using status indicator LEDs and sounds” (page 343).

Sounds are provided through optional external alarms to customer premises equipment (CPE). Connecting external alarms is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Hardware parts that can be replaced or upgraded

Most Passport 15000 or 20000 hardware units can be replaced due to failure or damage. All such field replaceable units (FRUs) and service replaceable units (SRUs) are listed in “Field replaceable units” (page 367). This list is more comprehensive than the Passport 15000 or 20000 Ordering Catalog because it includes part numbers of some assemblies.

Chapter 2

Breaker interface panel

The breaker interface panel (BIP) provides a central location where redundant input dc power feeds (nominal -48/-60 V) of up to 100 A are connected and routed to two or four breaker interface modules (BIMs). Power is distributed from the BIMs to the shelves and cooling units. Passport 15000 or 20000 supports the use of either a two-BIM (single shelf) or a four-BIM (dual shelf) BIP. The BIP also contains an alarm module which monitors system parts, generates alarms, and controls LED status indicators.

The following BIP components and connections are described in this section:

- “Front cover of the BIP” (page 53)
- “Breaker interface modules (BIMs)” (page 54)
- “BIM filler plates” (page 62)
- “Alarm module” (page 62)
- “Alarm cable connectors” (page 68)
- “Power connections to and from the BIP backplane” (page 73)
- “Sources of dc input power to the BIP backplane” (page 83)
- “Grounding the Passport and interworking equipment” (page 85)

See the figure “The BIP in a NEBS 2000 frame, front view” (page 52) for the location of individual parts, and “Rear of the BIP” (page 53) for the location of input power cables.

Figure 4
The BIP in a NEBS 2000 frame, front view

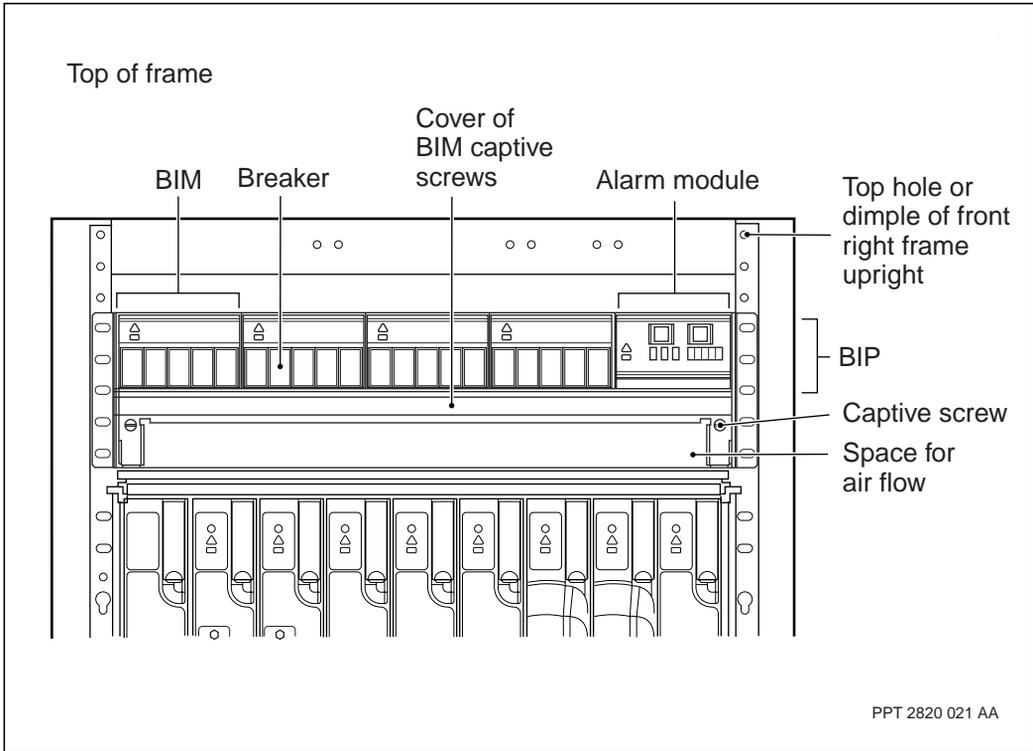
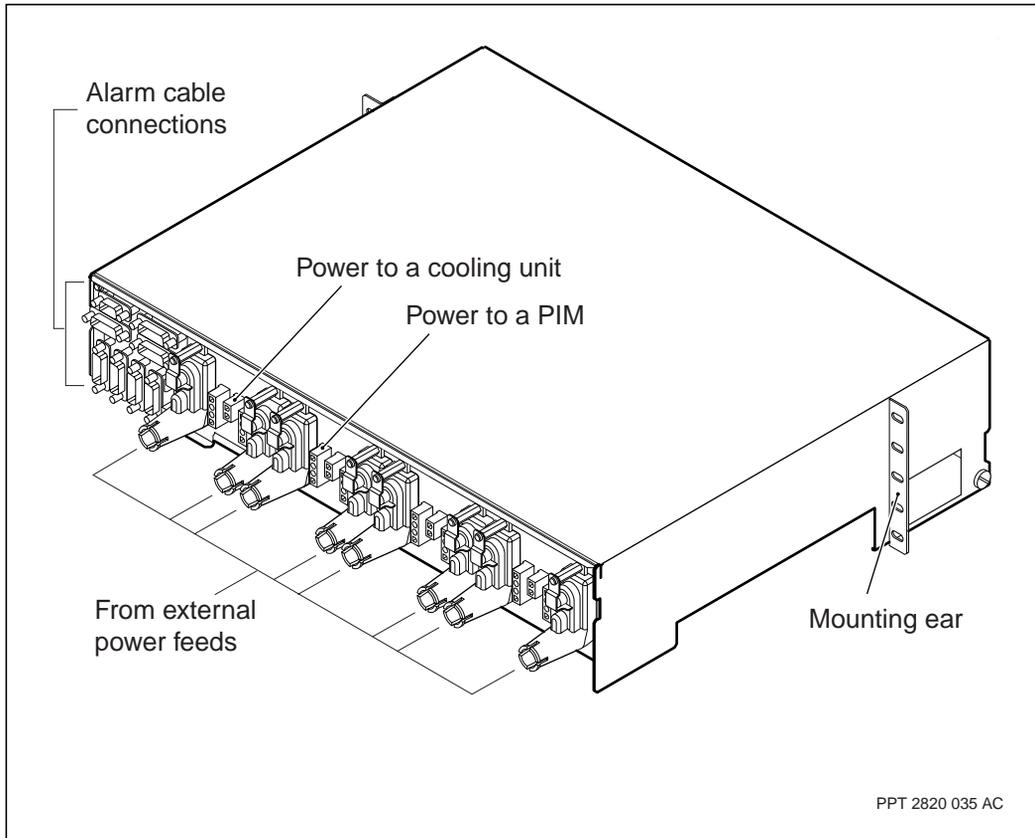


Figure 5
Rear of the BIP



Front cover of the BIP

The BIP front cover has the following functions:

- it protects the parts and connections on the front of the power breakers and the alarm module
- it directs air exhaust venting from the upper cooling unit
- it provides tool-only access through captive screws (for security and convenience)

The front cover can be opened to access the retaining screws holding the breaker interface modules (BIMs) and alarm module in place. See “The BIP in a NEBS 2000 frame, front view” (page 52) for an illustration of the BIP with the front cover opened.

Breaker interface modules (BIMs)

This section describes the location and functions of the breaker interface modules (BIMs) inside the breaker interface panel (BIP). It provides information on the following topics:

- “BIP with two or four BIMs” (page 54)
- “Location of the BIMs” (page 55)
- “Functions of the BIMs” (page 55)
- “BIMs distributing power to PIMs” (page 56)
- “Combined BIM pairs in a BIP” (page 60)
- “Front panel of a BIM” (page 60)
- “BIM power filters” (page 61)

BIP with two or four BIMs

Two models of the BIP are available: one with two breaker interface modules (BIMs) or one with four BIMs. The two-BIM model is used in the NEBS 2000 frame or equivalent mounting apparatus to support only one Passport 15000 or 20000 (for example, in equipment packages NTQS10 and NTHQ10). The four-BIM model is used in NEBS 2000 frame when two Passport 15000 switches or two Passport 20000 switches are housed (for example, in equipment packages NTQS20 or NTQH20). If a two-BIM model is used (for example, in NTQS04 and NTQH04), the empty BIM slots are covered with filler plates to protect BIP circuitry and to meet safety requirements. See “BIM filler plates” (page 62) for more information.

When a second switch is added to the NEBS 2000 frame, two additional BIMs can be added to the BIP to power that switch. Refer to the criteria in “Combined BIM pairs in a BIP” (page 60).

When one Passport 15000 or 20000 is shipped in the NEBS 2000 frame, the insulation boots and lugs are provided for the second set of BIMs. This accommodates adding a second switch of the same kind to the frame. The equipment package NTQS10 or NTQH10 includes the wiring harnesses for adding a second shelf.

Location of the BIMs

The breaker interface modules (BIMs) are located in the breaker interface panel (BIP). In four-BIM models, all BIM slots are filled up to the alarm module. In two-BIM models, the BIMs are located in the two right-hand slots next to the alarm module, with the two left BIM slots covered with filler plates. See the figure “The BIP in a NEBS 2000 frame, front view” (page 52). See “BIM filler plates” (page 62).

Functions of the BIMs

The power breakers on each BIM control the -48/-60 V dc A and B power supplies to the power interface modules (PIMs) and to the upper and lower cooling units. See the figure “The BIP in a NEBS 2000 frame, front view” (page 52) for the location of the power breakers.

For a Passport 15000, each BIM with PEC NT6C60PA supports a maximum of five PCB-mount circuit breakers made up of four 20-amp shelf breakers and one central 5-amp cooling unit breaker. See the table “Circuit breaker configuration for each BIM of a Passport 15000 or 20000” (page 55). The position of the breaker is relative to facing the front of the BIP.

Table 1
Circuit breaker configuration for each BIM of a Passport 15000 or 20000

Location of circuit breaker	Left	Middle left	Middle	Middle right	Right
Passport 15000	20 amp	20 amp	5 amp	20 amp	20 amp
Passport 20000	25 amp shelf upper half	25 amp shelf upper half	5 amp cooling units	25 amp shelf lower half	25 amp shelf lower half

For a Passport 20000, each BIM with PEC AP6C67PA supports a maximum of five PCB-mount circuit breakers made up of four 25-A shelf breakers and one central 5 A cooling unit breaker. See the table “Circuit breaker configuration for each BIM of a Passport 15000 or 20000” (page 55). The position of the breaker is relative to facing the front of the BIP.

Although the breakers of BIMs for a Passport 20000 are higher than those of a Passport 15000, the maximum power input feed is 100 A for either type of switch. When having a Passport 15000 and 20000 in the same frame, observe the criteria in “Combined BIM pairs in a BIP” (page 60).

The power breakers are arranged such that each Passport 15000 can draw power from two independent power sources (usually labelled A and B). See “Function of the BIP backplane power input connections” (page 74) for a summary of the BIP power breaker functions. Breakers should be set to off before a BIM is removed from the BIP. One BIM receives an input power feed for a shelf, so that two BIMs are required for each shelf.

BIMs distributing power to PIMs

Each breaker interface module (BIM) receives power redundantly from the site power source through separate feeds, labelled A and B. Since the PIMs receive their power from the BIMs, each pair of PIMs per shelf also has an A and B feed. Each pair of PIMs is referred to as a rear upper (RU) or rear lower (RL) behind slots 7 and 15 to correspond to its position at the rear of the shelf. The five breakers in each BIM are referred to as breakers 1 to 5 counting from the left. Refer to the figures:

- “Relationship between feeds, breakers, and equipment slots in upper shelf” (page 57)
- “Relationship between feeds, breakers, and equipment slots in lower shelf” (page 58)

The BIP breakers that control specific PIMs are identified in the figure “Cable paths of PIMs at the rear of a NEBS 2000 frame” (page 59).

Figure 6
Relationship between feeds, breakers, and equipment slots in upper shelf

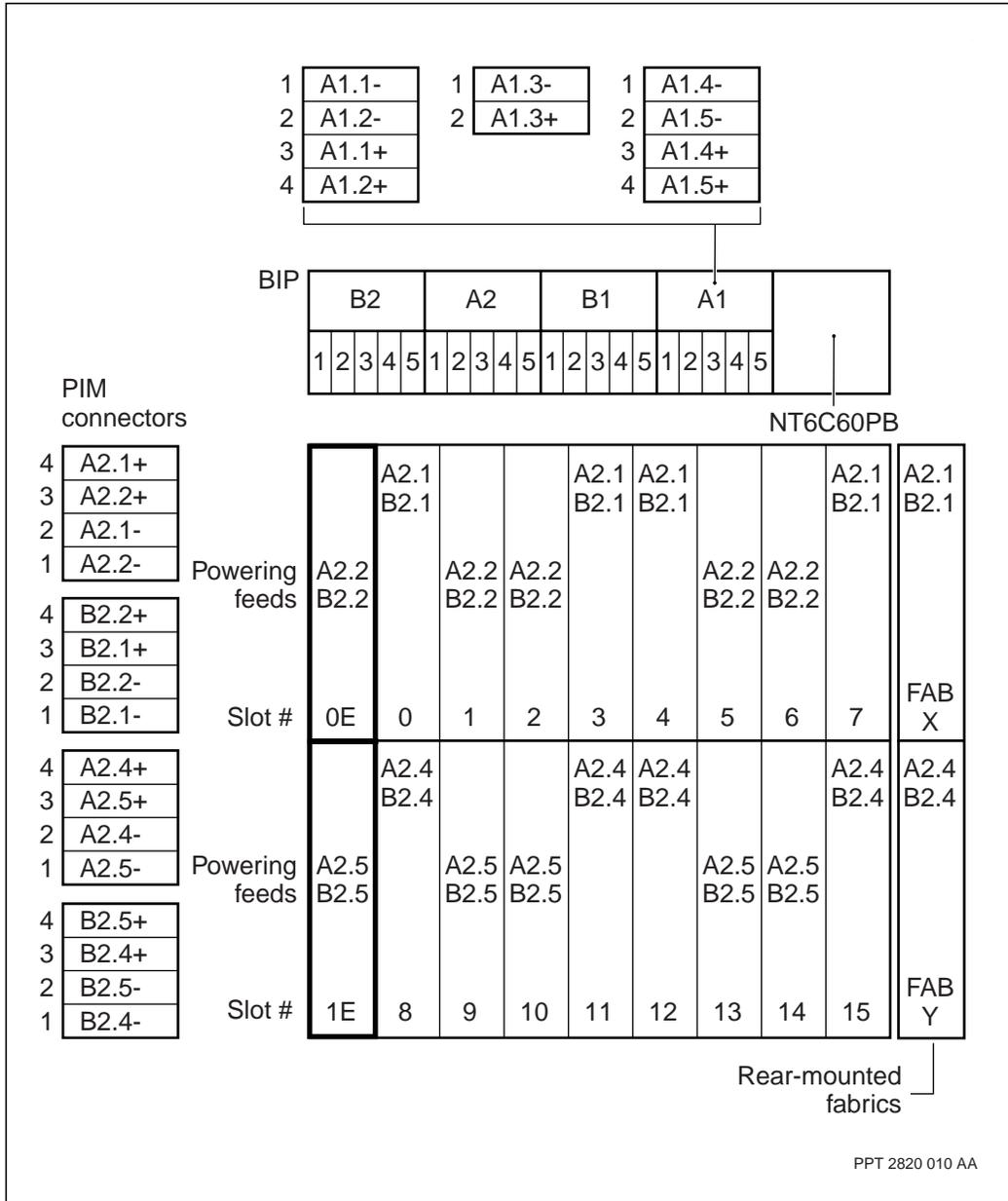


Figure 7
Relationship between feeds, breakers, and equipment slots in lower shelf

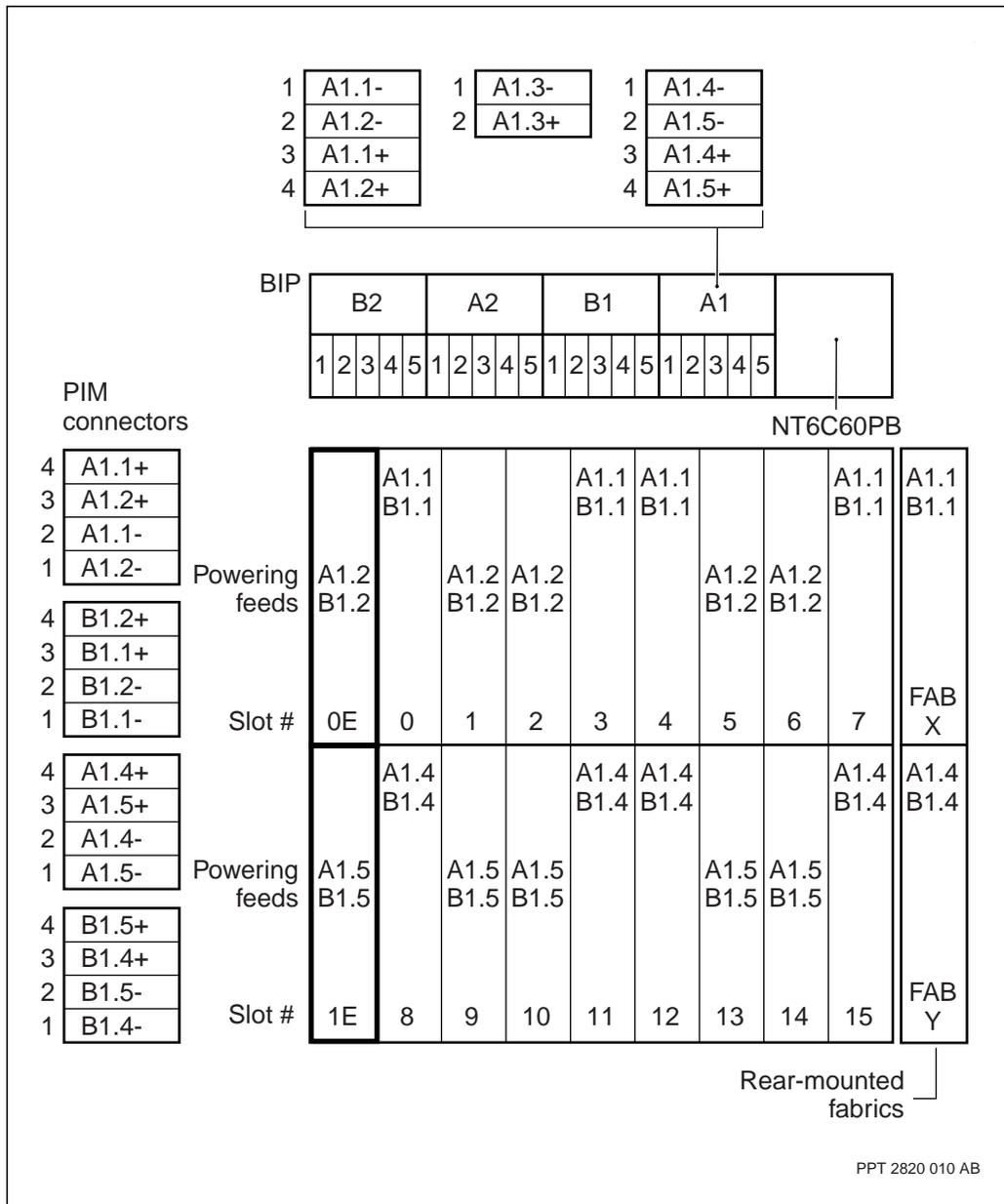
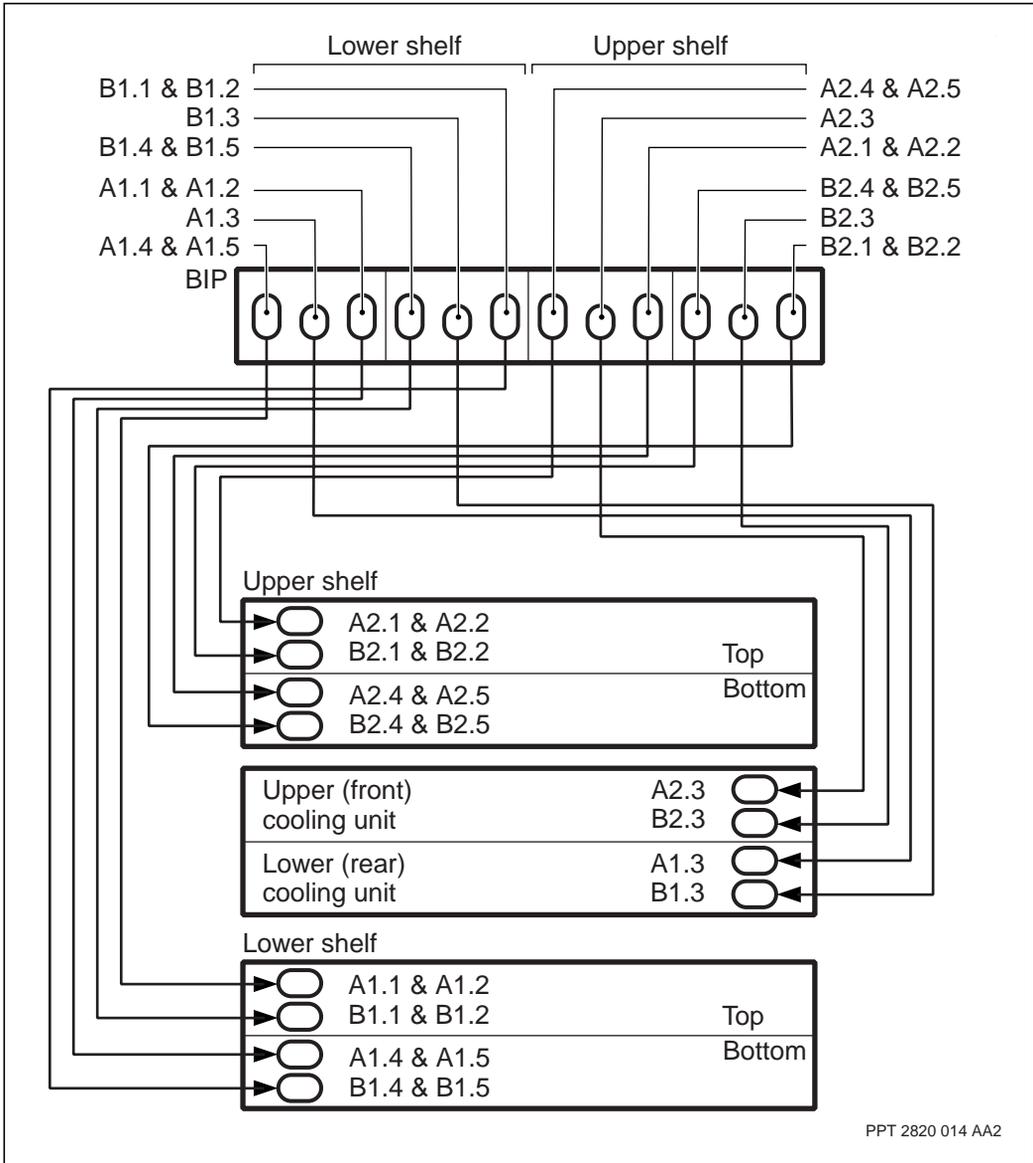


Figure 8
Cable paths of PIMs at the rear of a NEBS 2000 frame



Combined BIM pairs in a BIP

When two Passport 15000 or two Passport 20000 nodes are installed in the same NEBS 2000 frame, they share the same BIP. When a Passport 15000 and a Passport 20000 are installed in the same NEBS 2000 frame, they can safely share the same BIP (NT6C62 or AP6C68) even though the BIMs have different ampere ratings.

Each BIM must be matched with its mate to safely distribute power to the Passport 15000 or 20000, and the pair must be matched to the switch as indicated in the table “Combinations of BIMs in a BIP” (page 60).

Table 2
Combinations of BIMs in a BIP

Shelf type	PEC of a BIP with 2 BIMs	PECs of the BIM pairs that can be installed
Passport 15000	NT6C62	two or four 20-amp NT6C60PA for one or two Passport 15000s or two 20-amp NT6C60PA for the Passport 15000 in the lower half of the NEBS 2000 frame and two 25-amp AP6C67PA for a Passport 20000 in the upper half of the NEBS 2000 frame
Passport 20000	AP6C68	two or four 25-amp AP6C67PA for one or two Passport 20000s or two 25-amp AP6C67PA for the Passport 20000 in the lower half of the NEBS 2000 frame and two 20-amp NT6C60PA for a Passport 15000 in the upper half of the NEBS 2000 frame

Since there is no visible exterior difference between the BIM faceplate of either a Passport 15000 or 20000, you must use the part number that is labeled on each unit.

Front panel of a BIM

The front panel of each breaker interface module (BIM) includes

- a triangular alarm LED
- a rectangular power LED

- five PCB circuit breakers (four 20 A and one 5 A)
 - for a Passport 15000, four 20 A and one 5 A
 - for a Passport 20000, four 25 A and one 5 A
- a captive screw to hold the module in place

There is no visible exterior difference between the BIM faceplate of either a Passport 15000 or 20000.

The different states of the LEDs are listed in the table “Alarm LED status indicators for BIMs” (page 61) and the table “Power LED status indicators for BIMs” (page 61).

Table 3
Alarm LED status indicators for BIMs

LED color	Mode	Meaning
red	solid	major fault
off		no fault

Table 4
Power LED status indicators for BIMs

LED color	Mode	Meaning
green	solid	no fault, in service — active
off		invalid state — test for loss of power

BIM power filters

Each BIM contains a power filter. Power filters ensure low frequency stability of the battery feed lines that supply -48/-60 V dc power to each Passport 15000 or 20000. This reduces the amount of electric noise produced by each Passport and ensures clean power for the point-of-use power supplies (PUPS) used in the processor cards and cooling units.

Note: Power cycling the breakers can be done on a Passport 15000 or 20000 without damaging equipment.

BIM filler plates

Filler plates are used to cover any empty power breaker interface module (BIM) slots. Filler plates are fastened to the front of the BIP, over the empty BIM slot, by a captive screw. Filler plates are used in two-BIM modules, in which the BIP is installed in a frame which contains only one Passport 15000.

Filler plates must cover any empty BIM slots to protect BIP circuitry and to ensure compliance to safety requirements.

Alarm module

This section provides information on the following topics relating to the BIP alarm module:

- “Location of the BIP alarm module” (page 62)
- “Functions of the BIP alarm module” (page 62)
- “Front panel of the BIP alarm module” (page 63)
- “Hardware alarm definitions” (page 66)

Location of the BIP alarm module

The BIP alarm module is located at the front, on the right side of the BIP. See the figures “The BIP in a NEBS 2000 frame, front view” (page 52) and “Alarm module of the BIP” (page 65).

Functions of the BIP alarm module

The alarm module

- monitors and filters alarms for hardware indicators and software displays
- drives the alarm LED board (the board that activates the audio-visual follow-me hardware indicators)
- is part of the aisle alarm system
- monitors the state of the power breakers
- has numbered switches on the top of the module that are preset at the factory and must not be adjusted

The alarm module can monitor up to four cages contained in two nodes housed in a single frame. The module can also be used to monitor external office equipment.

Front panel of the BIP alarm module

The BIP alarm module front panel has the following features:

- a triangular and a rectangular alarm LEDs for the alarm module; see the table “Power LED status indicators for the BIP alarm module” (page 63) for an explanation of the LED displays.
- three separate alarm indicators for minor, major, and critical alarms. See “Hardware alarm definitions” (page 66) for a description of alarm types.
- a visual follow-me indicator of 10 LEDs to assist a craftsperson to locate a faulty module; see the table “Frame level indicators for the BIP alarm module” (page 64)

Note: When a Passport 15000 shares the BIP of a Passport 20000, that is, the two nodes are installed in the same frame, the LED test function operates only for the Passport 20000.

- a LEDTEST switch which, when pressed for five seconds, causes all the BIP LED alarm indicators to light up
- an audible alarm cut-off switch labeled ACO
- a captive screw to hold the module in place

Table 5
Power LED status indicators for the BIP alarm module

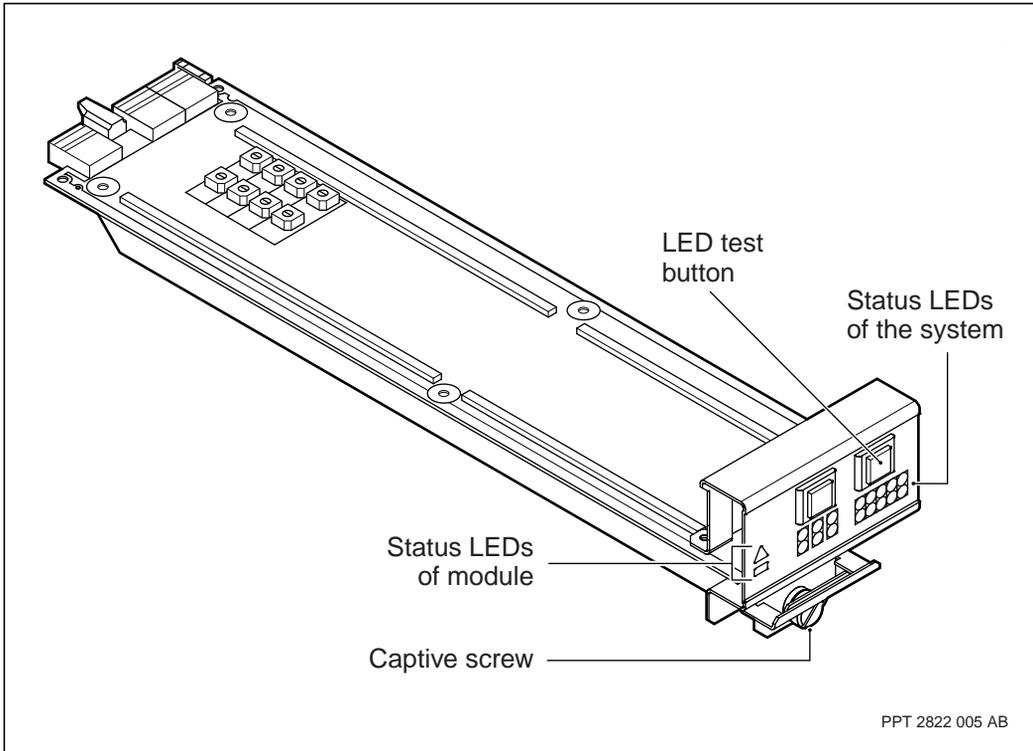
LED color	Shape	Mode	Meaning
green	triangle	solid	no fault, in service — active
red	square	solid	minor fault with the alarm module
off			invalid state — test for loss of power

Table 6
Frame level indicators for the BIP alarm module

LED color	Quantity	Mode	Meaning
red	2	solid	critical alarm in the frame
red	2	solid	major alarm in the frame
amber	2	solid	minor alarm in the frame
amber	10 (2 rows)	solid	follow me indicators to attract attention to the frame under an alarm condition

See the figure “Alarm module of the BIP” (page 65).

Figure 9
Alarm module of the BIP



All visual alarms on the BIP alarm module will remain on until the fault conditions are cleared. When a BIP alarm module LED is lit, an associated red LED is also lit on the module that has failed. The alarm module LED also lights when a high temperature alarm for a shelf (not a fabric) is detected. There is no LED for a high temperature alarm because it is caused from high ambient air temperature or a clogged air filter, not equipment failure. The section “Hardware alarm definitions” (page 66) identifies the hardware alarms that are indicated on the alarm module. These alarms are also reported in the software that monitors the operating status and performance of each Passport 15000 or 20000. (There are many other alarms that are also reported to the software.)

Hardware alarm definitions

The hardware alarms that are displayed on the front panel of a BIP alarm module and sometimes of the BIP BIM are given the severity as critical, major, or minor. Specific hardware actions or conditions trigger a specific severity. The hardware alarm severities are defined as follows.

Critical indicates that a severe, service-affecting condition has occurred and immediate corrective action is required. These are examples.

- A CP failure causes a loss of call processing capability.
- A fabric failure preventing a switchover to a standby (redundant) fabric card.

Major indicates that a service-affecting condition has occurred and urgent corrective action is required. Service-affecting conditions include disruption or degradation of service, or malfunction of an important circuit. These are examples.

- A breaker is tripped.
- A breaker has failed, meaning the breaker interface module (BIM) has failed or the input power to the BIM has failed.
- When an Astec MFA150 system of ac rectifiers is the power source and the external alarm cable assembly P0940531 is connected between it and the BIP, power to the BIP from one or more rectifiers has failed. Ac or dc failures are detected by the absence of voltage at the A or B feed of a function processor (FP). Three red LEDs are lit on the BIP alarm module. Alarm number 70120050 is reported to the Preside Multiservice Data Manager software.
- When an Astec MFA150 system of ac rectifiers is the power source and the system's alarm output wires are connected to J2 at the rear of the BIP, a rectifier or its fan has failed, or an ac or dc breaker on a Helios rectifier has tripped or been reset.
- When a system of ac rectifiers is the power source and the rectifier's alarm output wires are connected to the central office side of the BIP alarm module. In this case, a failed breaker alarm is also indicated.
- A fan or its controller has failed. A major, as well as a minor, frame-level alarm is generated.

Minor indicates that a non-service-affecting hardware or software failure has occurred. Corrective action must be taken to prevent a minor fault from escalating into a more serious problem. These are examples.

- A fan or its controller has failed. A minor, as well as a major, frame-level alarm is generated.
- A shelf temperature is higher than 72 degrees Celsius (161.2 degrees Fahrenheit).
- The BIP alarm module has failed.

BIP alarm LED board

The BIP alarm LED board connects to the alarm backplane. The alarm LED board indicates

- shelf failure
- BIP failure

If a fault occurs in either of the nodes connected to the BIP, an alarm is generated. If physical maintenance at the frame site is necessary, the network operator can alert a craftsperson to help clear the alarm. The LED indications on the alarm module assist the craftsperson in locating the correct frame. LEDs on the alarm module and the cages then direct the craftsperson to the part that caused the alarm.

The network operator can supply the craftsperson with this information:

- the location and part responsible for the fault
- a list of possible pieces of equipment at fault

The craftsperson can then use this information with the lit LEDs on the spot to determine which part to replace.

Amber follow-me lights are located on the BIP. A frame indicator light (aisle light), provided by the customer, can be connected to the alarm system. The following lights are designed to guide the technician to the system that generated the alarm:

- “Aisle indicator” (page 68)

- “Follow-me indicator” (page 68)

In addition, the alarm module provides a bank of 10 LEDs for frame failure which will come on when any of the other types of alarms are activated.

Aisle indicator

An aisle indicator, located at eye level in the aisle, indicates which row of nodes or frames contains the problem Passport 15000. The indicator light must be provided by the customer.

When the external alarm cable P0940531 is connected between the BIP and an MFA150 system of rectifiers, the aisle indicator trips if a rectifier is powered off or fails.

Follow-me indicator

A follow-me indicator draws attention from a craftsperson to the frame that has an alarm. The LEDs at the frame indicate the alarm status of parts of the system.

Major and minor alarms generated in a system are indicated by the frame indicator light.

Alarm cable connectors

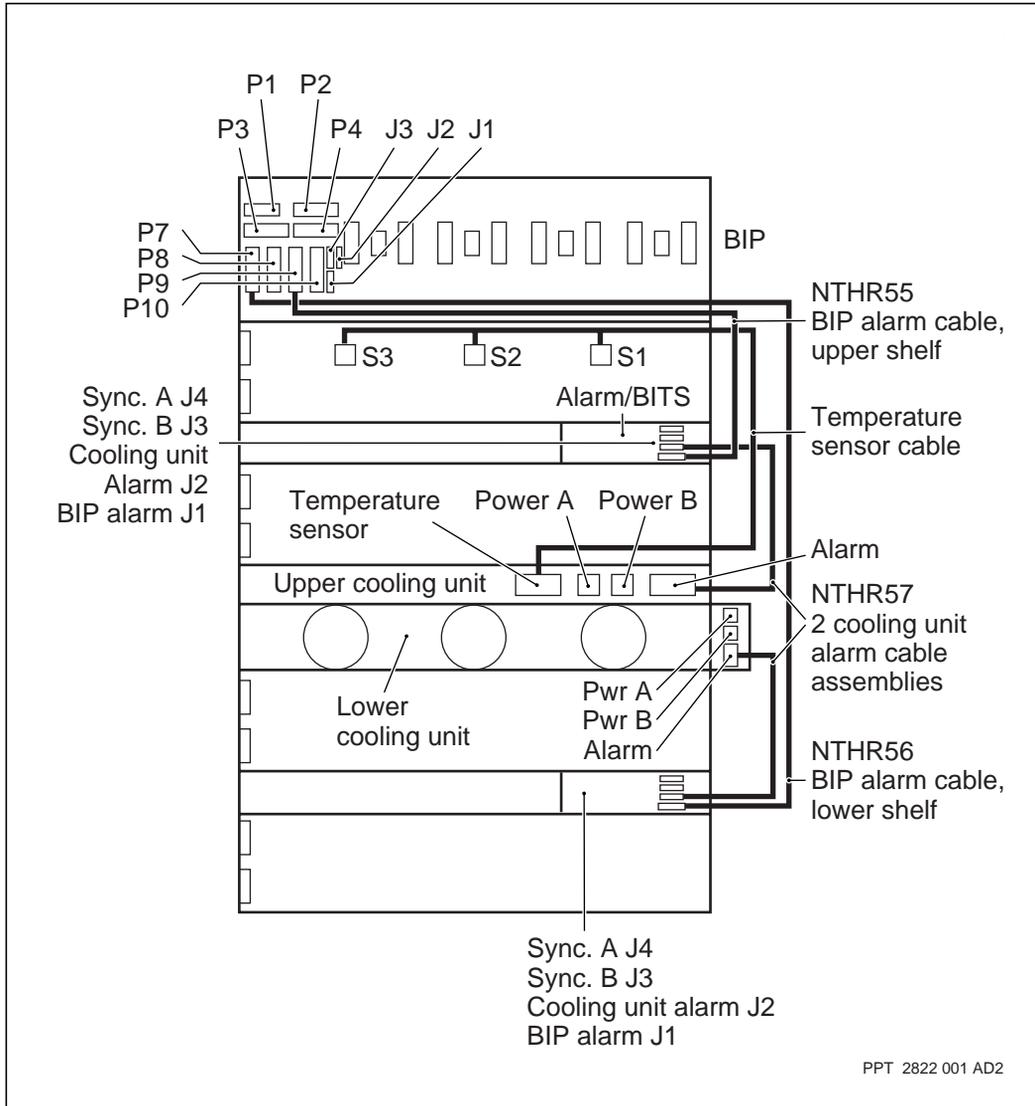
This section provides the following information about the BIP alarm cable connectors:

- “Location of the BIP alarm connectors” (page 68)
- “Functions of the BIP alarm connectors” (page 70)
- “Features of the BIP alarm connectors” (page 70)

Location of the BIP alarm connectors

The alarm cable connectors are located at the rear of the BIP backplane on the lower left side. See the figure “Location of alarm cable connectors for two shelves” (page 69).

Figure 10
Location of alarm cable connectors for two shelves



PPT 2822 001 AD2

Functions of the BIP alarm connectors

The alarm cable connectors provide alarm connectivity from the BIP to each of the nodes in a frame, and to other frames in the aisle.

Features of the BIP alarm connectors

The features are listed in the table “Features of the BIP alarm connectors” (page 70).

Table 7
Features of the BIP alarm connectors

Label	Type of connector	Feature
P1	15-pin D-sub, high density	interface for access by a craftsperson for connecting external telephone and data jacks when the BIP is in a DMS-100 office environment
P2	25-pin D-sub, high density	interface for office alarms to link or daisy-chain adjacent BIPs according to the DMS-100 office alarm scheme; used with connector J1 for an end-of-aisle lamp
P3	26-pin D-sub, high density	interface for stand-alone office alarms to connect a remote external alarm scanner in a stand-alone alarm environment (for example, to monitor the frame using an OEM scanner); for maximum flexibility, the connection is isolated form C (dry) contacts; the maximum is 100 mA/20 V
P4	25-pin D-sub, high density	interface for office alarms the same as connector P2
P5	110-pin	inside for the alarm module, not available for use
P6	55-pin	inside for the alarm module, not available for use
(Sheet 1 of 2)		

Table 7 (continued)
Features of the BIP alarm connectors

Label	Type of connector	Feature
P7, P8, P9, P10	26-pin D-sub, high density	<p>interfaces for shelf alarms such that:</p> <ul style="list-style-type: none"> • P7 is for the bottom cage of the lower shelf • P8 is unconnected • P9 is for the bottom cage of the upper shelf • P10 is unconnected <p>Unconnected connections will not generate alarms.</p>
J1	1x2 MATE-N-LOK with louvertec contacts	for aisle lamp output when the BIP is at the end of a lineup; must be used with connectors P2 and P4, or if the drive is still needed, their pin 19 must be connected to L +ABS on BIP connector P2 or P4
J2	1x4 Berg (pin 1 is at the top position on the BIP, pin 4 at the bottom)	for use if external power equipment is to be monitored; the equipment must have isolated form C (dry) alarm contacts; the alarm is generated on contact closure; see “BIP alarm connections from a system of ac rectifiers” (page 71)
J3	2x4 Berg	large fail indicator (frame or follow-me) for the module when the view of the indicators are blocked (for example, by cabinet doors); for driving a front and rear LED board
(Sheet 2 of 2)		

The installation and pinout of each BIP alarm connector is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

BIP alarm connections from a system of ac rectifiers

When a system of ac rectifiers, such as an Astec MFA150 power system, rectifiers is used to power a Passport 15000 or 20000, external alarms can be connected between the two setups. Selected alarm connections can indicate a hardware status at the Passport 15000 or 20000, while other selected alarm connections at the Passport 15000 or 20000 can indicate a hardware status at

the rectifier system. Since Nortel Networks supports the use of an Astec MFA150 power system, this section indicates the possible alarm connections at both ends.

When the BIP receives an alarm failure output from the rectifier of Astec MFA150 power system, it is a major alarm that indicates one or more of the following has occurred.

- One or more rectifiers has failed.
- One or more rectifier fans has failed.
- An ac failure occurred.
- An ac breaker was tripped or manually reset.
- A dc failure occurred.
- A dc breaker was tripped or manually reset.

The alarm cable connection end points between an MFA150 controller card and a BIP are identified in the table “Pin-to-pin connections between an MFA150 controller card and a BIP” (page 72). When the cable is connected and the system is operating normally, a failed rectifier generates critical alarm 70120050 that is reported to the network management software called Preside Multiservice Data Manager (if present).

Table 8
Pin-to-pin connections between an MFA150 controller card and a BIP

At the MFA150	At the BIP	Type of alarm
terminal block TB2: pin 1 for the black wire, pins 2 and 4 for the red wire, no connection (NC) for the white and green wires	J2, pin 2, L-	major

For the description of BIP alarm connector J2, see “Features of the BIP alarm connectors” (page 70).

The installation of the alarm cables for terminal block 2 (TB2) at the MFA150 are in Astec's document 167-9021-133 *Advanced Power Systems MFA150 Modular Front Access Power System Detailed Installation Guidelines and Procedures Manual*.

The prefabricated MFA-to-BIP external alarm cable assembly has part number P0940531. The installation of the cable and the pinout of the alarm connector are described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Power connections to and from the BIP backplane

Whether your site uses the top or bottom method of installing power cables, the BIP accommodates

- directly routing the cable from the site power source, or a branch panel as the last leg of connection, to the breaker interface panel (BIP) of the Passport 15000 or 20000
- using a cable tapped off a main power cable (instead of directly from the site power source) as the last leg of cable to the BIP
- including electrical conduit hardware with the power cables
- using the optional power-and-ground assembly at the rear of the BIP

This section includes the following information about the BIP backplane and the backplane power input connections:

- “Location of the BIP backplane power connections” (page 73)
- “Function of the BIP backplane power input connections” (page 74)
- “Hardware for connecting power input cables to the BIP” (page 75)
- “Function of the BIP backplane power output connections” (page 79)

Location of the BIP backplane power connections

The BIP backplane power connections are located along the right side of the rear of the BIP. A strain-relief bar is located directly in front of the power connections. This bar is used to prevent heavy input power cables from placing too much stress on the BIP backplane.

The power input connections located on the BIP backplane are shown in the figure “Rear of the BIP” (page 53).

The power output connections located on the BIP backplane are shown in the figures

- “Location of power output cable connectors at rear of two shelves” (page 82)
- “Backplane connections at the BIP” (page 81)

Function of the BIP backplane power input connections

The BIP backplane power connections are the terminations for input power feeds up to 100 A, and for output power cables from the BIP to the shelves and cooling units. A four-BIM model BIP supports four input feeds (a battery and battery return wire per BIM), while a two-BIM model supports two power feeds (four cables). A backplane safety cover overlays the backplane to prevent inadvertent shorts from metallic contact with the connectors. Each power input connection is covered by an insulating boot.

Each Passport 15000 or 20000 in the same NEBS 2000 frame requires four power cables (two feeds) through the same BIP.

Installing top power cabling involves routing four or eight cables (two or four feeds) from the dc power source along an overhead trough (or equivalent setup) and down to the BIP.

Installing bottom power cabling involves routing four or eight cables (two or four feeds) from the site dc power source under or through the floor and up to the BIP.

Installing the feeds through conduit or not depends on the access classification of your site as restricted or non-restricted. For information on classifications, see 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

The table “BIP backplane power connections in a dual shelf frame” (page 75) shows how the power connections on the backplane of the BIP are connected to other parts in the Passport 15000 frame setup.

Table 9
BIP backplane power connections in a dual shelf frame

BIM	Connector	Connects to
A1	P15	PIM 15RU lower shelf
	P16	cooling unit lower shelf
	P17	PIM 7RU lower shelf
B1	P 18	PIM 15RL lower shelf
	P19	lower cooling unit
	P20	PIM 7RL lower shelf
A2	P21	PIM 15RU upper shelf
	P22	upper cooling unit
	P23	PIM 7RU upper shelf
B2	P24	PIM 15RL upper shelf
	P25	upper cooling unit
	P26	PIM 7RL upper shelf

Hardware for connecting power input cables to the BIP

The cables that input power to the rear of the breaker interface panel (BIP) can be connected by one of the following methods.

- directly to the studs on the rear of the BIP
- indirectly through one of the power-and-ground assemblies (described in “Using an optional power-and-ground assembly” (page 76))

See the figure “Backplane connections at the BIP” (page 81). The power input connections include the following parts for each BIM:

- one pair of studs for connecting one dc power input cable and one return, that is, one feed
- one power input stud with an anti-rotation mate for each 2-hole lug

- one lug per pair of studs that is a 90-degree offset narrow-tongued 2-hole lug sized No. 2/0 AWG; the lug is oversized so that it accommodates the different thicknesses of 1/0 AWG (53.49 mm²) cable by various manufacturers, for example, with a 0.625 pitch

Note: When using power input cables that are thinner than 1/0 AWG, you must provide lugs matched to the cable gauge. When powering from an Astec MFA150 power system of ac rectifiers, the appropriately sized lugs for power cable installation are specified for the installation.

- one insulating boot per pair of studs to safely cover the studs, the end of the 1/0 AWG cable, and the lug

Note: When using power input cables that are thinner than 1/0 AWG, the same insulating boot is used and the gap is addressed by the procedure to connect each cable.

Using an optional power-and-ground assembly

The power-and-ground assemblies enable the connection of power input cables ranging in size from No 6 AWG (13.3 mm²) to 2/0 AWG (67.43 mm²), and enables using cable that is much less flexible than Super Flex. There is a polyvalent version (part number A0834143) and an equivalent version (part number A0834149) for the European Telecommunications Standards Institutes (ETSI). Both versions are identical in purpose and function. The mounting bracket of either assembly fits a NEBS 2000 frame, that is, a 21-inch wide mounting apparatus.

Each power-and-ground assembly includes:

- four pairs of terminal blocks along a rail, one per breaker interface panel (BIM); the uneven spacing is normal
- a bridge between the frame ground terminal and the adjacent battery return terminal (only on the ETSI terminal blocks)
- from each bridge, one ground cable ended with a straight 2-hole lug (ETSI only)
- at the top of the left and right terminal blocks, a clamping screw into the openings for the cables
- a blank label to identify the cable connection for each terminal block

- eight 2/0 AWG (67.4 mm²) Super Flex excelene cables rated as (R) +105C 600V (manufactured by Essex), two per BIM, connecting the terminal blocks to the BIP power input studs
- each cable has a 90-degree offset narrow-tongued 2-hole lug

At each set of three ETSI terminal blocks on the power-and-ground assembly:

- the top of the left block receives a power input cable from the site power source, while the bottom has a power output cable to the BIP
- the top of the middle block has a ground cable to fasten to a frame ground
- the top of the right block receives a power input cable from the site power source, while the bottom has a power output cable to the BIP

A power-and-ground assembly must be added to the switch hardware on site. The polyvalent or an ETSI assembly has a row of four unevenly spaced terminal blocks mounted on a flat metal bar. The bar is to be fastened to the frame uprights. An ETSI assembly has three terminal blocks per set instead of two. See the figures:

- “The polyvalent power-and-ground assembly A0834143” (page 78)
- “The ETSI power-and-ground assembly A0834149” (page 79)

All the site power cable preparation criteria up to the rear of the BIP also apply to a polyvalent or an ETSI power-and-ground cable assembly.

Adding a power-and-ground assembly in the field means either

- adding the assembly to the NEBS 2000 frame as an initial installation before the input power feeds are connected to the BIP
- adding the assembly after the Passport 15000 or 20000 has been powered up with feeds connected directly to the BIP

Figure 11
The polyvalent power-and-ground assembly A0834143

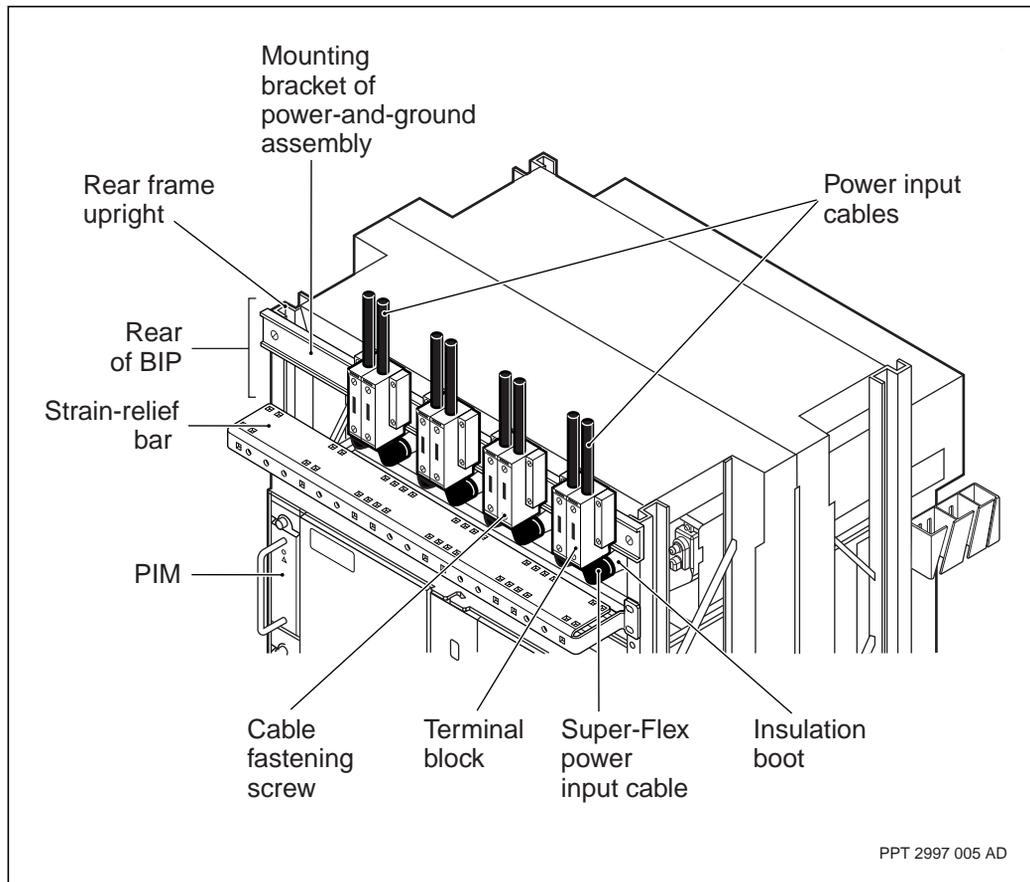
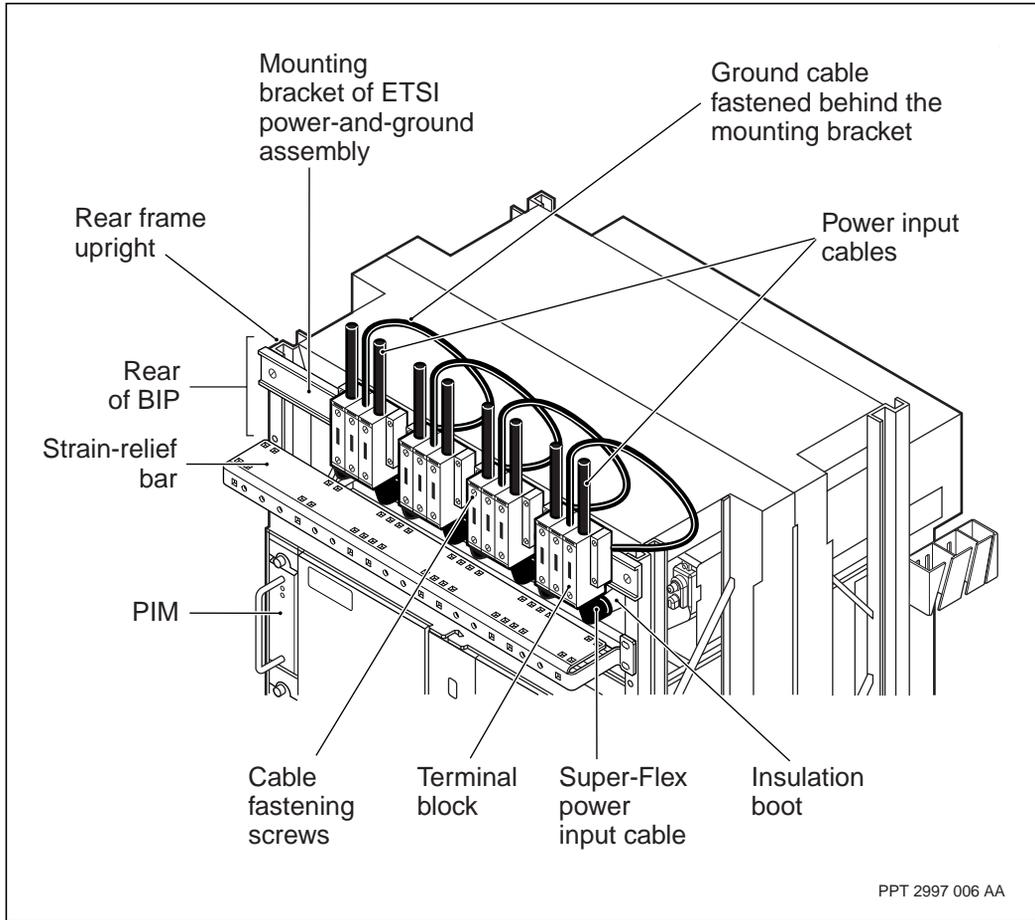


Figure 12
The ETSI power-and-ground assembly A0834149



Function of the BIP backplane power output connections

The power output connections at the BIP distribute the input power from the A and B feeds to the Passport 15000 shelf or shelves and the cooling unit or units. Each breaker interface module (BIM) is connected through the BIP backplane to a group of output connections. The group includes a connection to each PIM of a shelf and a connection to that shelf's cooling unit. See the figure "Backplane connections at the BIP" (page 81). The paired BIMs for each shelf provide redundant power to each shelf and its cooling unit.

The power output cables from the rear of the BIP to the parts of the shelf include:

- two 1x4 MATE-N-LOK II connectors with louvertec contacts for cables providing power output to the PIMs in the shelves
- one 1x2 MATE-N-LOK II connector with louvertec contacts for cables providing power output to either the upper or lower cooling unit

The power output cable assemblies are always installed for both shelves even if only one is mounted in a NEBS 2000 frame. For the cable connection points, see the figure “Location of power output cable connectors at rear of two shelves” (page 82).

Figure 13
Backplane connections at the BIP

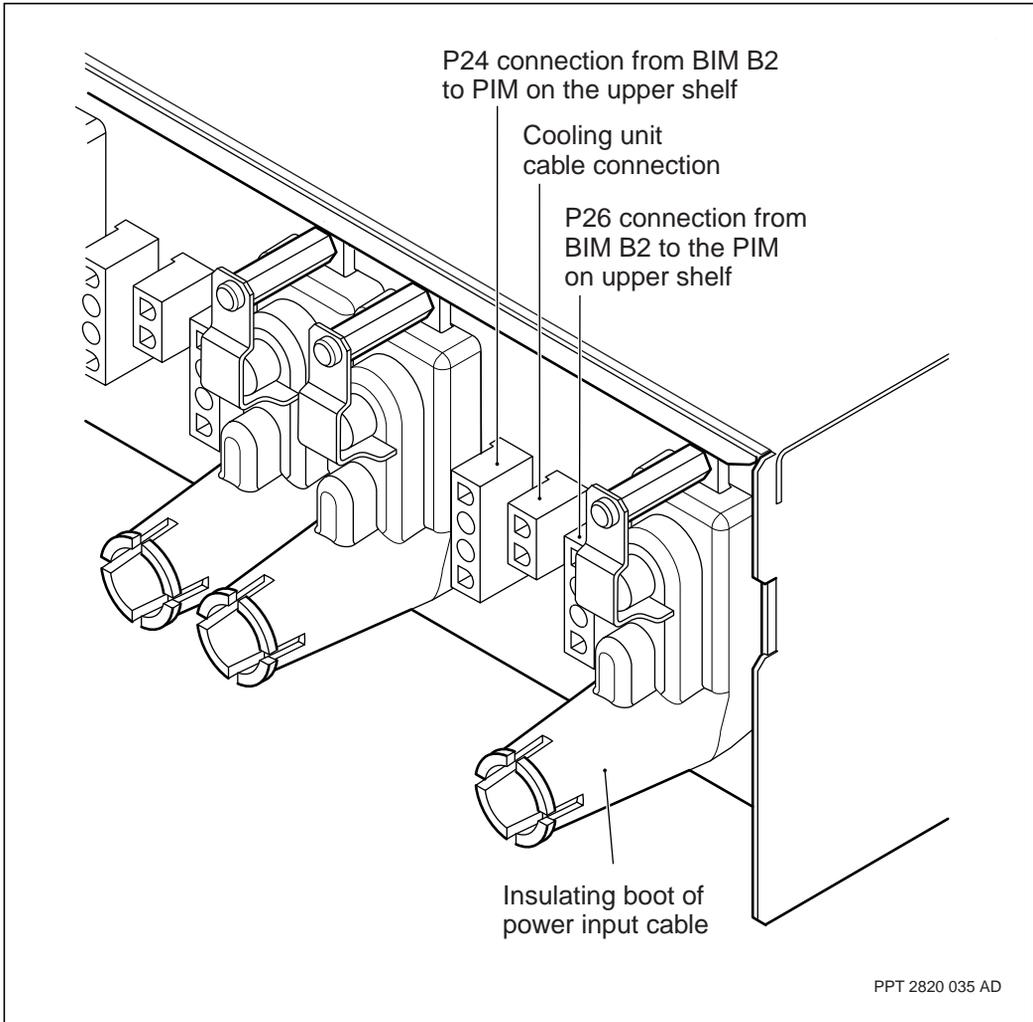
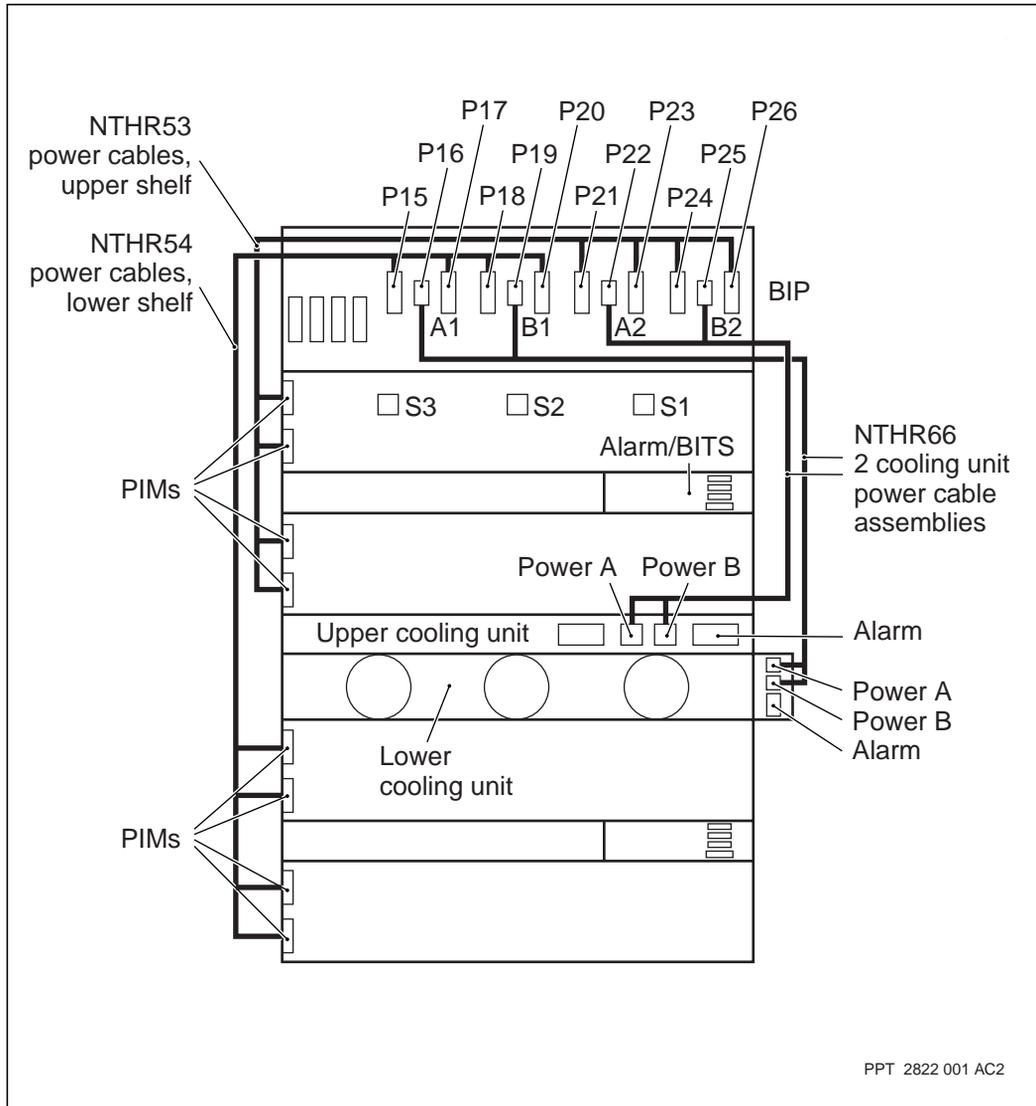


Figure 14
Location of power output cable connectors at rear of two shelves



Sources of dc input power to the BIP backplane

The breaker interface panel (BIP) of a Passport 15000 receives and distributes dc power for the system. The source of dc power can be from either:

- a dc power setup for the building or room of operation at the site
- co-located ac rectifiers, for example, when using an Astec MFA150 power system

Most of the preparations and requirements for dc power cabling between the MFA150 rectifiers and the BIP of the Passport 15000 have the same criteria as cabling from a site dc power plant. For information of this kind, see 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

Powering the BIP from ac rectifiers

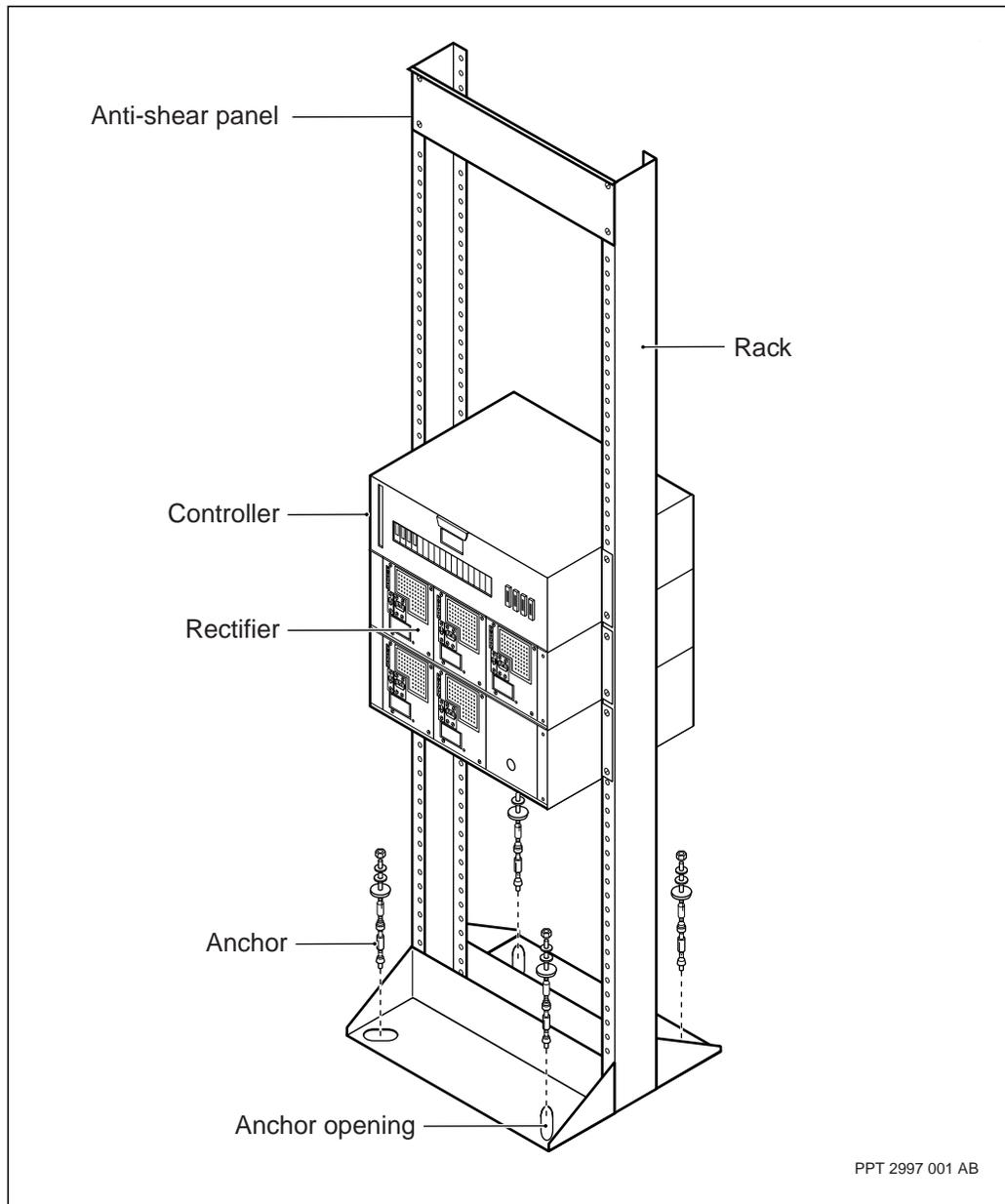
The BIP can be powered from any system of ac rectifiers that provides the power, safety, and performance required to operate one or two Passport 15000 or 20000 shelves (not a combination). Nortel Networks recommends using one of the configurations of the Astec MFA150 power system of rectifiers. The system is manufactured by Astec Advanced Power Systems. Consult your Nortel Networks sales representative for the available equipment. For an example, see the figure “MFA150 power system of five rectifiers for a dual shelf configuration” (page 84).

One configuration provides up to 100 A of dc power with 25 A of redundancy for two Passport 15000 or 20000 shelves (50 A per shelf). Another configuration provides 50 A of dc power with 25 A of redundancy for one Passport 15000 or 20000 shelf. Both configurations support n+1 redundant sparing of power output.

The MFA150 system consists of an integrated distribution and control panel and one or two rectifier shelves. Optional parts include an external battery return panel and a battery disconnect panel. Supplementary distribution and battery trays can also be added. The system may be engineered on a standard 59-cm (23-inch) relay rack or in a special wall-mounted enclosure.

To plan for the installation of an Astec MFA150 power system of ac rectifiers, refer to 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

Figure 15
MFA150 power system of five rectifiers for a dual shelf configuration



PPT 2997 001 AB

Grounding the Passport and interworking equipment

The NEBS 2000 frame is the grounding point for the switch hardware. The frame has a silvery grounding strip bonded to the front of each frame upright and across the top front. Mounting any Passport equipment onto the frame using the provided self-tapping bolts automatically grounds it to the frame.

The NEBS 2000 frame is to be grounded to the site ground window using a cable with a straight two-hole lug from a top front or top rear pair of pre-drilled unthreaded holes through the silvery strip. Grounding the frame to the site ground window grounds all equipment mounted onto the frame.

Any optional Passport or non-Passport equipment that is connected to or interworks with the hardware of a Passport must share the same ground window even if the equipment is mounted in different mounting apparatuses.

Chapter 3

Shelf assembly

A NEBS 2000 frame supports two shelf nodes, an upper and a lower. Each shelf node is a separate Passport 15000 or 20000. A shelf node is mostly comprised of the power distribution unit, the cooling unit, and a shelf assembly. A shelf assembly accommodates:

- plug-in processor cards or filler cards in two rows (cages) across the front
- a cable management channel across the front
- the identification logo of the Passport model on the cover of the upper cable management channel since the front of a Passport 20000 appears to be the same as a Passport 15000; (on some earlier models of Passport 15000, the cable cover is blank)
- two plug-in fabrics across its rear
- plug-in modules at the rear for power input, hardware alarms, external timing interfaces, and the MAC address
- the temperature sensors on an upper shelf for the upper cooling unit
- supporting the cooling fans which dissipate the heat generated by the Passport 15000 or 20000
- an ESD jack to plug a wrist strap into

The card slot numbers are sequential through both cages. The cages hold the processor cards which manage the node and provide physical interfaces for connection to high-speed data networks. The parts which make up the shelf assembly allow the processor cards to

- inter-communicate (across both card cages)

- support alarm, timing, and node addressing

A module is different from a card because it requires no software configuration and has no connected signaling (traffic) cables. All modules are installed at the rear of the shelf assembly. A fabric card is the only rear card and the only card without signaling cables. Replacing a rear card or module in a Passport 15000 or 20000 affects performance depending on whether it has a redundant mate (backup). Each replacement procedure minimizes the amount of time a card or module or a backup is out of service.

The software term *shelf* refers to the node rather than the shelf assembly. The term *shelf assembly* refers to the hardware part of a shelf node that contains the plug-in modules and processor cards.

These sections describe the hardware parts that constitute a single Passport 15000 or 20000 shelf assembly:

- “Common backplane” (page 92)
- “Fabric cards” (page 94)
- “Power interface modules (PIMs)” (page 107)
- “Media access control (MAC) address module” (page 112)
- “Alarm/BITS module” (page 114)
- “Cooling units” (page 126)

The exterior parts of the shelf assembly are shown in the figures

- “A typical shelf assembly, front view” (page 89)
- “A shelf assembly of a Passport 15000 without fabrics, rear view” (page 90)
- “A shelf assembly of a Passport 20000 with one fabric removed, rear view” (page 91)

For information about installing or maintaining any of the shelf parts described in this section, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 16
A typical shelf assembly, front view

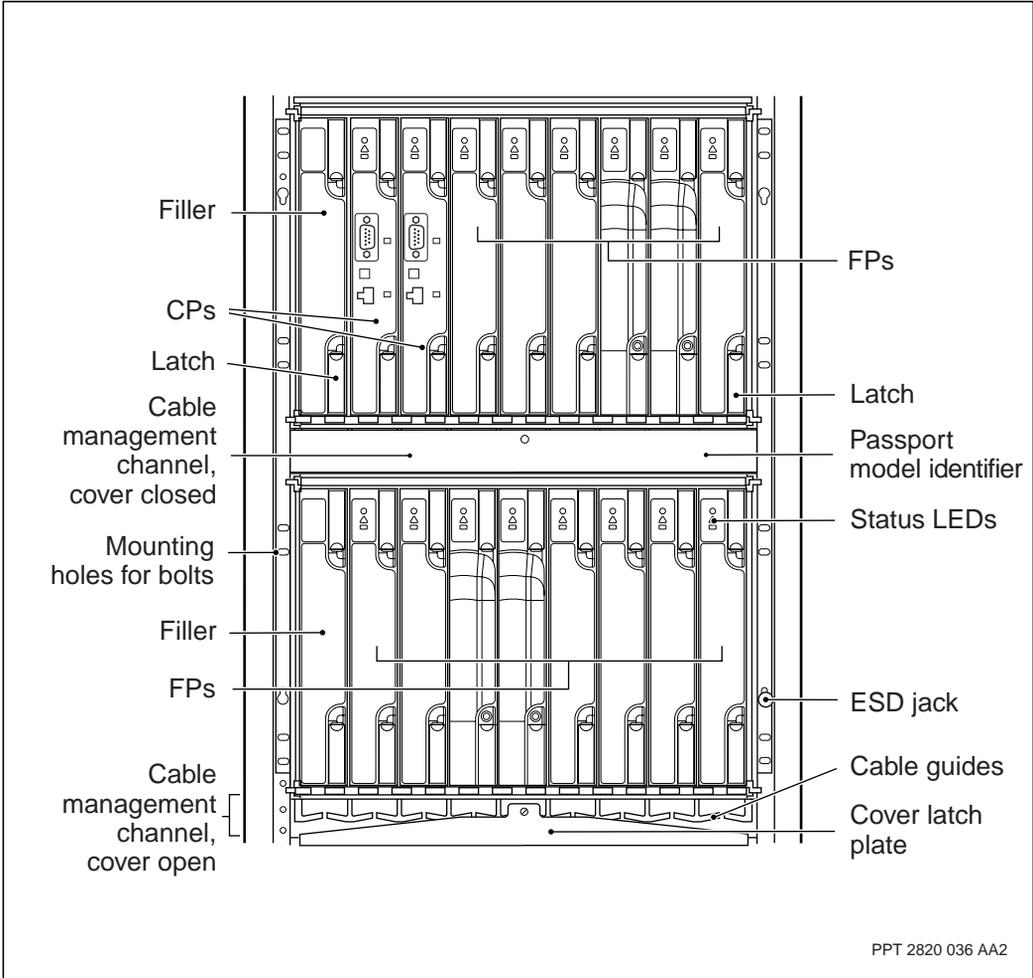


Figure 17
A shelf assembly of a Passport 15000 without fabrics, rear view

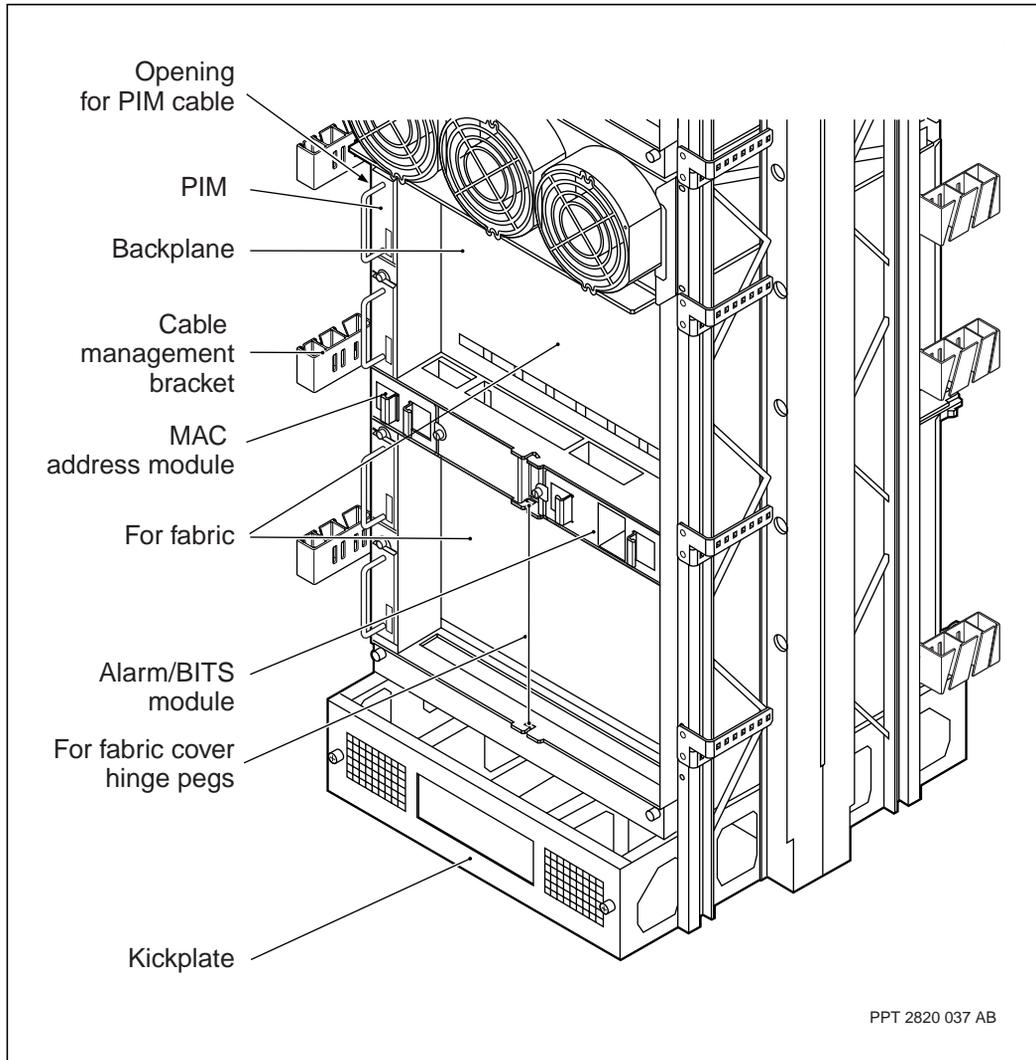
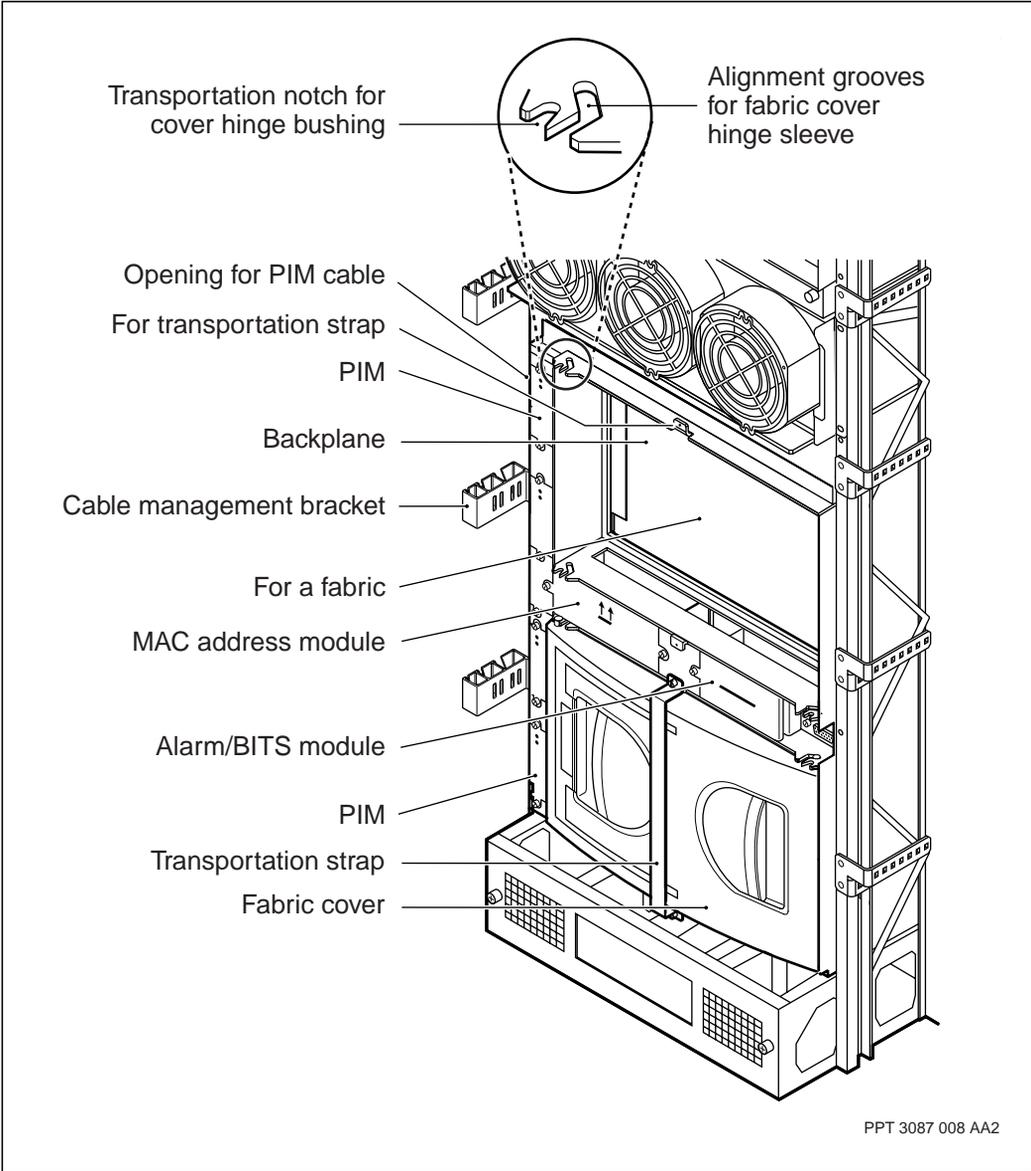


Figure 18
A shelf assembly of a Passport 20000 with one fabric removed, rear view



Common backplane

This section provides the following information about the shelf assembly common backplane:

- “Backplane location and physical description” (page 92)
- “Function of the common backplane” (page 93)

The backplane can also be considered a midplane since cards can be inserted on both sides.

Backplane location and physical description

The backplane is located at the rear of the shelf assembly between the processor cards and the fabrics. The backplane spans both card cages and extends over the full height and width of the shelf. The backplane is not a field-replaceable unit. The location of the backplane is shown in the figure:

- “A shelf assembly of a Passport 15000 without fabrics, rear view” (page 90)
- “A shelf assembly of a Passport 20000 with one fabric removed, rear view” (page 91)

The backplane of a Passport 15000 is a 20-layer printed circuit board containing 8 signal layers and 12 power/ground layers. Each processor card connects to the backplane with 4 Z-PACK connectors with a total of 658 pins per processor card slot, plus additional pins for the fabric card, MAC address module, alarm/BITS module, and the power interface modules (PIMs). Compliant pins are mechanically inserted in the backplane with a friction fit. The backplane circuit board itself contains no active electronic parts.

The backplane of a Passport 20000 is a 20-layer printed circuit board containing 10 signal layers, 12 ground, and 2 power layers. Each processor card connects to the backplane with 4 Z-PACK connectors and 2 power connectors with a total of 658 pins per processor card slot. This includes pins for the fabric card, MAC address module, alarm/BITS module, and the power interface modules (PIMs). Compliant pins are mechanically inserted in the backplane with a friction fit. The backplane circuit board itself contains no active electronic parts.

Function of the common backplane

The backplane is referred to as the common backplane because it is the point across which all processor cards and fabric cards in a shelf intercommunicate.

In a Passport 15000, the backplane provides redundant 3.52 Gbits/s serial links between the processor cards and the fabric cards to support power and signal distribution. The high-speed lines on the backplane have a nominal impedance of 50 ohm and 100 ohm differential to reduce signal ringing and reflections caused by impedance mismatches. The serial link architecture of the backplane allows for hot-swapping packs by isolating each card to a single fabric port, preventing card failures from propagating through the switching fabric. The backplane also provides links between adjacent FPs for functions such as sparing, clock distribution, and distribution of -48/-60 V dc.

In a Passport 20000, the backplane provides redundant serial links or Unilinks between the processor cards and the fabric cards to support power and signal distribution. The Passport 20000 has the 3.52 Gbits/s link capability of the Passport 15000 and adds an overlay of 16.0 Gbits/s of link capability. Only one capability is active per slot. The high-speed lines on the backplane have a nominal impedance of 50 ohm and 100 ohm differential to reduce signal ringing and reflections caused by impedance mismatches. The serial link architecture of the backplane allows for hot-swapping packs by isolating each card to a single fabric port, preventing card failures from propagating through the switching fabric.

The backplane also provides links between adjacent FPs for functions such as sparing and clock distribution. The backplane has layers dedicated to power distribution of -48/-60 V dc to all plug-in cards and modules.

The backplane can function in dual- or single-fabric mode. Traffic is typically loadshared through the backplane across both fabrics. Dual-fabric mode is the standard mode used by the Passport 15000 or 20000. Single-fabric mode occurs while one of the fabrics is being replaced or upgraded.

Fabric cards

This section contains the following information about the fabric cards:

- “Fabric card carrier” (page 94)
- “Fabric card transportation” (page 97)
- “Fabric card location and physical description” (page 98)
- “Function and operation of the fabric cards” (page 101)
- “Fabric LED behavior is different from FPs” (page 104)
- “Fabric replacement can affect traffic” (page 104)
- “Fabric replacement can affect system cooling” (page 105)
- “Fabric replacement may need a firmware upgrade” (page 106)

Fabric card carrier

Each shelf assembly contains two fabrics. each fabric is enclosed in a carrier module. The carrier protects the fabric card, provides EMC compliance, and provides a mechanism for inserting the card.

The figure “Faceplates of both fabrics installed in a lower Passport 15000” (page 95) shows the position of the fabrics in a Passport 15000.

The figure “Faceplates of both fabrics installed in a lower Passport 20000” (page 96) shows the position of the fabrics in a Passport 20000.

Figure 19
Faceplates of both fabrics installed in a lower Passport 15000

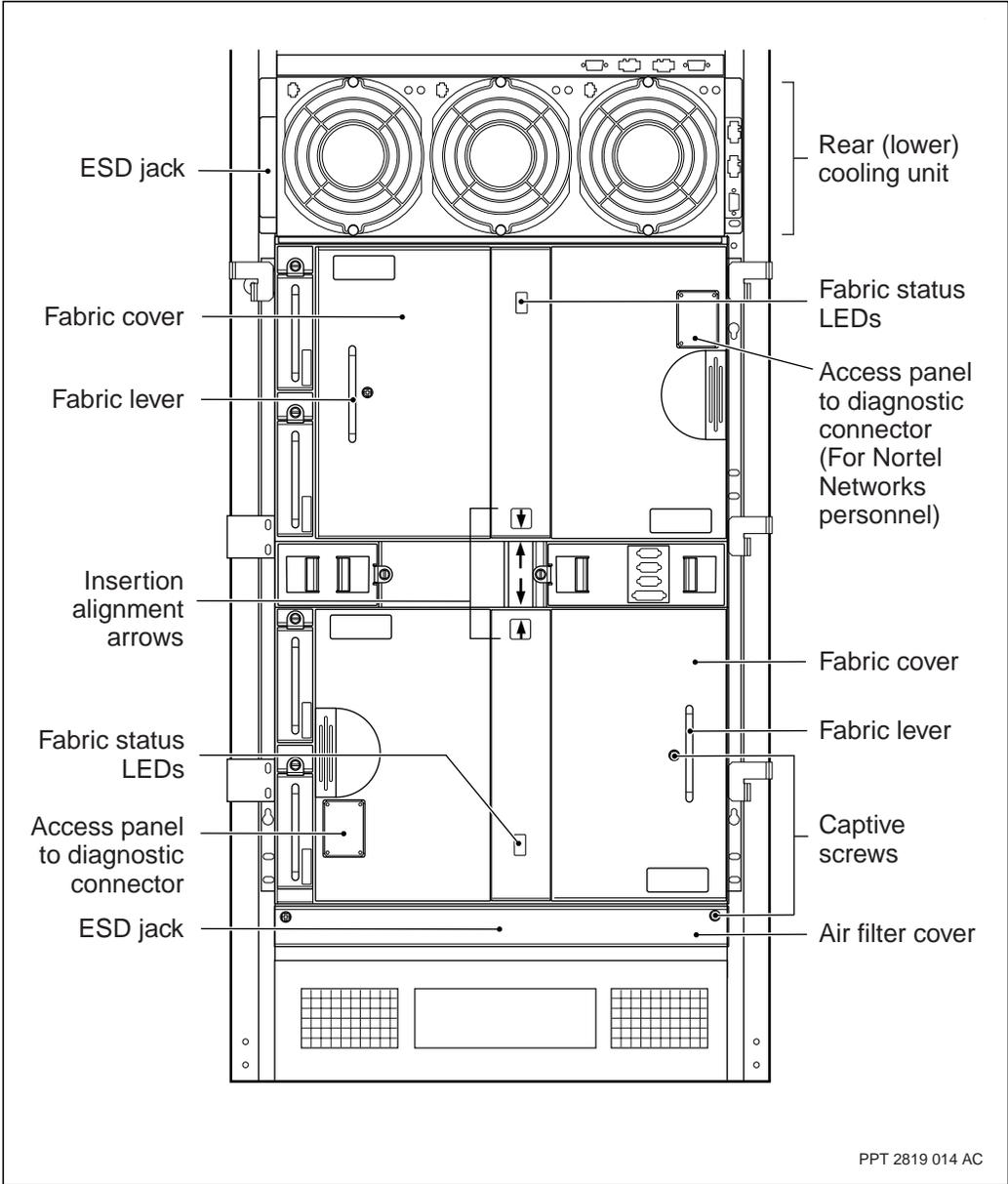
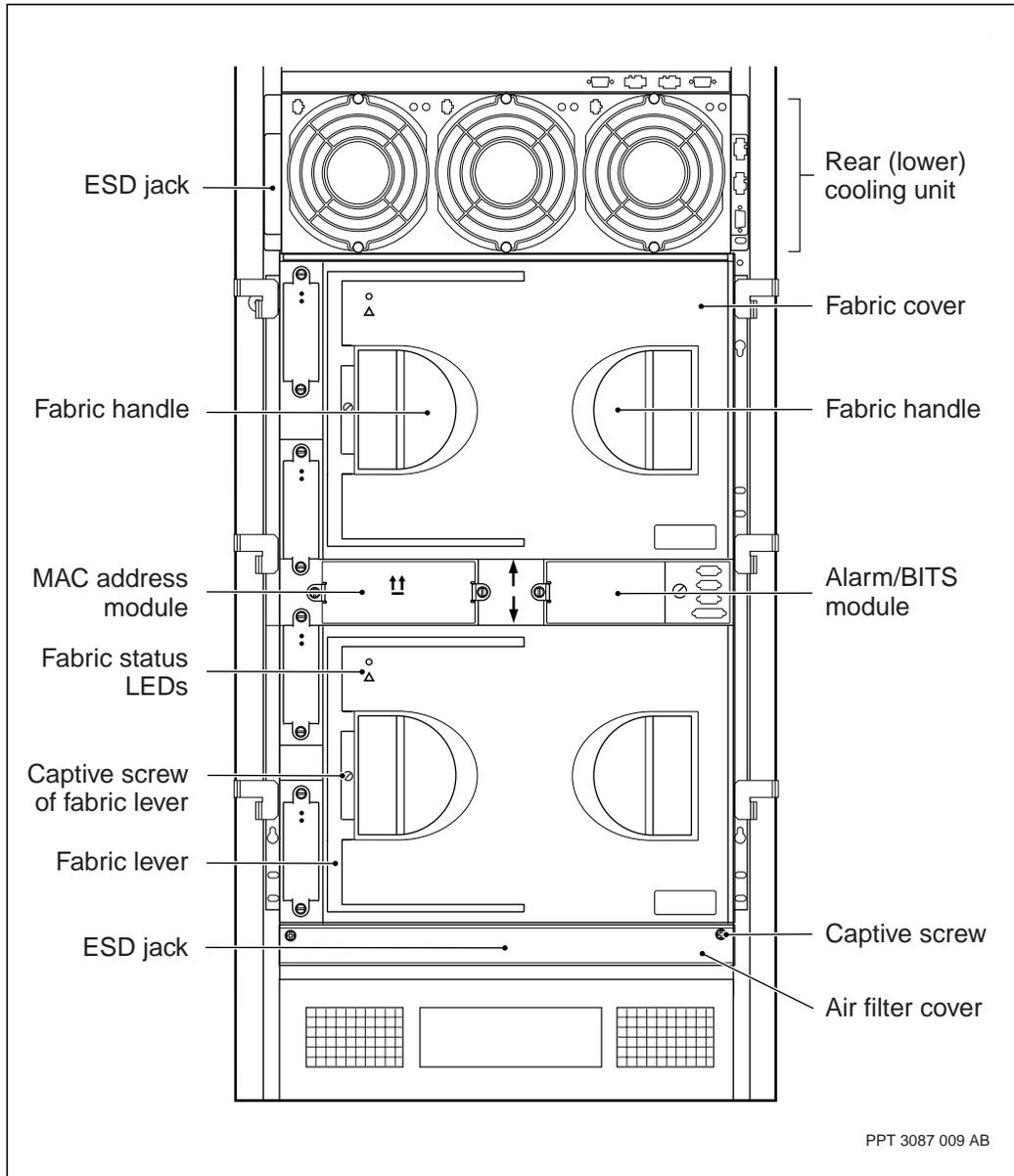


Figure 20
Faceplates of both fabrics installed in a lower Passport 20000



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Fabric card transportation

The method of transporting fabric cards differs between a Passport 15000 and 20000.

Each fabric of a Passport 15000 is shipped in its own transportation container. The container and packaging protects the card from damage by minor impacts and electromagnetic discharges (ESD).

Each fabric card of a Passport 20000 is strapped into a transportation position against the rear of the shelf assembly. During transportation, the card connectors are not engaged with the backplane. The outer card carrier provides protection from ESD. After the NEBS 2000 frame or equivalent mounting apparatus is anchored to the floor and the switch hardware is fastened to that apparatus, removing the transportation strap allows the fabric to be seated. Store the strap for re-use in case the shelf assembly is ever moved from its position. See the figure “Transportation strap of a Passport 20000 fabric” (page 98).

The transportation strap for a fabric (part number P0936800) is not supposed to be mounted on an in-service system because having to remove it to replace a fabric will delay removal of the fabric. Replacing a fabric is a time-sensitive task.

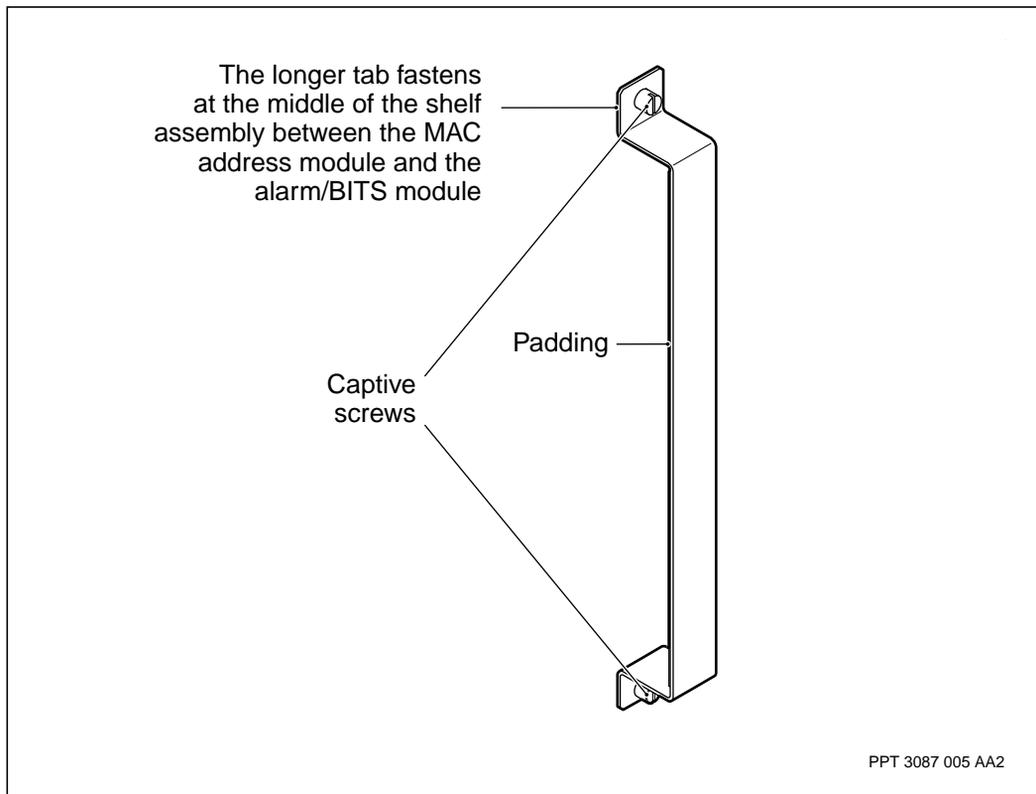
Put the strap aside for re-use whenever the shelf assembly is to be moved with a fabric in the transportation position. Always keep a hand on the fabric to ensure it stays against the shelf assembly.

Note: When the shelf assembly is shipped in its own container as part of a shelf-based package (for example, NTQH03), the fabric is also shipped in its own container. This makes the shelf assembly weigh less for handling during installation into the mounting apparatus.

Each Passport 20000 in the upper position of a NEBS 2000 frame is shipped with temporary protective tape covering the air vent of the fabric cage. If the tape is not removed before initially powering up the node, the accumulated heat that is trapped against the fabrics can exceed each fabric’s temperature threshold. When the threshold is exceeded, the fabric drops its traffic until the temperature goes below the threshold. Built-in hysteresis prevents the fabric from toggling between on and off at the temperature threshold. A shelf

assembly in the lower position of a NEBS 2000 frame does not have the strip of tape. A shelf assembly from package NTQS03 or NTQS04 may not have the tape on it. Removing the protective tape is an essential step of the installation procedure.

Figure 21
Transportation strap of a Passport 20000 fabric



Fabric card location and physical description

Each Passport 15000 or 20000 shelf assembly houses two fabric cards, located one above the other at the rear of the shelf assembly. The fabric in the upper position is referred to by the software as fabric X, while the lower is fabric Y.

Each fabric is an individual switch embedded in a chip set.

Passport 15000 fabrics

In a Passport 15000 the upper and lower fabric cards are rotated 180 degrees relative to each other to minimize serial link lengths. The figure “Faceplates of both fabrics installed in a lower Passport 15000” (page 95) shows the fabrics rotated.

Each Passport 15000 fabric provides 16 input and 16 output DASL ports at 3.52 Gbits/s bandwidth for each port. The fabric capacity is 56 Gbits/s while the shelf (usable) capacity using that fabric is 40 Gbits/s. The 40G fabric supports the 2.5 Gbits/s function processors (FPs).

The table “The features of a 40 Gbits/s fabric” (page 99) lists the major features of a Passport 15000 fabric.

Table 10
The features of a 40 Gbits/s fabric

Feature	Description
throughput capacity	56.32 Gbits/s (40 Gbits/s shelf capacity) from 2 fabrics each with 40 Gbits/s operating at half capacity in load-sharing (redundant) mode for a total shelf capacity of 40 Gbits/s
port configuration	16 x 16 non-blocking
base speed per port	3.52 Gbits/s
self routing	yes
multicast, broadcast	yes
flow control	grant
shared memory depth	256 or 512 cells
QoS support	Passport 15000 uses 2 priorities
DASL interface	440 Mbits/s
JTAG	yes
technology	CMOS5S6, 0.35 Um

Passport 20000 fabrics

In a Passport 20000 the fabrics are both installed with the same way orientation. (This is different than a Passport 15000.)

The fabric capacity is 112 Gbits/s each while the shelf capacity using that fabric is 70 Gbits/s. Shelf capacity is the portion that is available to traffic. Each fabric provides 16 input ports and 16 output ports. Both fabrics connect to the 16 processor cards (2 CP3s and 14 FPs) in the shelf using one of two types of serial link ports:

- DASL for a 3.52 Gbits/s full duplex connection used by the 2.5 Gbits/s FPs
- Unilink for a 16 Gbits/s full duplex connection in preparation for use by the upcoming 10 Gbits/s FPs

Each 70G fabric provides up to 16 ports in a combination of DASL and Unilink ports with a maximum of 4 Unilink ports. For example, the combination can be 4 Unilinks and 12 DASLs, or 3 Unilinks and 13 DASLs.

DASL connections are used by the function processors (FPs) that have ASIC devices called CPAC1 or CPAC2. Unilink connections will be used by the FPs that have the C192 ASICs. (The ASICs of each FP type are identified in *241-5701-615 Passport 7400, 15000, 20000 FP Configuration Reference*.) Card slots 6 and 7 or 14 and 15 can accommodate FPs that use either DASL or Unilink. All other slots accommodate DASL. The slots are paired so that they can be configured for card-to-card sparing.

The 70G fabric supports both the 2.5 Gbits/s FPs and the 10 Gbits/s (C192) FPs. The 10G FPs must be installed in the Unilink slots.

The table “The features of a 70 Gbits/s fabric” (page 101) lists the major features of a Passport 20000 fabric.

Table 11
The features of a 70 Gbits/s fabric

Feature	Description
throughput capacity	112.6 Gbits/s (70 Gbits/s shelf capacity) from 2 fabrics each with 70 Gbits/s operating at half capacity in load-sharing (redundant) mode for a total shelf capacity of 70 Gbits/s
port configuration	16 x 16 non-blocking
base speed per port	4.0 Gbits/s and 16.0 Gbits/s for the four slots when 10 G cards are installed
self routing	yes
multicast, broadcast	yes
flow control	grant
shared memory depth	256 or 512 cells
QoS support	Passport 20000 uses 2 priorities
DASL interface	3.52 Gbits/s
Unilink interface	16 Gbits/s
JTAG	yes
technology	CMOS5S6, 0.35 Um

Function and operation of the fabric cards

The fabric cards provide the shelf with two redundant 16x16 switching elements for interconnecting up to 16 processor cards. Both fabrics balance and load-share traffic. Each one operates at about half capacity so that it can take over the traffic of its mate. Either fabric can handle all traffic carried by a fully provisioned and configured Passport 15000 or 20000 switch.

Under normal operation, each processor card transmits to and receives from half the processors on the upper fabric (the X fabric in software) and half on the lower fabric (the Y fabric). When the control processor (CP) detects a fault in a fabric, or when the fabric is manually locked, the CP blocks all new

traffic to that fabric and reroutes its established traffic to the unlocked fabric. When all traffic in progress is established on the fabric that is taking over the full load, the locking of the fabric completes.

The fabrics are hot-swappable. When the software is prepared for the removal by manually locking the fabric X or Y in software, and then returning the replacement to service by the manually unlocking it, traffic in progress on the fabrics is maintained. When hot-swapping a fabric without locking it in software the traffic in progress on the removed fabric is lost and the inserted fabric is automatically tested and returned to service provided the tests pass.

Unlocking a fabric returns it to service. The CP allows new traffic to use the fabric. Traffic that was transferred to the other fabric is transferred back so that balanced load sharing resumes.

The internal port-to-card mapping of the 70G fabrics is different from the 40G fabrics (and their physical connectors to the backplane are different). This means a 40G fabric cannot be used in a Passport 20000, and a 70G cannot be used in a Passport 15000. When the system first detects which type of fabric it has, the system automatically:

- knows how to treat the fabric, that is, as two 40Gs of a Passport 15000 or two 70Gs of a Passport 20000
- compares the firmware versions between the pre-loaded firmware on the fabric and in the software load on the system and flags any discrepancy
- adjusts the port-to-card mapping between the fabrics and the processor cards (transparent to the end-user)
- updates the system with the total fabric capacity of the shelf

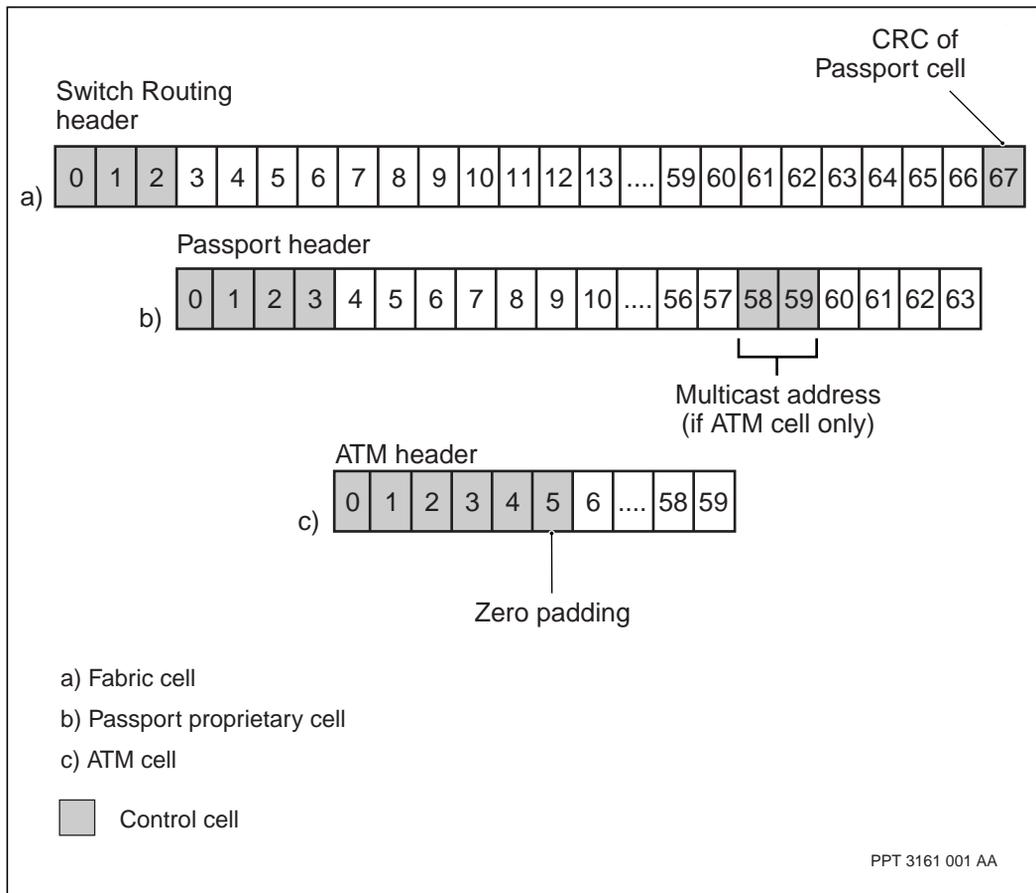
For Passport 15000 or 20000, each of the 16 links to the fabric supports 3.52 Gbit/s bi-directional data rate per link or 2.5 Gbit/s user data rate. The fabric data rate is greater than the user data rate for two key reasons:

- bandwidth reserved to accommodate internal cell headers
- fabric speedup to provide non-blocking architecture

Passport 15000 or 20000 use fixed 68 byte cells or packets in the fabric route between the processor cards. The figure “Passport fabric cell” (page 103) shows the cell formats and encapsulation. It encapsulates the following:

- 3 bytes for switch routing header
- 64 bytes for Passport proprietary cell
- 1 byte for CRC (cyclic redundancy check) to protect payload

Figure 22
Passport fabric cell



For more information about the operation of fabrics, see the chapter on fabrics in 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*.

Passport 15000 fabrics are installed in opposite orientations relative to each other (unlike Passport 20000). Orient installing a fabric by using the insertion alignment arrows that are labeled onto each Passport 15000 fabric and the middle of the shelf assembly. Passport 20000 fabrics are installed in the same orientation relative to each other.

Fabric LED behavior is different from FPs

Since a red LED can be caused by more than disabling, a fabric with a red LED can still be transmitting traffic. Similarly, a fabric with a green LED might be prevented from transmitting traffic. To handle these unusual fabric behaviors, and to prevent uncontrolled errors from hot-swapping an unlocked fabric, always manually lock a fabric and allow time for the transfer of connections before physically removing it from a shelf, and unlock it as soon as a replacement is seated.

For the complete pattern of fabric LED behaviors, refer to “Status LEDs of a fabric in a Passport 15000” (page 352) or “Status LEDs of a fabric in a Passport 20000” (page 354).

Fabric replacement can affect traffic

When both fabrics of a Passport 15000 or 20000 are in service, they operate in a load-sharing mode such that either fabric can take over all the traffic of its mate. When a fabric fails completely, the failure triggers the remaining fabric to take over the incoming load of the failed fabric and the failed fabric is put into a lock-out state. Traffic in progress is unavoidably lost during the switchover.

When the system removes a fabric from service (disables it), it puts the fabric in a lock-out state, but it does not automatically lock it in software. Prior to removing a fabric from a shelf assembly, you must always manually lock the fabric in software. (This is not the same as the lock-out state of a failed fabric.) Locking the target fabric allows a takeover of traffic by its mate and prepares the system to allow returning the replacement fabric to service. Without manual locking, the system cannot put the replacement fabric into service. Manually unlocking the fabric triggers the return to service, but the lock command had to have been used first.

If the fabric you must replace still has traffic passing through it, then the traffic in progress can be maintained through its redundant mate provided that mate is in service and operating normally. Traffic is maintained by manually locking the target fabric so that the mate fabric takes over its traffic.

Replacing a fabric that has no in-service mate causes all CPs and FPs to reset. A reset loses all traffic in progress. The CPs and FPs will not reboot until a fabric is installed and returns to service.

For a description of handling fabric software sparing, takeover, and lockout, refer to 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*.

Fabric replacement can affect system cooling

An installed fabric is an integral part of the cooling system and electromagnetic compatibility (EMC). The duration of replacing a fabric affects the cooling system and electromagnetic compatibility (EMC).



CAUTION

Risk of service loss or equipment damage

Removing a fabric for an extended period of time affects the cooling system's capability to maintain a nominal temperature of operation inside the Passport 15000 or 20000. The period of time varies according to the ambient temperature of the room. See the table "Durations for replacing a fabric" (page 105).

Table 12
Durations for replacing a fabric

Ambient room temperature	Interval between removing and inserting
25 degrees Celsius (77 degrees Fahrenheit)	20 minutes
30 degrees Celsius (86 degrees Fahrenheit)	8 minutes
40 degrees Celsius (104 degrees Fahrenheit)	3 minutes

Before removing a fabric, ensure that the cooling unit of the switch is operating with all three fans at normal speeds. If at least one fan is not operating at normal speed, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Fabric replacement may need a firmware upgrade

A fabric card stores fixed firmware from the factory, and can be loaded with additional firmware after being seated into an operating Passport 15000 or 20000. Once the writable memory bank is loaded, for example, with version 9.3, it automatically becomes active and controls the operation of the fabric card. For information on installing new firmware on the fabric card, see 241-5701-272 *Passport 7400, 15000, 20000 Software Upgrade*.

An upgrade to fabric card firmware occurs independently of software upgrades to the function processors (FPs) and control processors (CPs). All Passport software is compatible with all fabric card firmware. Some versions of fabric firmware can include enhanced or new functionality to increase efficiency. For example, the software package called fabric_CB02A is used by PCR 2.2 GA software and contains the fabric firmware. The B refers to the 2 in PCR 2.x, the 02 refers to the .2 in PCR 2.2, and the A refers to GA. CB02S1A would refer to the first software supplement for PCR 2.2 GA software. Both fabric_CB02A and fabric_CB02S1A use the same firmware.

When inserting a version of a fabric with a product engineering code (PEC) that is different than the fabric being replaced, the replacement may require a different firmware load to be downloaded from the software distribution site (SDS). When a new fabric is installed, the system software prompts the operator to upgrade the firmware to a specific version if that version is not already running. Information about fabric firmware is described in 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*. The work flow for installing new fabric card firmware is identified in 241-5701-272 *Passport 7400, 15000, 20000 Software Upgrade*.

Power interface modules (PIMs)

The power interface modules (PIMs) pass power from the breaker interface panel (BIP) into the shelf assembly. This section provides the following information about the PIMs:

- “Location and physical description of the PIMs” (page 107)
- “PIM faceplate” (page 107)
- “PIM cable assembly” (page 110)
- “Power LED status indicators for PIMs” (page 110)
- “PIM cable assembly” (page 110)

Location and physical description of the PIMs

Four power interface modules (PIMs) are located along the left side of the rear of the shelf assembly. See the figure “A shelf assembly of a Passport 15000 without fabrics, rear view” (page 90).

Each PIM provides a point at which power cables from the BIP are connected. Each shelf assembly contains four PIMs: two for A power feeds and two for B feeds. See “Function of the BIP backplane power input connections” (page 74) for more information about how input power feeds from the BIP are routed to each shelf. Each PIM provides separate power filtering for the portions of the shelf it supports. The PIMs also provide termination for the shelf clocks and for the secondary control bus.

The PIM is a field-replaceable unit; however, the shelf must be powered down from the appropriate BIP circuit breakers and the PIM power cables unplugged before the module can be removed.

PIM faceplate

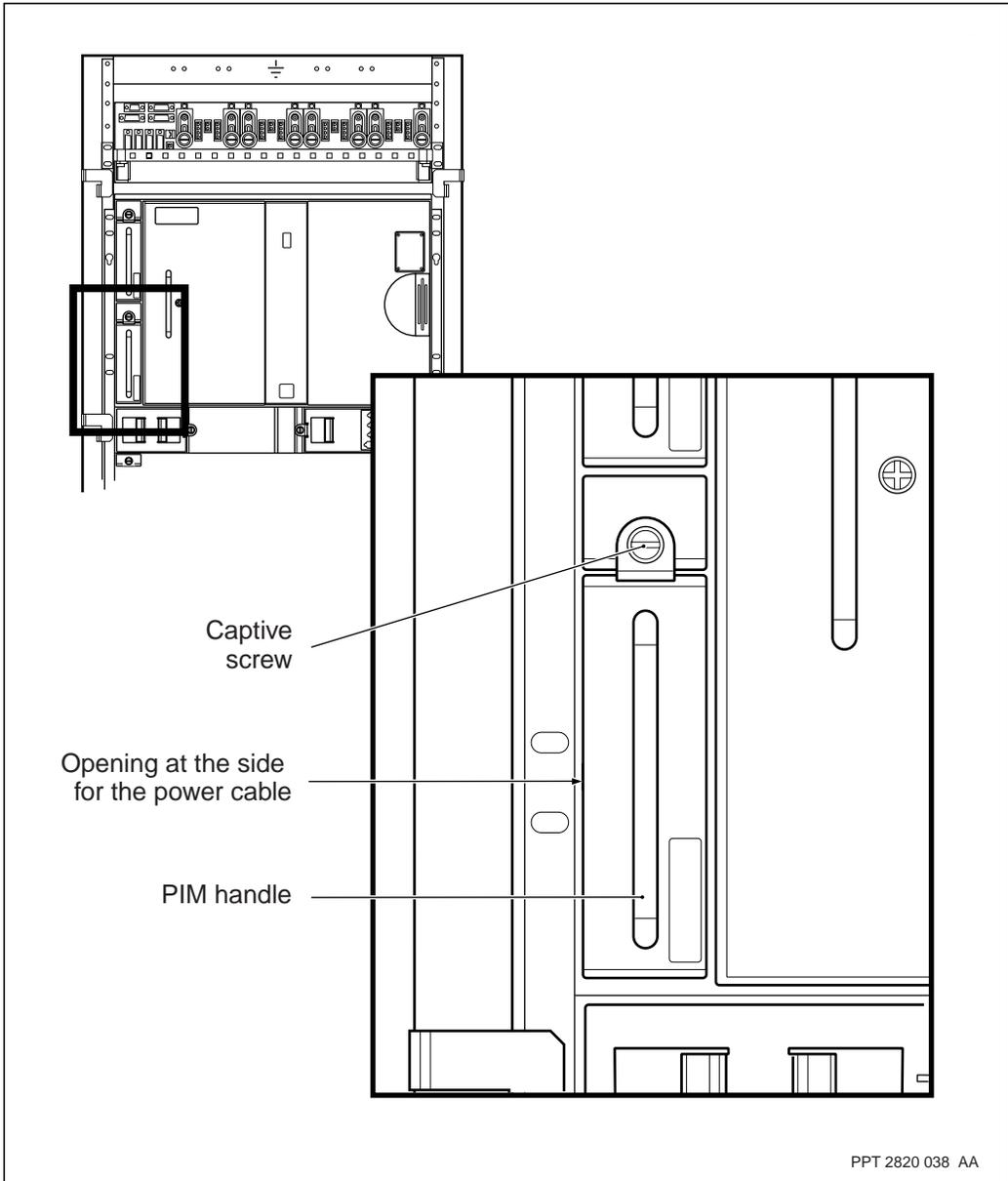
The side of a power interface module (PIM) where the power cables from the BIP are connected. The faceplate is designed such that you cannot remove PIM unless the power cable is removed first. This protects the backplane pins from arcing if the PIM is pulled with the power left on. The figure “Faceplate of a PIM on a Passport 15000” (page 109) shows the opening for the connection point.

The table “Pin description for the PIM faceplate power connector” (page 108) lists the pin assignments for the PIM faceplate.

Table 13
Pin description for the PIM faceplate power connector

Pin number	Signal	Function	Description
4	L +1	input	battery return feed 1/3
3	L +2	input	battery return feed 2/4
2	L -1	input	negative battery feed 1/3
1	L -2	input	negative battery feed 2/4

Figure 23
Faceplate of a PIM on a Passport 15000



Power LED status indicators for PIMs

Each PIM of a Passport 20000 has a LED for the A and B power feeds to the BIP. See the figure “Location of the PIMs, the MAC address, and the alarm/BITS module in a Passport 20000” (page 111). While a PIM is powered, the green LED is lit solid. See the table “Power LED status indicators for each PIM” (page 110) for an explanation of the LED displays.

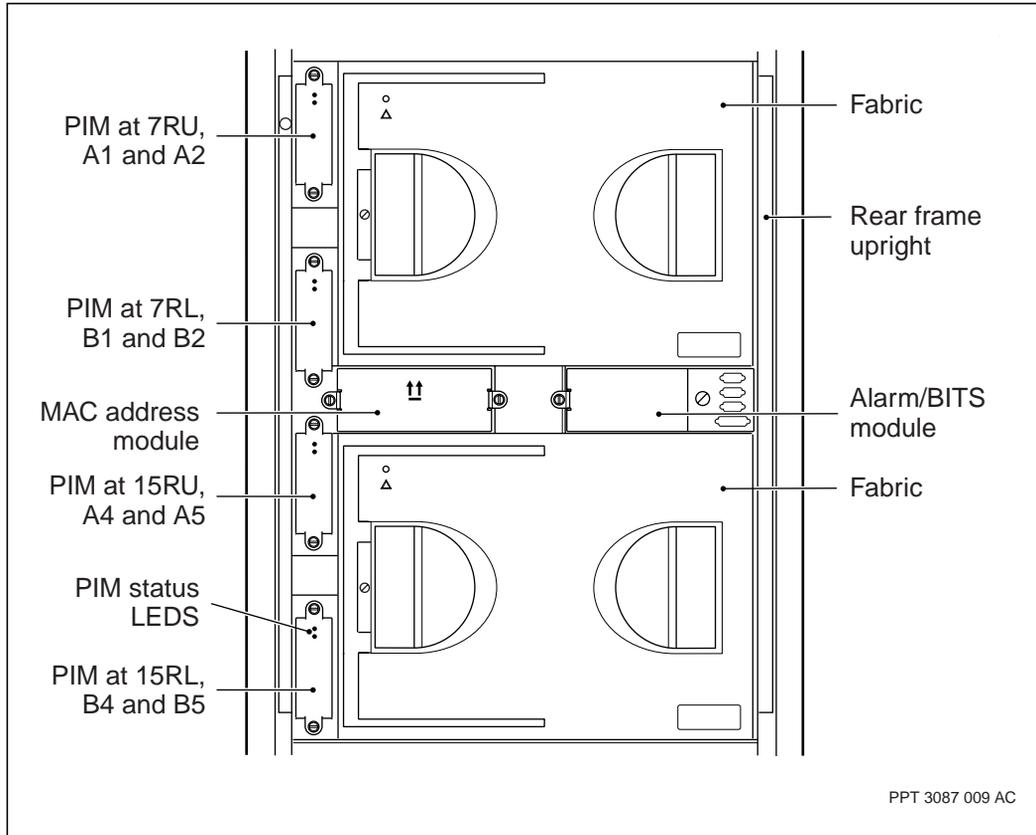
Table 14
Power LED status indicators for each PIM

LED color	Mode	Meaning
green	solid	power is on for the slots powered by the PIM
off		power is off because of one or more of the following: <ul style="list-style-type: none"> • the breaker on the BIM that distributes power to it is off • the cable from the BIP to the PIM is disconnected at one or both ends • the power input to the BIP is off or missing for the indicated A or B feed • the BIM is missing or defective • the LED is burned out

PIM cable assembly

A cable assembly distributes power from the breaker interface modules (BIMs) in the breaker interface panel (BIP) to the PIMs. The cable assemblies for the upper and lower Passport 15000 or 20000s are different lengths. The cable assemblies are installed when a Passport 15000 or 20000 is installed in a NEBS 2000 frame. The cable assembly of the second Passport 15000 or 20000 is typically installed even if the frame is shipped with only one shelf.

Figure 24
Location of the PIMs, the MAC address, and the alarm/BITS module in a Passport 20000



Media access control (MAC) address module

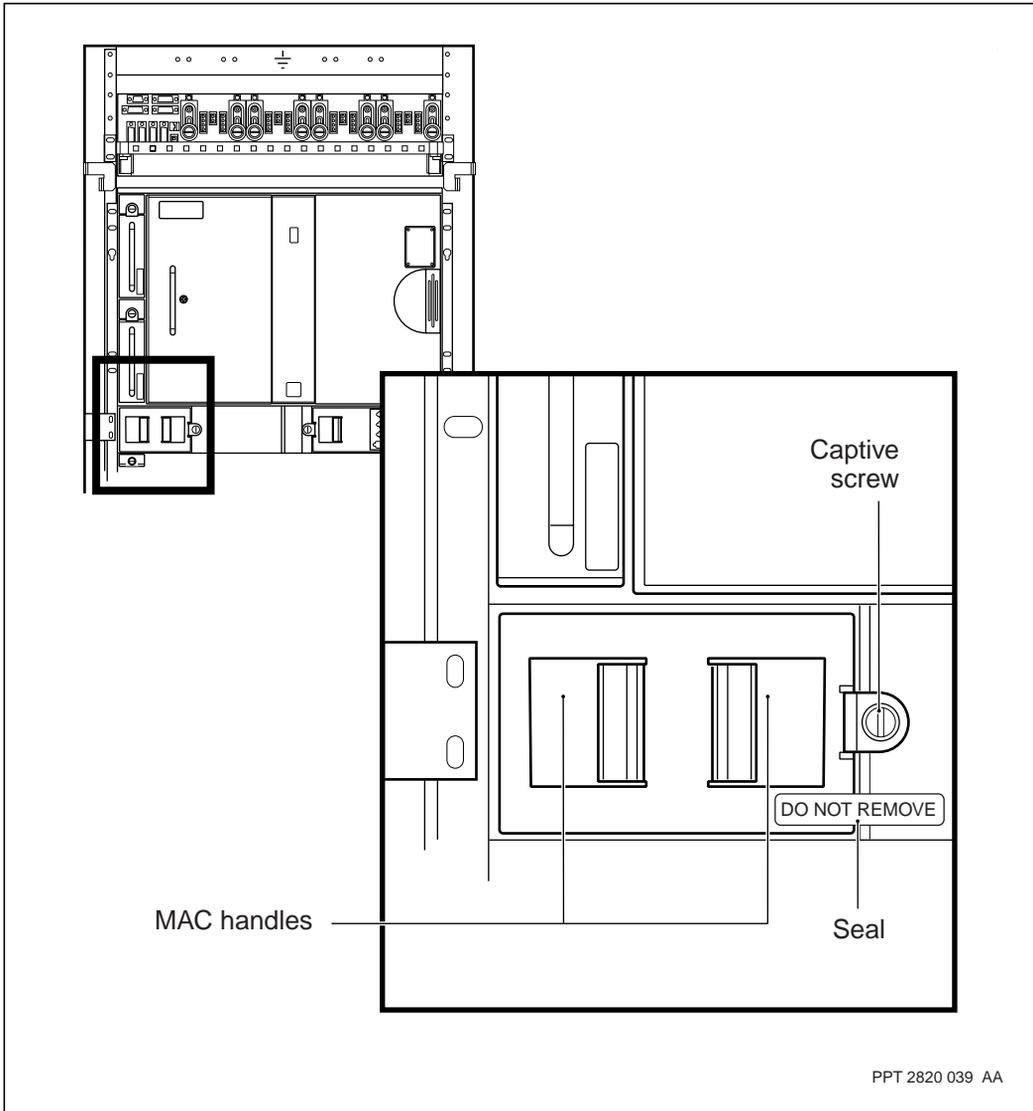
The media access control (MAC) address module contains a circuit board with an 87C51 8-bit microcontroller and a Z-PACK connector used to provide an interface to the shelf backplane. The module contains the base MAC address and the range of MAC addresses available for assignment (based on the base address value). During the Passport 15000 or 20000 software boot sequence, the active control processor (CP) card takes the range stored in the MAC address module, divides this value by the number of functional processor (FP) cards, and distributes to each FP a base value and a range.

The MAC address module is located on the left side of the rear of the shelf assembly, between the two fabric cards and between the power interface modules (PIMs) of the upper and lower module cage. The location of the MAC address module is shown in the figure “A shelf assembly of a Passport 15000 without fabrics, rear view” (page 90).

The MAC address module is a field-replaceable unit (FRU) which provides the shelf with MAC addresses for the CP and FP cards. The module also communicates the shelf type to the CP cards.

The faceplate is shown in the figure “Faceplate of a MAC address module” (page 113) and “Location of the PIMs, the MAC address, and the alarm/BITS module in a Passport 20000” (page 111).

Figure 25
Faceplate of a MAC address module



PPT 2820 039 AA

Alarm/BITS module

The alarm/BITS module provides the alarm monitoring and the building integrated timing supply (BITS). There is only one alarm/BITS module per Passport 15000 or 20000. When it is removed or failed there is no:

- BITS timing signal to the control processors (CPs)
- reporting of the fabric LED status to the software
- reporting of any cooling unit alarms to the control processors (CPs)
- reporting of any CP alarms to the breaker interface panel (BIP)

The suspension of timing depends on how the timing was configured in the software. Since the software detects and reports a missing card, which is triggered as soon as the cable to a card or module is disconnected, your replacement activity must be coordinated with the software operator of the switch to ensure minimum impact on service. Have the software operator consider putting the CP timing in holdover mode or line timing for the duration of the replacement.

There are no software or hardware alarms specific to the removal of the alarm/BITS module itself or leaving its slot empty. Other alarms that may occur as a result of the removal of the alarm/BITS module are:

- 7002 0003, if the fabric card component temperature has increased above the accepted operating temperature
- 7012 0051, if the cooling unit is not function correctly on a bus-based shelf or the cooling fan is not functioning correctly or the temperature is too high on a fabric-based shelf
- 7017 1000, if the CP is not synchronized to the reference

When the module is replaced, reporting of current alarm status resumes.

Unlike most other hardware parts of the Passport 15000 or 20000, there is no software command associated with locking, removing, inserting, or unlocking the alarm/BITS module, however there are commands for locking the ports on the module.

The alarm/BITS module passes the signals over the shelf backplane to the control processor (CP) cards and expansion slots. (The expansion slots are currently unsupported.)

The alarm/BITS module is a field-replaceable unit (FRU).

This section provides the following information about the alarm/BITS module:

- “Types of alarm/BITS modules” (page 115)
- “Alarm/BITS module faceplate” (page 116)
- “Alarm/BITS module cable assemblies” (page 122)
- “Timing cable specifications for the DS1 circuit” (page 123)
- “Timing cable specifications for the E1 balanced circuit” (page 123)
- “Timing cable specifications for the E1 unbalanced circuit” (page 124)
- “Line build out application settings” (page 125)

Types of alarm/BITS modules

The types of alarm/BITS module are matched to the CP cards for the type of interfacing signal as follows.

The types of the alarm/BITS module for a Passport 15000 include

- NTHR12, for balanced DS1 twisted pair (matched to the DS1 CP NTHR06 or NTHW06)
- NTHW76, also for the DS1 CP types NTHR06 or NTHW06. This module is intended for use with the external sync wire-wrap cable assembly NTHW75. The module and cable assembly are typically factory-installed. In the case of a retrofit, the parts are also available as external sync wire wrap hardware kit NTHW74. This alarm/BITS module is for use in an environment requiring an 8 kHz BITS timing source signal for customers requiring GR-1244 compliance.
- NTHR13, for balanced E1 twisted pair (matched to the E1 CP NTHR35 or NTHW08)
- NTHR14, for unbalanced E1 coax (matched to the E1 CP NTHR35)

The types of the alarm/BITS module for a Passport 20000 include

- NTPN12, for balanced DS1 twisted pair (matched to the DS1 CP NTHW06)
- NTPN78, also for the DS1 CP type NTHW06. This module is intended for use with the external sync cable wire-wrap assembly NTHW75. The module and cable assembly are typically factory-installed, if that is how the Passport was initially ordered. In the case of a retrofit, the parts are also available separately. This alarm/BITS module is for use in an environment requiring an 8 KHz BITS timing source signal for customers requiring GR-1244 compliance.
- NTPN13, for balanced E1 twisted pair (matched to the E1 CP NTHW08, or matched to the E1 CP NTHR14 when used with the E1 balanced-to-unbalanced cable assembly NTHR81)

Alarm/BITS module faceplate

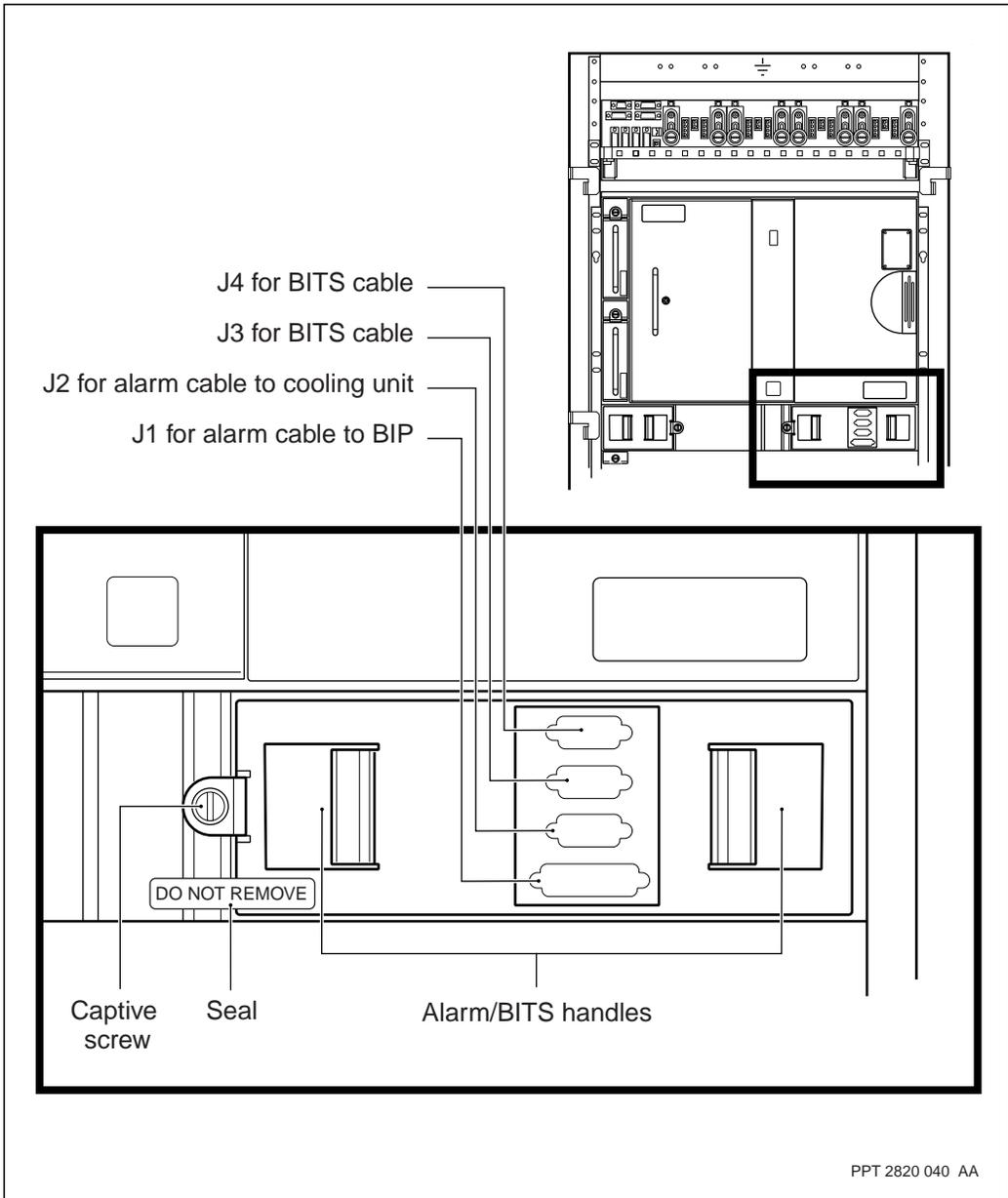
The alarm/BITS module is located at the right side of the rear of the shelf assembly, between the upper and lower fabric modules (see the figure “A shelf assembly of a Passport 15000 without fabrics, rear view” (page 90)).

The alarm/BITS module contains the following connectors:

- “BITS ports (Sync A-J4 and Sync B-J3)” (page 119)
- “Cooling unit alarm connector” (page 119)
- “BIP alarm connector” (page 120)

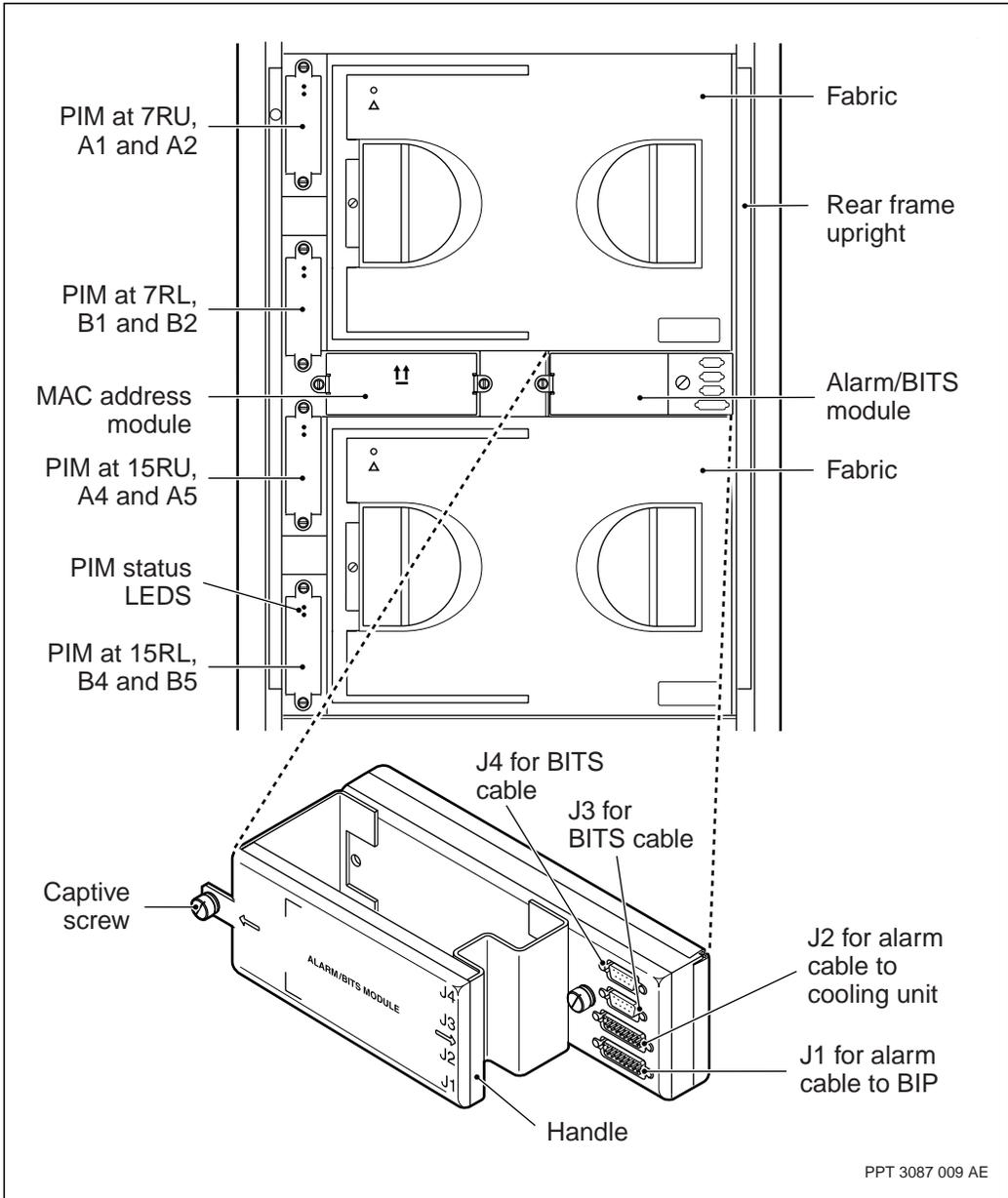
The alarm/BITS faceplate is shown in the figure “Faceplate of an alarm/BITS module in a Passport 15000” (page 117) and “Location of the PIMs, the MAC address, and the alarm/BITS module in a Passport 20000” (page 111).

Figure 26
Faceplate of an alarm/BITS module in a Passport 15000



PPT 2820 040 AA

Figure 27
Faceplate of an alarm/BITS module in a Passport 20000



BITS ports (Sync A-J4 and Sync B-J3)

The alarm/BITS module provides two ports for connecting the shelf to a building integrated timing supply (BITS) interface. The ports are labeled Sync A-J4 and Sync B-J3. These ports are paired with the control processors that contain the active BITS circuits. Depending on the variant of the alarm/BITS module used, these ports support connection to

- a DS1 balanced cable (twisted pair D-sub)
- a DS1 wire-wrap cable assembly for operation and direct connection of BITS wires to an externally-mounted terminal block
- an E1 balanced cable (twisted pair D-sub)
- an E1 unbalanced cable (75-ohm coax D-sub)

The BITS ports are shown in the figure “Faceplate of an alarm/BITS module in a Passport 15000” (page 117).

The pin assignments and the functional specifications for the transmit and receive circuits for the BITS connectors are listed in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade* under the section for connecting the timing wires.

Cooling unit alarm connector

The cooling unit alarm connector is a 9-pin D connector which receives alarm signals from the shelf’s cooling unit and transmits them to the node backplane through the alarm/BITS module.

The cooling unit alarm connector is shown in the figure “Faceplate of an alarm/BITS module in a Passport 15000” (page 117).

The pin assignments for the fan alarm connectors are shown in the table “Fan connector pin-out” (page 120).

Table 15
Fan connector pin-out

Pin	Signal
1	no connection
2	FANTEMP
3	no connection
4	GND
5	no connection
6	no connection
7	GND
8	FANFAIL
9	no connection

BIP alarm connector

The BIP alarm connector is the bottom connector in the alarm/BITS module. It performs the following functions:

- BIP alarm termination, which provides proper over-voltage protection for all BIP alarms and provides an interface between the BIP and the CP and CPX slots through the backplane
- shelf ID termination, which provides proper over-voltage protection and a backplane interface for shelf ID and the BIP signals to the CP and CPX slots
- audio/visual alarm termination, which provides a connection between the backplane audio/visual alarm signals and the BIP interface to the CP and CPX slots

The location of the BIP alarm connector is shown in the figure “Faceplate of an alarm/BITS module in a Passport 15000” (page 117).

The pin assignments for the BIP alarm connector are shown in the table “BIP alarm connector pin-out” (page 121).

Table 16
BIP alarm connector pin-out

Pin	Signal
1	MINAUDN
2	MAJAUDN
3	CRITAUDN
4	SHID4
5	GND
6	+5BIP
7	ALMFAILN
8	no connection
9	LEDTESTN for Passport 20000, no connection for Passport 15000
10	MINVISN
11	MAJVISN
12	CRITVISN
13	SHID3
14	no connection
15	no connection
16	BKRFAILBN
17	EXTPWRN
18	ACON
19	SHID0
20	SHID1
21	SHID2
22	SHID5
23	BKRTRIPAN
24	BKRFAILAN

(Sheet 1 of 2)

Table 16 (continued)
BIP alarm connector pin-out

Pin	Signal
25	BKRTIPBN
26	no connection
(Sheet 2 of 2)	

Alarm/BITS module cable assemblies

The alarm/BITS module connects to four cable assemblies:

- two for incoming external timing signals
- one for sending cooling unit alarms and receiving LED status changes
- one for sending hardware alarms to the BIP and receiving LED status changes for cards from the CP

The part numbers of the cable assemblies vary according to their length for reaching the module in an upper or a lower shelf assembly and according to the type of alarm/BITS module.

The alarm cable assemblies have part numbers NTHR55 for an upper shelf or NTHR56 for a lower shelf, or NTHR57 for both. The assembly includes the wires and connectors for connecting to the J1 and J2 outlets on either a Passport 15000 or 20000.

The prefabricated alarm/BITS timing cables are identified by these PECs:

- NTHR75 unbalanced E1 coax for J3 or J4 of the alarm/BITS module
NTHR14
- NTHW76 wire-wrap DS1 for J3 or J4 of the alarm/BITS module
NTHW76 for a Passport 15000 or NTPN78 for a Passport 20000
- NTPN81 unbalanced E1 for J3 or J4 of the alarm/BITS module NTPN13

The optional balun cable assembly NTPN81 of a Passport 20000 converts the balanced E1 alarm/BITS module into an unbalanced E1 module.

Using custom or prefabricated timing cable assemblies for the building integrated timing supply (BITS) is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Timing cable specifications for the DS1 circuit

The DS1 BITS interface is a digital clocking (SF (D4) framing is default, ESF (Fe) is also supported) format interface - no signals or analogue modes. It must have the following operational characteristics into the alarm/BITS module.

- The BIT rate/accuracy is 1.544 kbits/sec +/- 50 bits/sec (+/- 32 ppm) or better in self-timed, free-running mode.
- The Pulse Amplitude is between 2.4 to 3.6 V peak at the source for a “mark” isolated pulse, across a 100 Ohm impedance (cable run is dependant on line build out).
- See the ITU-T G.703 Section 5 for other details with respect to pulse mask, power levels for all ones, and other considerations.

The functional specifications for the DS1 receive (RX) circuit for a 100-ohm twisted pair of the A or B timing reference interface are

- two 475-ohm resistors for over-voltage protection
- two surface-mounted fuses for current protection on the network side
- a diode bridge for voltage protection
- 33-pF capacitors used as a high frequency filter for immunity to noise
- two 49.9-ohm resistors for matching impedance
- generally, a 1-to-1 step-up transformer is added to interface to the transceiver

Timing cable specifications for the E1 balanced circuit

The E1 balanced BITS interface is the digital clocking source with the line format called common channel signalling (CCS)- no signals or analogue modes. Zero suppression is HDB3, CRC-4 is enabled. It must have the following operational characteristics into the alarm/BITS module.

- The operating frequency is 2,048 kbits/s with a tolerance of +/- 50 ppm or better.

- The Pulse Amplitude for balanced is at 3.0 V with peak “mark”, a value of 0 (zero) +/- 0.3 V “space” into 120 Ohms at the transmitter.
- Balanced is 120-Ohm twisted pair cable.
- At the receiver end at 1024 kHz, the maximum loss due to cables is 0 to 6 db.
- See the ITU-T G.703 Section 9 for other details with respect to pulse mask, one’s ratio, and other considerations.

The functional specifications for the E1 balanced receive (RX) circuit for a 120-ohm twisted pair of the A or B timing reference interface are

- two 475-ohm resistors for over-voltage protection on the ZPACK connector
- two surface-mounted fuses for current protection on the network side
- a diode bridge for voltage protection
- 33-pF capacitors used as a high frequency filter for immunity to noise
- two 68.1-ohm resistors for matching impedance
- generally, a 1-to-1 step-up transformer is added to interface to the transceiver

Timing cable specifications for the E1 unbalanced circuit

The E1 unbalanced BITS interface is the digital clocking source with the line format called common channel signalling (CCS)- no signals or analogue modes. Zero suppression is HDB3, CRC-4 is enabled. It must have the following operational characteristics into the alarm/BITS module.

- The operating frequency is 2,048 kbits/s with a tolerance of +/- 50 ppm or better.
- The Pulse Amplitude for unbalanced is at 2.37 V with peak “mark”, a value of 0 (zero) +/- 0.273 V “space” into 75 Ohms at the transmitter.
- Unbalanced is 75-Ohm coax cable.
- At the receiver end at 1024 kHz, the maximum loss due to cables is 0 to 6 db.

- See the ITU-T G.703 Section 9 for other details with respect to pulse mask, one's ratio, and other considerations.

The functional specifications for the E1 unbalanced coax receive (RX) circuit for a 75-ohm coax of the A or B timing reference interface are

- two 475-ohm resistors for over-voltage protection on the ZPACK connector
- two surface-mounted fuses for current protection on the network side
- a diode bridge for voltage protection
- 470-pF capacitors used as a high frequency filter for immunity to noise
- two 37.4-ohm resistors for matching impedance
- generally, a 1-to-1 step-up transformer is added to interface to the transceiver

Line build out application settings

Cable length depends on the transmitter line build out and the gauge of the cable. See the table “Typical line build out application settings” (page 125)

Table 17
Typical line build out application settings

0	0 to 41 m (133 ft)	0 db DSX-1/CSU
1	41 m (133 ft) to 81 m (266 ft)	DSX-1
2	81 m (266 ft) to 122 m (399 ft)	DSX-1
3	122 m (399 ft) to 163 m (533 ft)	DSX-1
4	163 m (533 ft) to 200 m (655 ft)	DSX-1
5		-7.5 db CSU
6		-15 db CSU

Cooling units

Each Passport 15000 or 20000 has a cooling unit to maintain an ambient temperature inside its shelf assembly. Maintaining the temperature at optimum levels maintains the operation and performance of the switch hardware. Keeping the shelf temperature within its normal operating range will improve the system's service life.

When two Passport 15000 or 20000 switches are mounted into a NEBS 2000 frame, their cooling units are nested against each other. This integration maximizes the use of hardware real estate. The cooling unit that operates with the node in the bottom half of a NEBS 2000 frame is the lower cooling unit, also known as the rear cooling unit because its fans face the rear of the switch hardware and it is accessed from there. The unit that operates with the node in the upper half is the upper cooling unit, also known as the front cooling unit because its fans face the front of the switch hardware (where the processor cards are) and it is accessed from there.

The versions of the lower cooling unit are NTHR51AA and AB while the versions of the upper cooling unit are NTHR52AA and AB. Each cooling unit has a modular design that enables field replacement of the whole unit or any of its parts.

The physical versions of fans, fan controllers, and temperature sensors are different depending which version of cooling unit you have. A replacement part must match the part number that is identified in the tables "Cooling unit parts for the AA versions" (page 378) and "Cooling unit parts for the AB versions" (page 379).

The different versions of parts provide the same performance except the shroud of the middle Dyna fan is shaped to reduce the overall noise level of the lower or upper cooling unit NTHR51AB and NTHR52AB.

For the names and locations of the parts, see these figures:

- "Parts inside a lower cooling unit NTHR51AA (bottom shown upside down)" (page 127)
- "Parts inside a lower cooling unit NTHR51AB (bottom shown upside down)" (page 128)

Figure 28
Parts inside a lower cooling unit NTHR51AA (bottom shown upside down)

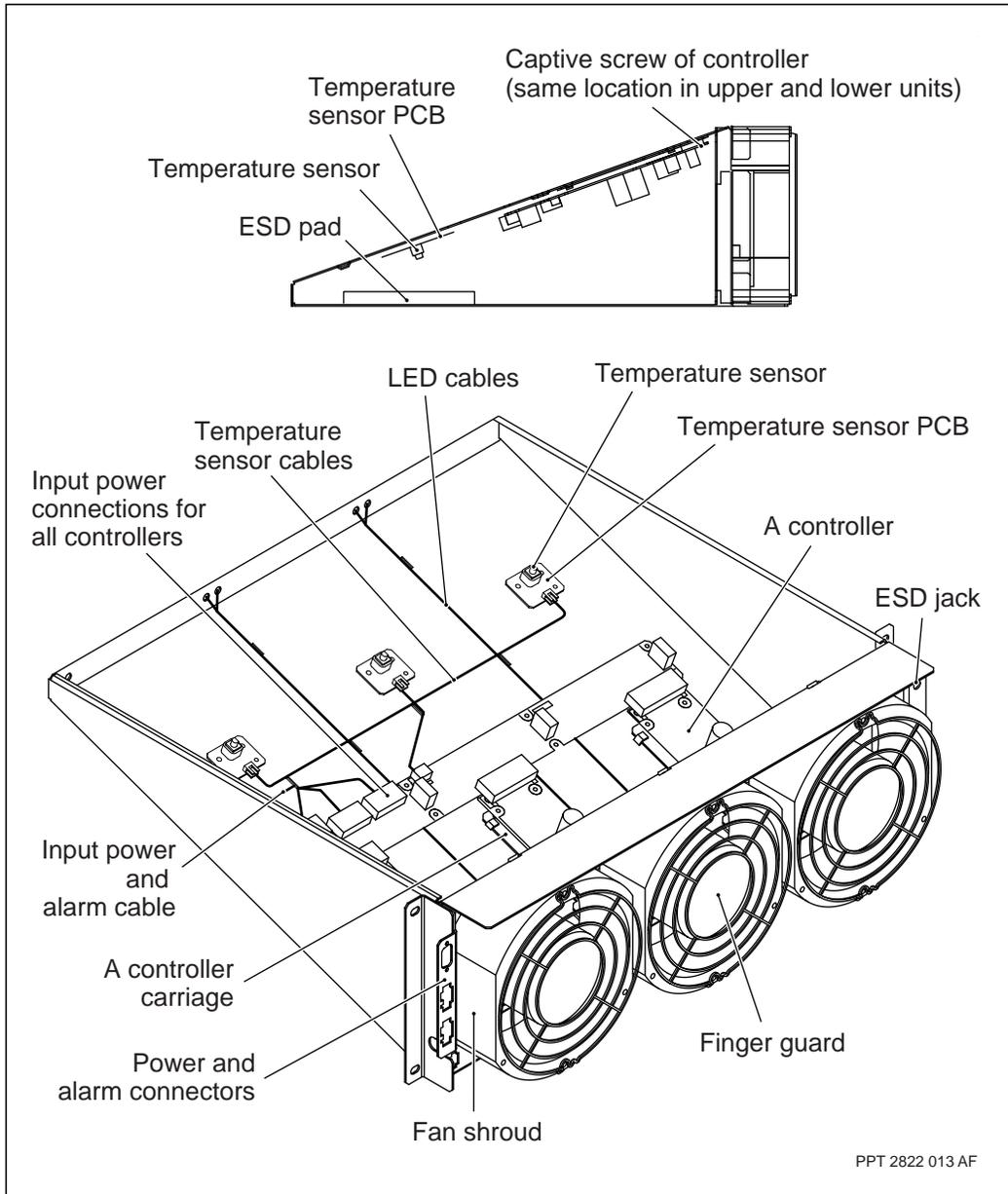
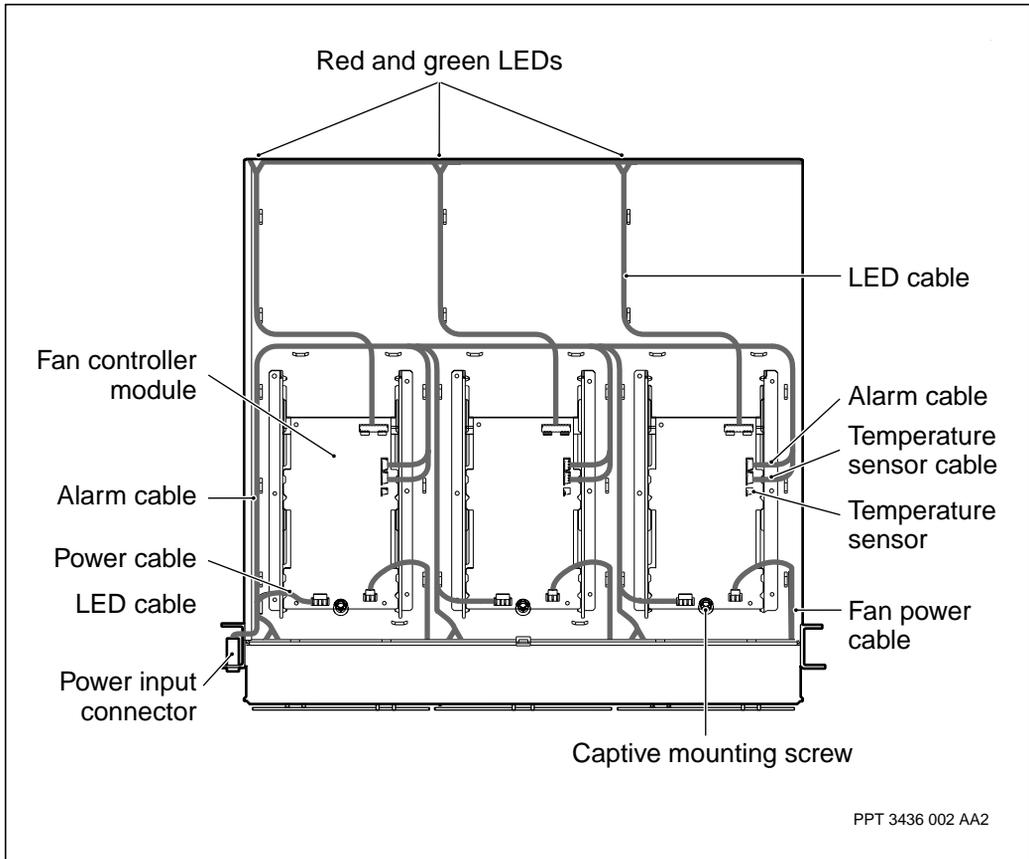


Figure 29
Parts inside a lower cooling unit NTHR51AB (bottom shown upside down)



This parts of the upper and lower cooling units are described in these sections:

- “Environmental control equipment” (page 129)
- “The impact of heat dissipation on rising shelf temperatures” (page 131)
- “Fans” (page 133)
- “Fan controllers” (page 133)
- “Air filters” (page 133)
- “Temperature sensors” (page 134)

- “Cooling unit LED indications” (page 134)
- “Cooling unit connections” (page 135)

Environmental control equipment

The Passport 15000 or 20000 environmental control equipment consists of two cooling units located in the middle of the frame between the upper and lower shelf assemblies. The upper cooling unit pushes air from the fan under the modules in the upper shelf assembly and out through the exhaust plenum under the BIP. The lower cooling unit pulls air in from the bottom of the NEBS 2000 frame, over the modules in the lower shelf assembly and out through the fan assembly. This arrangement in a NEBS 2000 frame is shown in the figure “Upper and lower cooling unit in a frame with air flow direction” (page 130).

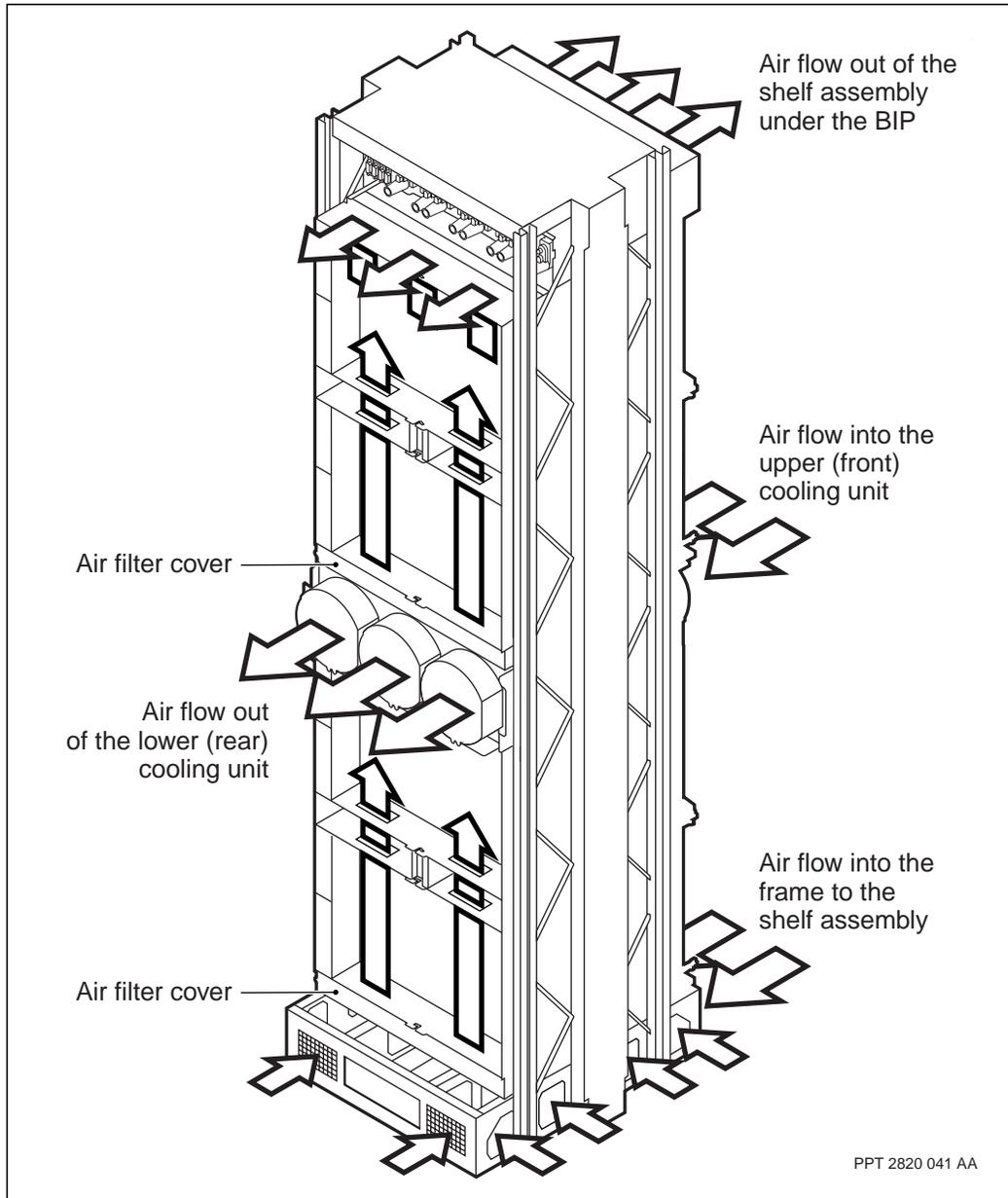
When a Passport 15000 or 20000 is in a mounting apparatus other than a NEBS 2000 frame (is shelf-based), its cooling unit is an upper cooling unit that is mounted upside down in a lower shelf position and therefore draws the air into the switch from the front and exhausts it under the BIP.

Each cooling unit consists of three fans and a cooling unit housing located in a common shelf. Each cooling unit is controlled by temperature sensors located near where air exits the shelf assembly. Air temperature is measured as the air exits the shelf enclosure.

Under normal operation and with 3000 Watts dissipated power, the cooling unit will provide, in the case of air conditioner failure, sufficient air flow (1 to 1.2 m/s) to maintain overall air temperature rise across the shelf of less than 15 degrees Celsius (59 Fahrenheit).

When the exhaust air temperatures rises above 55 degrees Celsius (131 Fahrenheit), the fans switch to high (full) speed to increase air flow and cooling of the shelf. The fans return to normal speed when the temperature falls below 46 degrees Celsius (115 Fahrenheit). Passport nodes should always be operated with the cooling units on to avoid damage to the CP, FPs, and fabric cards, even when dusty air filters are removed.

Figure 30
Upper and lower cooling unit in a frame with air flow direction



The impact of heat dissipation on rising shelf temperatures

As soon as a cooling unit of an in-service Passport 15000 or 20000 is unpowered, the air temperature inside the shelf immediately rises and the temperature sensor readings by the cooling unit are suspended. The fabrics continue to measure the internal temperature of the shelf. If the rise continues, one or more FPs can eventually fail. When a fabric reaches 72 degrees Celsius (161.6 degrees Fahrenheit), it automatically drops all traffic. When both fabrics reach that temperature, traffic through the Passport stops until the temperature for one or both drops below the threshold. A built-in hysteresis prevents the fabrics from continuously toggling on and off at the temperature threshold.

The air temperature inside the shelf depends on the ambient room temperature and the heat dissipation of the shelf. As the ambient room temperature or the heat dissipation increases, the air temperature inside the shelf increases. The rate of rising temperature depends on the shelf configuration, that is, the type and number of in-service cards, and the amount of traffic they are handling.

Since the Passport 15000 or 20000 has a rating of up to 150 watts per card slot, the air temperature rise within the shelf may be as high as 10 degrees Celsius (50 degrees Fahrenheit) per card cage with the cooling unit in service. When the cooling unit is unpowered, the temperature rise will be as high as 40 degrees Celsius (104 degrees Fahrenheit) per card cage. Since normal operating conditions are below 40 degrees Celsius (104 degrees Fahrenheit), the elevated temperature will result in service degradation. To determine whether your shelf configuration will affect service when the cooling unit is unpowered (for example, for replacing the entire unit), do the following.

Determine whether the total heat dissipation of your shelf configuration will affect service when removing an entire cooling unit.

- 1 Calculate the power consumption of the selection of cards on your shelf. (This may already have been done to determine the size of power cable to your shelf.)
- 2 Calculate the power consumption of each card in the bottom cage and the one in the cage directly above it.
- 3 Compare the power consumptions to the table “Maximum shelf heat dissipation relative to ambient room temperature” (page 132).

To calculate the power consumption of the selection of cards on your shelf, see the section on power distribution and consumption in 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

Table 18
Maximum shelf heat dissipation relative to ambient room temperature

Ambient room temperature degrees	Total power dissipation of all CPs and FPs	Combined power dissipation of card in bottom cage and the one above it
25 Celsius (77 Fahrenheit)	1350 watts	170 watts
30 Celsius (86 Fahrenheit)	1200 watts	150 watts
35 Celsius (95 Fahrenheit)	1040 watts	130 watts
40 Celsius (104 Fahrenheit)	900 watts	110 watts

In general, if the comparison of power consumptions exceeds either the value of total or combined power dissipation, and the cooling unit is unpowered, service will be affected as follows.

- At 65 degrees Celsius (149 Fahrenheit) inside a fabric, a temperature alarm occurs. Service is unaffected.
- At 72 degrees Celsius (161.6 Fahrenheit) inside a fabric, the fabric is automatically shut down to protect it. When both fabrics reach the threshold, the shelf reboots until the temperature sensor inside either fabric drops below the threshold. A rebooting shelf drops all service.

For more information on the effects of temperature, refer to the environmental data and power dissipation in 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

Fans

The fans push or pull air across the surfaces of the processor cards and modules to keep them as cool as ambient room temperature allows. When a fan is mounted in a lower (rear) cooling unit, it pushes air. When the same fan is mounted in an upper (front) cooling unit, it pulls air.

Fan controllers

A fan controller controls the power supply to a fan, monitors the operation of the fan and its speed, and monitors the status of the remote temperature sensors. In the case of a failure, the controller sends an alarm signal to the alarm/BITS module and sends a status signal to the other fans, forcing them to switch to the higher rpm speed.

Air filters

The Passport 15000 or 20000 frame is equipped with air filters to prevent dust and other airborne contaminants from being drawn into the shelf assemblies by the cooling units. The filters also assist air flow by acting as air flow diffusers. The air filter for the lower cooling unit is located at the bottom of the frame. The air filter for the upper cooling unit is located in the middle of the frame, between the upper cooling unit and the upper shelf assembly.

The figure “Upper and lower cooling unit in a frame with air flow direction” (page 130) shows the location of the air filter. The air filter is the same part number for all versions of cooling units.

The air filters must be installed in the frame assembly to ensure proper air flow across the shelf assembly. The Passport 15000 or 20000 should not be operated without air filters, except briefly during filter replacement. The fans should remain powered while the filter is being replaced.

The air filters must also be changed periodically so that the accumulation of dust is prevented from degrading performance or failing plug-in cards, fabric cards, or modules. For information about the frequency of replacing air filters and how to replace them, refer to 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade* in the chapter of safety considerations and best practices, the section on equipment maintenance.

Temperature sensors

A set of three temperature sensors monitors exhaust air flow from each of the cooling units, as shown in the figure “Upper and lower cooling unit in a frame with air flow direction” (page 130). The sensors for the lower cooling unit are inside the unit itself, while the sensors for an upper cooling unit are on a sensor bracket assembly that is mounted in the air flow space above the shelf assembly. Each temperature sensor is mounted on a PCB. The temperature sensors are not linked directly to a specific fan and can monitor the air flow generated by multiple fans simultaneously.

The temperature sensors are linked to a temperature interface block, which provides bias to the sensors, monitors faults in the sensor circuit, and processes temperature information. If a temperature greater than 72 degrees Celsius (162 Fahrenheit) is detected, a HighTemp alarm is sent to the alarm/BITS module where the alarm is indicated. When a temperature less than 55 degrees Celsius (131 Fahrenheit) is detected, the fans operate at normal speeds. If a temperature between 55 and 72 degrees Celsius is detected, the fans switch to high-speed operation.

A built-in hysteresis prevents the fans from continuously toggling slower and faster at the temperature threshold.

Cooling unit LED indications

Each cooling unit is equipped with LEDs to indicate its status. The table “Cooling unit LED indications” (page 134) lists the possible LED displays.

Table 19
Cooling unit LED indications

LED	Description
Green on	The unit is on and no fault is detected.
Red on	A fan fault has occurred: missing at least one fan or at least one temperature sensor has failed. A FANFAIL signal is sent to the alarm/BITS module, and the remaining fans are switched to the high speed setting.
None on	The middle circuit breakers (for the cooling units) on both BIMs are switched off or there is no power to both BIMs for that shelf.

Cooling unit connections

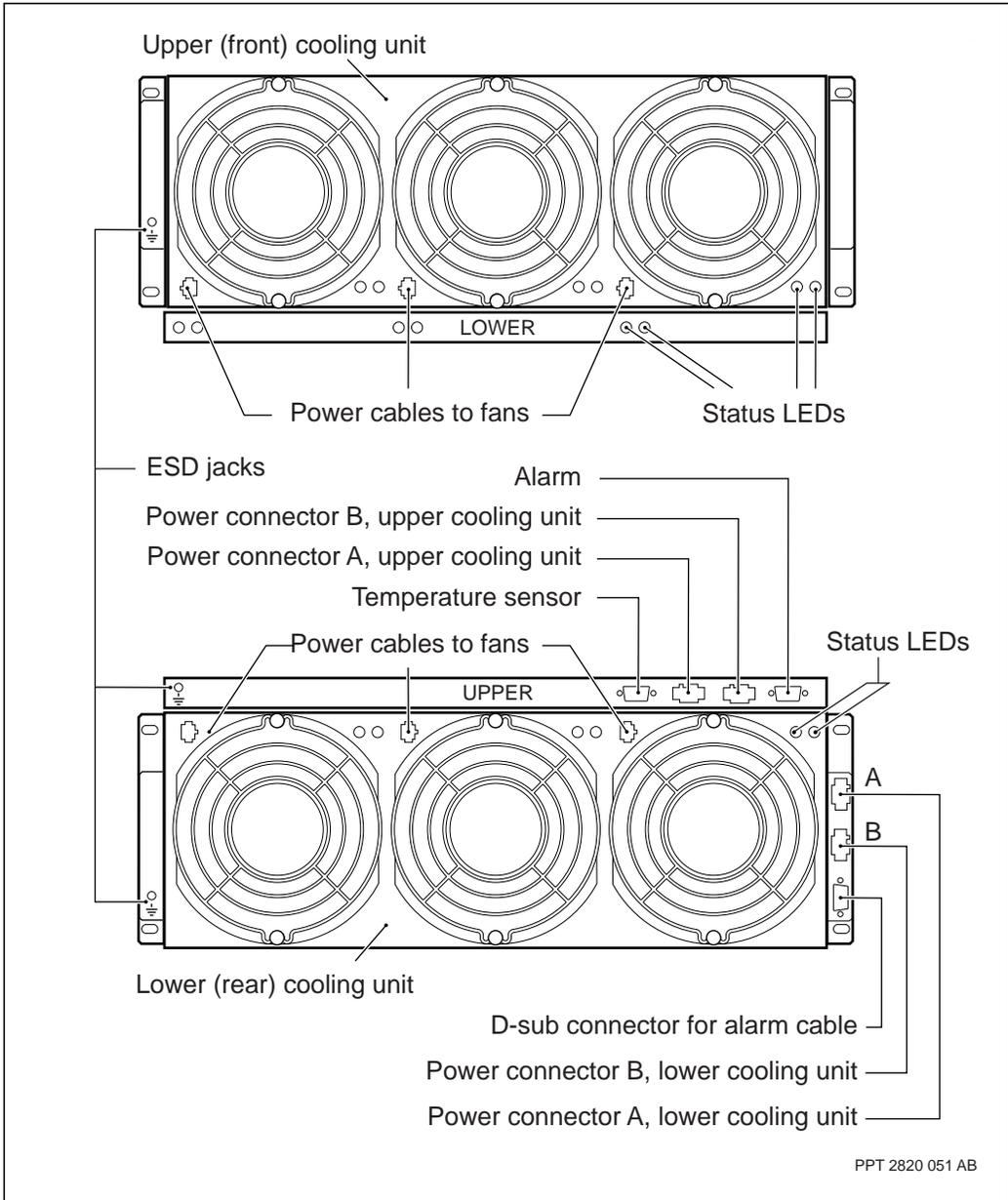
For a description of the cooling unit power connectors, see “Function of the BIP backplane power output connections” (page 79).

For the location of the internal connectors, see the figures:

- “Parts inside a lower cooling unit NTHR51AA (bottom shown upside down)” (page 127)
- “Parts inside a lower cooling unit NTHR51AB (bottom shown upside down)” (page 128)

For the location of the external connectors, see the figure “External cooling unit cable connections” (page 136).

Figure 31
External cooling unit cable connections



NEBS 2000 frame enclosure

The NEBS 2000 frame can be enclosed in part or completely by a combination of extended side panels and doors or regular side panels and frame cover panels. Enclosing the frame controls the accessibility of people or objects to the equipment inside the frame.

Enclosing the frame with doors and extended side panels

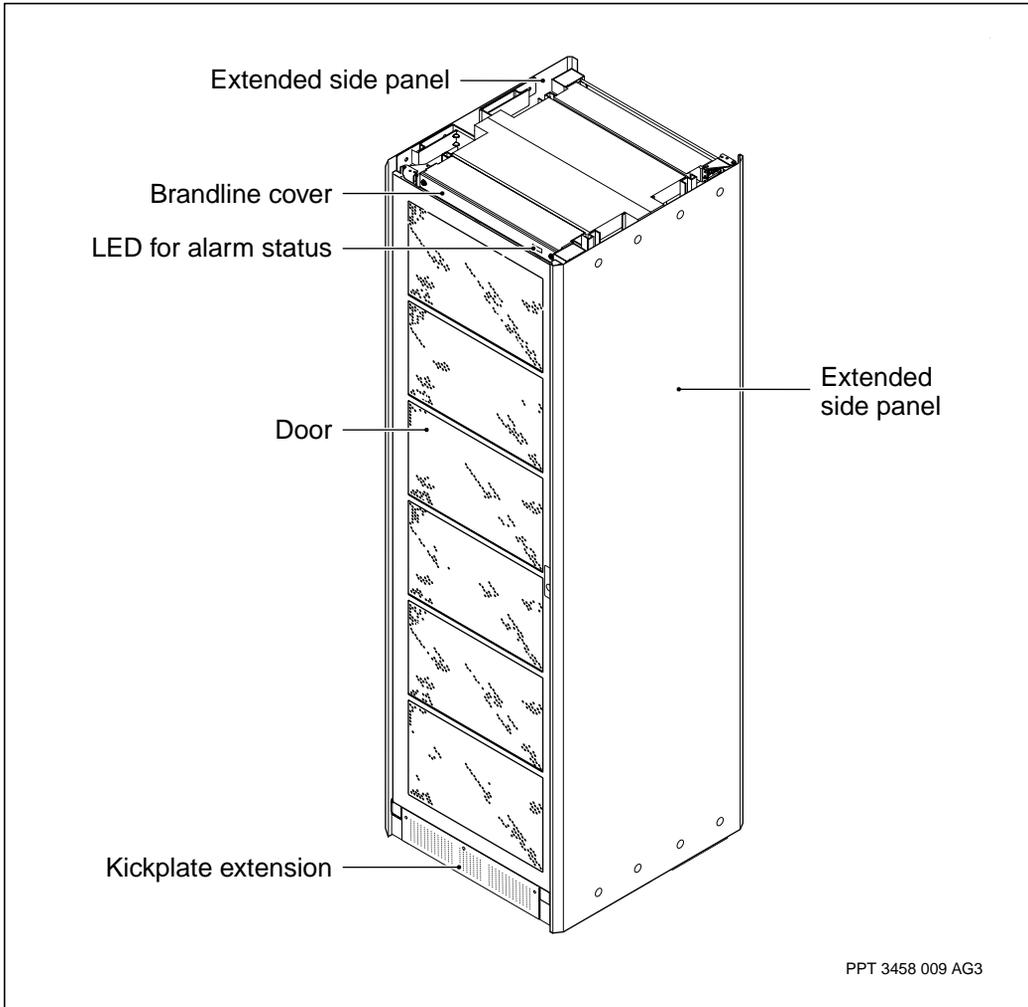
The doors are available in kit NTQS37AA or NTQSAB. The AB version is the same as AA except that it includes an illuminated brandline cover to replace the non-illuminated one that is already mounted on the frame.

The extended side panels are available in kit NTPX4050. An extended side panel can be installed alone or it with a door. Refer to the figure “Installed extended side panels with a door” (page 138).

The door or side panel hardware can be added to the frame at any time provided enough space around the frame is available. For example, a door kit requires an increase in the size of the frame footprint. The spacial requirements and considerations for installing a door kit or an extended side panel kit are in 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

The tasks to install the hardware are in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 32
Installed extended side panels with a door



Enclosing the frame with regular side panels and frame cover panels

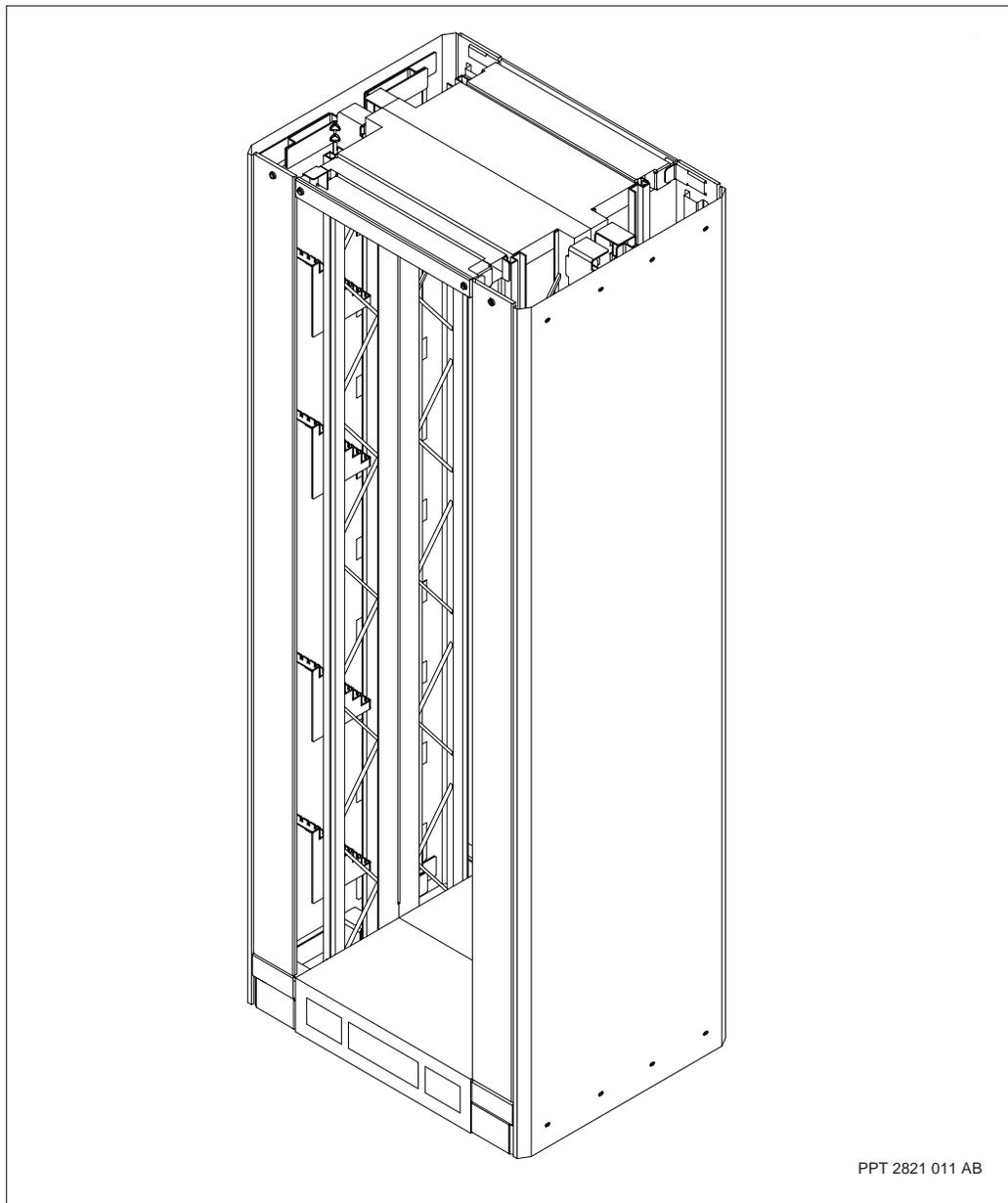
A regular-sized side panel is also available in kit NTRU0128. This panel will not work with a door, but it will cover the optional extended cable management brackets (NTRU0368 or NTRU0369) that can be mounted on a side of the frame. This panel also coordinates enclosure by the front or rear frame cover panels from kit NTRU0366. Refer to the figure “Installed side panels with front and rear frame cover panels” (page 140).

The frame cover panels are intended to hide the extended cable management brackets from the front or rear of the frame. These panels can be installed without the side panels being present, especially if the frame-joining hardware kit NTRU0370 is used to maximize space usage between adjacent frames.

The side panel and frame cover panel hardware can be added to the frame at any time provided enough space around the frame is available. Except for the thickness of a side panel, the frame footprint is not increased by adding the hardware. The spacial requirements and considerations for installing a regular side panel with or without frame cover panels to enclose the optional extended cable management brackets are in 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

The tasks to install the hardware are in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 33
Installed side panels with front and rear frame cover panels



Chapter 4

Control and function processors

This section describes the plug-in processor cards which support network management, switch management, user services, and network clocking synchronization.

This section also briefly describes how processor cards support being upgraded or downgraded.

The location of the control and function processors (CPs and FPs) is shown in the figure “A typical shelf assembly, front view” (page 89).

For the list of capabilities of each FP, refer to the FP type in 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*.

The sections are

- “Connecting a Passport to another node” (page 142)
- “Blank processor card” (page 146)
- “Control processors” (page 148)
- “2-port DS3Ch TDM FP” (page 160)
- “4-port DS3Ch FR FP” (page 166)
- “4-port DS3Ch ATM FP with IMA” (page 175)
- “4-port DS3Ch FP with AAL1 CES” (page 180)
- “12-port DS3 FP” (page 185)
- “12-port E3 ATM FP” (page 195)

- “2-port DS3Ch TDM FP” (page 160)
- “32-port E1 TDM FP” (page 209)
- “2-port general processor with disk” (page 202)
- “4-port Gigabit Ethernet FP” (page 205)
- “6-module packet server FP” (page 215)
- “4-port OC-3/STM-1 ATM FPs” (page 218)
- “4-port OC-3/STM-1Ch TDM/CES FP” (page 223)
- “16-port OC-3/STM-1 ATM FP with MT-RJ connectors” (page 227)
- “16-port OC-3/STM-1 ATM FP with LC connectors” (page 231)
- “16-port OC-3/STM-1 POS and ATM FP” (page 238)
- “1-port OC-12/STM-4 FP” (page 250)
- “4-port OC-12/STM-4 ATM FP” (page 254)
- “1-port OC-48/STM-16 ATM FP with APS” (page 258)
- “1-port OC-48/STM-16 POS FP” (page 262)
- “1-port STM-1Ch FP” (page 266)
- “VPN extender card” (page 269)
- “Voice services processor 2 (VSP2) FP” (page 273)
- “Voice services processor 3 (VSP3) FP” (page 274)
- “Voice services processor 3 with optical TDM interface (VSP3-o) FP” (page 283)
- “SFP optical module” (page 288)

Connecting a Passport to another node

To have a Passport 15000 or 20000 switch interwork directly with another node, a connection must be established between a function processor (FP) on the Passport and an equivalent processor card on the other node.

Connecting two Passports

To have a Passport 15000 or 20000 interwork directly with another Passport, establish the connection between two FPs, one at either end, through a fanout panel.

If the other Passport is a Passport 7480, the connection is described in “Connecting nodes in a Passport 15000-VSS” (page 143).

Cabling an FP, sparing panel, or fanout panel is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

A fanout panel must have BNC-to-BNC connectors so that the BNC ends of the FP cables connect at the fanout panel. For example, you can use the cable assemblies with PECs NTHR58, NTHR59, or NTHR60. The pinout mapping of BNC cables to a mini-coax on these cable assemblies are indicated for the cabling procedures in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

After the cable is connected and the FPs have been power tested and loaded with software, have the software operator configure the port or ports at each FP to be the same type of ATM trunk or ATM bearer services trunk. Choose the type of trunk that provides appropriate interworking capabilities. To configure trunks for inter-nodal communication, refer to 241-5701-420 *Passport 7400, 15000, 20000 Trunking Guide*.

Connecting nodes in a Passport 15000-VSS

The fiber link between the Passport 15000 and the Passport 7480 in a Passport 15000-Variable Speed Switch (VSS) can be made using an external OC-3 connection between OC-3 single-mode or multi-mode function processors (FPs). The fiber cable requires SC connectors at each end. You must provide the customized fiber cable and connectors.

When the OC-3 card pair has different reaches (SR, IR, or LR), the 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade* indicates how to determine when to use inline attenuators. You must provide your own attenuators.

The routing of the fiber link cable should go through or beside the fan cover grill. This route is preferred because it isolates the fiber link from the other fiber cables. There is no problem with running the fiber link behind the Passport 7480 if another route must be used.

The software configuring of the Passport 7400 and the Passport 15000 is different. Any tools you use to configure the network must be able to adapt both sets of configuration commands.

Connecting a Passport 15000 or 20000 to a Shasta 5000

The fiber link between a Passport 15000 or 20000 and a Shasta 5000 can be made using an external OC-3 connection between a Passport 15000 OC-3 function processor (FP) and a Shasta 5000 OC-3 line card. The fiber cable requires SC connectors at each end. You must provide the customized fiber cable and connectors.

Connecting a Passport 15000 or 20000 to an EdgeLink 100

Before installing the interface cables and connecting them, the EdgeLink 100 multiplexor must be mounted and the DS3 function processor (FP) with BNC connectors of the Passport 15000 or 20000 must already be installed. The part number of the mux is NTPV02. For the installation of an EdgeLink 100, refer to Telco Systems' documentation, starting with the document *EdgeLink 100 Digital Multiplexer General Description*, section 825-102-001.

The EdgeLink interfaces to a DS3 function processor (FP) with BNC connectors in the Passport 15000 or 20000 and to an RJ48 termination through an access panel. The RJ48 connections are either:

- 64-pin Cinch or wirewrap to an RJ48 T1 access panel with monitor jacks (part number A0718812)
- 64-pin Cinch or wirewrap to an RJ48 T1 access panel (part number A0718813)

The interface cables that connect an EdgeLink 100 to the Passport or the Ethernet hub of a Preside Multiservice Data Manager are listed in the table "Interface cables between a Passport 15000 or 20000 and an EdgeLink 100" (page 145). Two cables are required, one for transmitting and one for receiving.

Table 20
Interface cables between a Passport 15000 or 20000 and an EdgeLink 100

Type and quantity	Part number	Length	Type of connector at EdgeLink	Type of connector at other end
DS1, two	A0718801, Telco Systems' AWX432G5	1.5 m (5 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1, two	A0718802, Telco Systems' AWX432G15	4.6 m (15 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1, two	A0718803, Telco Systems' AWX432G30	9.1 m (30 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1, set of two	A0718779, Telco Systems' AXX432G5	1.5 m (5 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS1, set of two	A0718780, Telco Systems' AXX432G25	7.6 m (25 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS1, set of two	A0718781, Telco Systems' AXX432G50	15.2 m (50 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS3, two	rated as 728A RG-6U or equivalent	custom	90-degree male-to-female BNC adapter for standard BNC male connector	male BNC on a DS3 FP
DS3, two	NTFP19AC	1 m (3.2 ft)	male BNC	male BNC on a DS3 FP
DS3, two	NTFP19AA	3 m (9.8 ft)	male BNC	male BNC on a DS3 FP
DS3, two	NTFP19AB	15 m (48.2 ft)	male BNC	male BNC on a DS3 FP
Ethernet	Telco Systems' AWX454G10 for standard LAN trunk cable IEEE 802.3	3 m (10 ft)	male RJ-45, eight-position modular	a male RJ45 connector for a female connector on the hub that is linked to Preside Multiservice Data Manager

Blank processor card

A blank processor card is an empty card used to fill an empty processor slot in the shelf assembly. A blank card protects the circuitry within the card cage and ensures proper air flow through the shelf assembly. If a card slot does not have a function processor (FP) or a control processor (CP) in it for longer than a few minutes, a blank must be used for the interim.

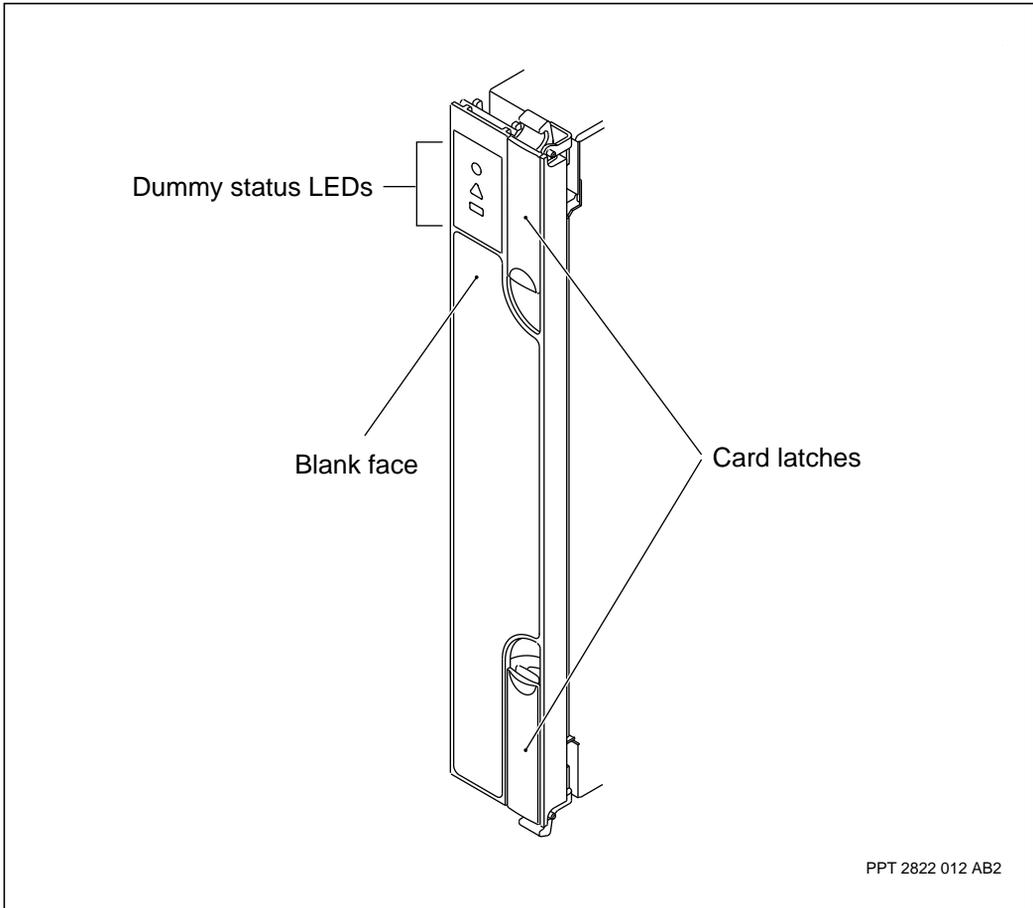
Having an empty slot while the switch is powered up, especially if it operating at full service, reduces the air flow through both cages of the shelf assembly and reduces the containment of EMI. Reducing the airflow means the ambient temperature inside the shelf rises towards the temperature shut-down thresholds of the fabrics.

A shelf assembly is typically shipped with blanks for empty slots. With a Passport 15000 or a shelf-based Passport 20000, blanks are shipped in a container. With a Passport 20000 in a NEBS 2000 frame, the blanks are shipped in the slots in the transportation position in the same way as other processor cards. Blanks have PEC NTHR64.

Note: A blank card can be used in a CP slot, but it is not recommended to run your Passport without the second (backup) CP.

Blank processor cards were formerly referred to as filler cards, but the faceplate has always been labeled with BLANK. See the figure “Faceplate of a blank processor card with PEC NTHR64” (page 147).

Figure 34
Faceplate of a blank processor card with PEC NTHR64



Control processors

A CP

- is either a CP2 or a more powerful CP3 which includes a Power PC processor, PQC ASICs for datapath frame forwarding, and larger disk storage. Both CPs perform the same functions, while a CP3 offers increased processing power and connection space.
- sequences FP startup
- downloads new software onto FPs
- performs memory-intensive tasks for services delivered by FPs
- manages and monitors the status of the FPs, the fabric cards, and other Passport 15000 or 20000 hardware
- provides system timing for all other processor cards connected to the backplane
- monitors and processes alarms and the performance of real-time clocking to support building integrated timing supply (BITS) through
 - an E1 BITS CP2 (NTHR35) or CP3 (NTHW08)
 - a DS1 BITS CP2 (NTHR06) or CP3 (NTHW06)
- interfaces with Preside Multiservice Data Manager (MDM) or a text interface device, which is used for network operator access, network monitoring, provisioning, and maintenance

Text interface devices connect directly to a port on the faceplate of a CP. These devices are not connected during normal operation, and are only used for installation and debugging purposes.

- connects to Preside MDM through a 10Base-T Ethernet port for CP2 or a 100Base-T port for CP3
- is half of a redundant pair in a Passport 15000 or 20000 such that failure of the active CP causes the standby CP to take over

For CP2 connectors, see “Faceplate of a CP2 with PEC NTHR06 or NTHR35” (page 150).

For CP3 connectors, see the figure “Faceplate of a CP3 with PEC NTHW06 or NTHW08” (page 151).

Note: Earlier versions of the NTHW06 and NTHW08 CP3 cards include the unused P4 port connector. In later versions, this feature has been removed.

For the description of the LEDs on the faceplate, see “Status LEDs of a CP” (page 357).

Figure 35
Faceplate of a CP2 with PEC NTHR06 or NTHR35

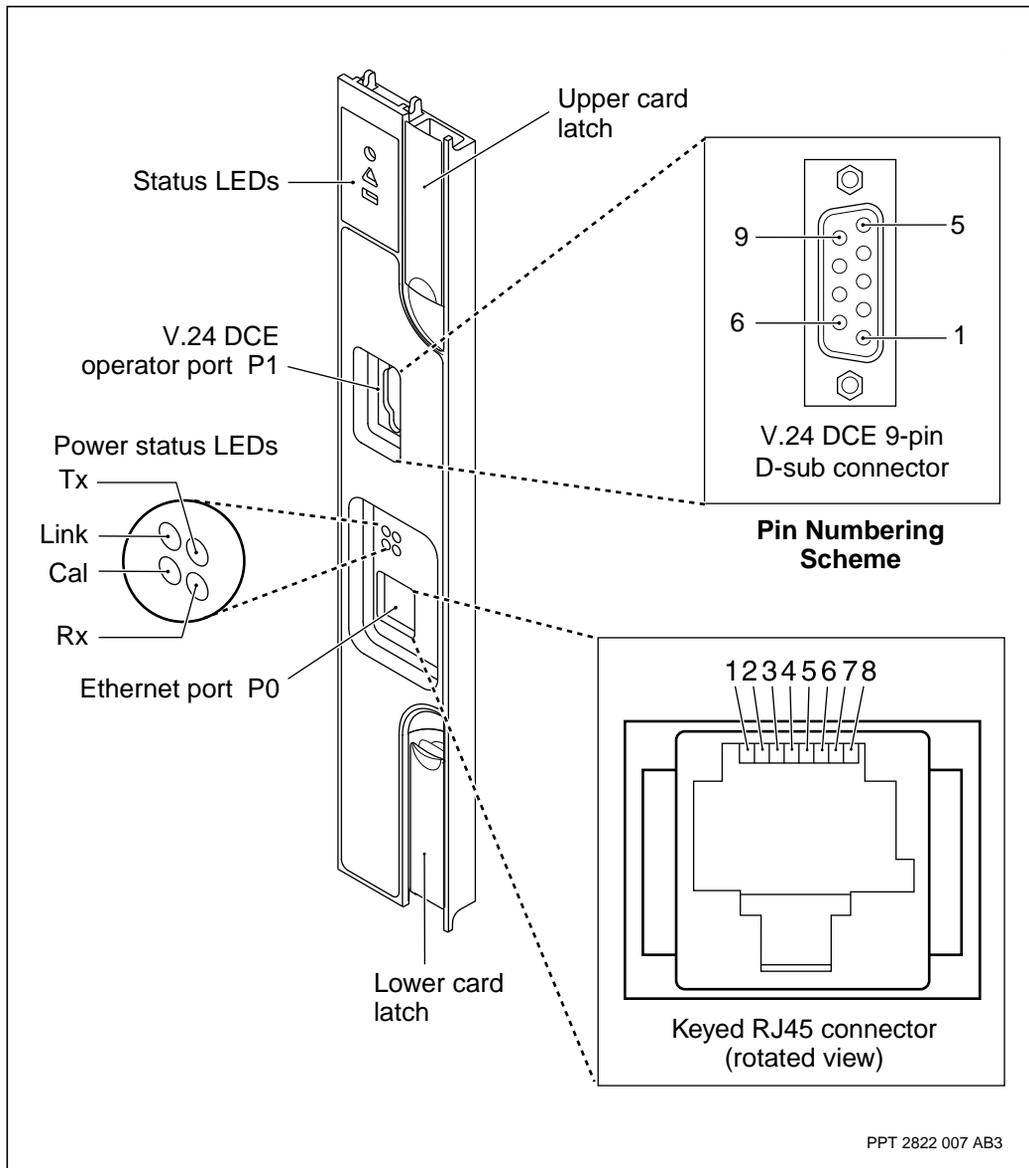
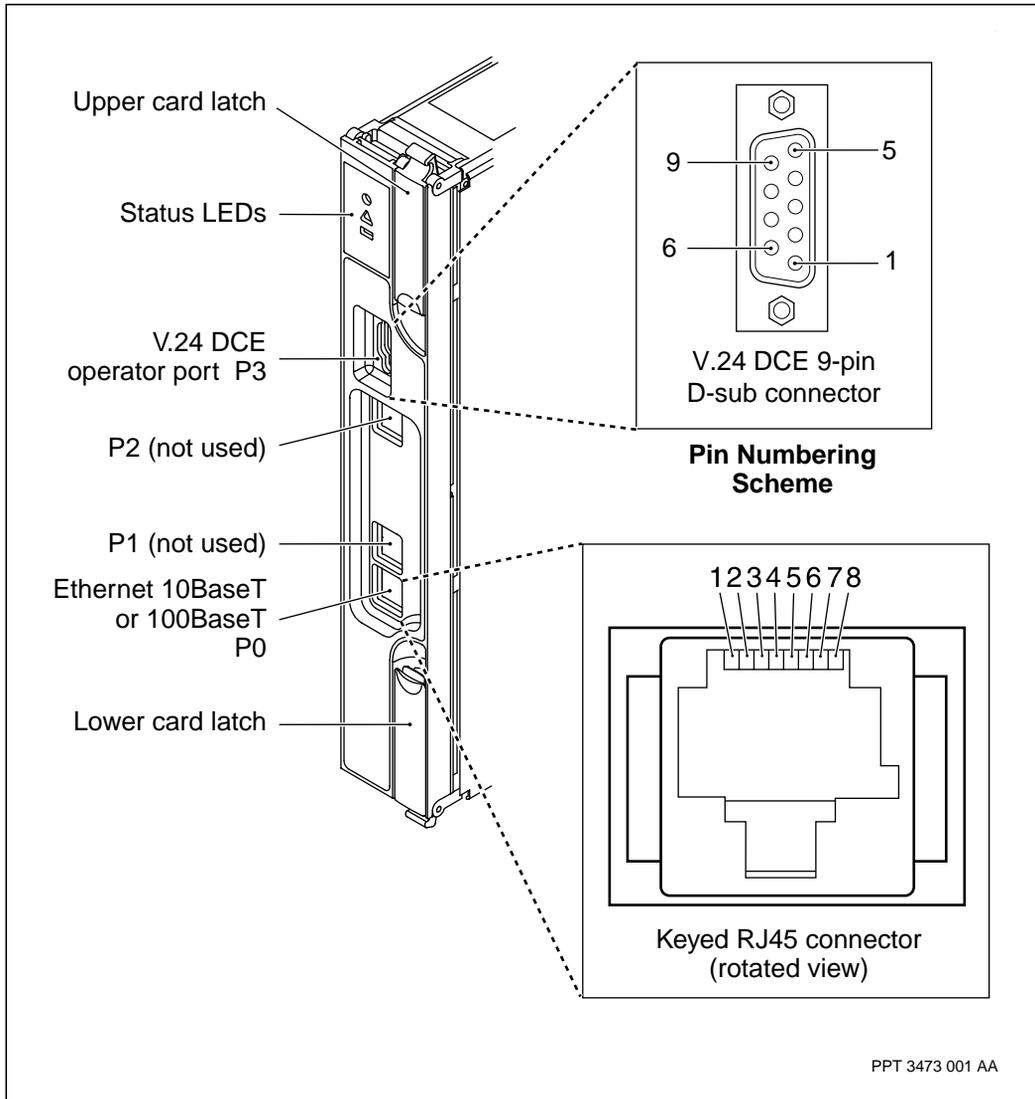


Figure 36
Faceplate of a CP3 with PEC NTHW06 or NTHW08



Information about CPs is divided into these sections:

- “CP hardware” (page 152)

- “CP software requirements” (page 152)
- “CP cables” (page 153)
- “Ethernet CP pinout and signal names” (page 158)
- “V.24 CP pinout and signal names” (page 158)
- “CP line rate” (page 159)
- “CP compliance with standards” (page 159)

CP hardware

The CP consists of a motherboard, a memory daughter card, and a power supply daughter card, with a hard disk mounted on the motherboard.

The CP connects to the shelf backplane, providing an interface to both fabric cards. It performs activities associated with the fabric cards and routing data through the switch.

The CP interface supports these functions

- disk interface
- stratum clock
- real-time clock (for example, for the time-of-day clock)
- shelf alarm circuitry
- external interfaces, including a V.24 DCE port for Preside MDM connectivity, a 10Base-T Ethernet port for OAM of CP2, and 100Base-T Ethernet for OAM of CP3
- building integrated timing supply (BITS) from the alarm/BITS module (if connected to the site source)

The CP hard disk drive stores the Passport software, configuration data, and spooled information.

CP software requirements

See the following tables for minimum software requirements of Passport 15000 and 20000 CPs:

Table 21
CP minimum software requirements for a Passport 15000

Order code	CP part description and software version
NTHR06CA, NTHR35CA	CP2s are supported with PCR1.1 and later releases.
NTHW06AA, NTHW08AA	CP3s are supported with PCR1.3 and later releases.

Table 22
CP minimum software requirements for a Passport 20000

Order code	CP part description and software version
NTHW06AA, NTHW08AA	CP3s are supported with PCR 3.1 and later releases provided each is migrated to the current PCR of the switch

CP cables

CPs of a Passport 15000 or 20000 are installed in slots 0 and 1. (Slots 0E and 1E are reserved for later development and must contain blank processor cards in the meantime.) Each control processor card has CP marked on its faceplate. (A CP2 indicates CP2 while a CP3 indicates CP.)

The types of CP cables and their connectors depend on the kinds of terminations on the faceplate of the CP2 or CP3, and on the equipment at the other end. You must provide the cables and connectors that link a CP to Nortel Networks equipment such as a local user interface terminal or a Preside MDM workstation communicating through a router or hub of a local area network (LAN), or to any other CPE termination.

Prefabricated cables are available for any CP. Each CP3 is shipped with its own two cables. CP2 cables are available in optional kit NT0479, which includes cable assemblies NT0460 and NT0477 as shown in the figures “CP2 Ethernet cable NT0460” (page 156) and “CP2 Ethernet crossover cable NT0477 with RJ-45 connectors and ferrite bead” (page 157). On a CP3, ports

P1, P2, and P4 are not supported for use. The available cables for all other ports are described in the table “Prefabricated CP cable assemblies” (page 154).

Table 23
Prefabricated CP cable assemblies

Part number	Description	Port number on type of CP	Examples of the far-end connection	Cable length
A0821568	Ethernet 100Base-T straight-through CAT 5 strand STP cable with RJ-45 connectors The above-mentioned cable assembly ships with the FP although the minimum shielding requirement is for a UTP cable.	P0 on CP3	the hub port that communicates with a Preside MDM	10 m (32.8 ft)
A0822236	null modem (Ethernet crossover) CAT 5 strand STP cable with RJ-45 connectors The above-mentioned cable assembly ships with the FP although the minimum shielding requirement is for a UTP cable.	P0 on CP3	an operator workstation	10 m (32.8 ft)
NT0460	Ethernet cable	P1 on CP2 or CP2E	an operator workstation with an RS232 serial port	1.2 m (4.0 ft)
928A	inline transceiver	with a CP2 Ethernet connection (as required)	_____	na
(Sheet 1 of 2)				

Table 23 (continued)
Prefabricated CP cable assemblies

Part number	Description	Port number on type of CP	Examples of the far-end connection	Cable length
NT0477	Ethernet crossover cable with RJ-45 connectors	P1 on CP2 or CP2E	the hub or router port that communicates with a Preside MDM	3 m (9.8 ft)
NTBP25	V.24 DEC operator port cable with 9-pin D-sub connectors, described in "Specifications for a custom-made CP cable NTBP25" (page 157)	P1 on CP2, P3 on CP3, and/or the 9-pin DCE port on either CP of the Passport 7400 in a Passport 15000-VSS	an operator workstation with a 9-pin D-sub connector for an RS232 serial port	4.5 m (15.0 ft)
(Sheet 2 of 2)				

The maximum length of 100Base-T Ethernet cable between a CP and the hub or router of a Preside MDM workstation, or directly to the workstation is 100 m (328 ft). Any equipment connected to the P0 Ethernet port must have a grounded RJ-45 connection so that both ends of the cable contact the grounding. The cable is already grounded at the CP3 end.

Figure 37
CP2 Ethernet cable NT0460

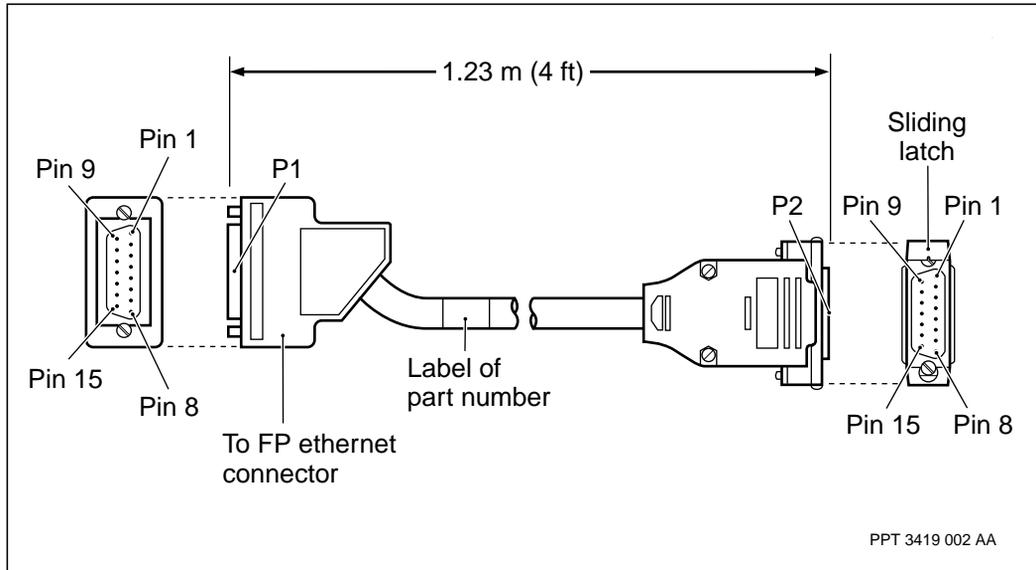
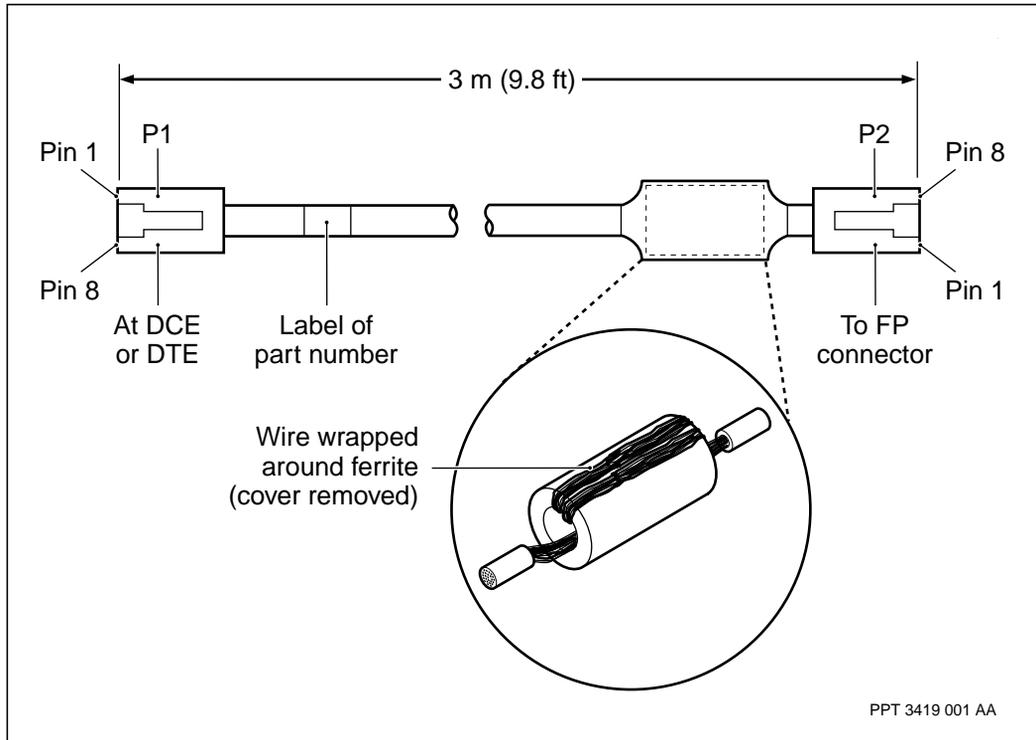


Figure 38
CP2 Ethernet crossover cable NT0477 with RJ-45 connectors and ferrite bead



Specifications for a custom-made CP cable NTBP25

You can make your own custom-length version of the NTBP25 cable assembly. You must consider the following requirements:

- RS232 4-pair CAT5 shielded operator cable
- V.24 DCE 9-pin D-sub pinout on both ends as indicated in the table “V.24 connector pinouts” (page 158)
- 0.205 mm² (24 AWG) thickness
- FT4 fire rating
- 30-m (50-ft) length

Ethernet CP pinout and signal names

The table “Ethernet connector pinouts” (page 158) lists the connector pinouts for the CP2 10BaseT Ethernet and the CP3 100BaseT Ethernet ports.

Table 24
Ethernet connector pinouts

Pin numbers	Signal name
1	Tx +
2	Tx -
3	Rx +
4	not used
5	not used
6	Rx -
7	not used
8	not used

V.24 CP pinout and signal names

This table “V.24 connector pinouts” (page 158) lists the pinouts for the local operator port connector.

Table 25
V.24 connector pinouts

Pin numbers	RS232-C pin numbers	V.24 signal	ITU-T signal number	Direction on DCE port
1	15	TSET	114	output
2	2	TXD	103	input
3	3	RXD	104	output
4	20	DTR	108	input
5	7	GND	102	not applicable
(Sheet 1 of 2)				

Table 25 (continued)
V.24 connector pinouts

Pin numbers	RS232-C pin numbers	V.24 signal	ITU-T signal number	Direction on DCE port
6	8	DCD (RSLD)	109	output
7	4	RTS	105	input
8	5	CTS (RFS)	106	output
9	17	RSET	115	output
(Sheet 2 of 2)				

CP line rate

The CP's line rate supports asynchronous data transfer at 9.6 kbit/s.

CP compliance with standards

The V.24 port supports a subset of CCITT V.24 standards and can accommodate most interface devices.

Ethernet compliance with standards

The Ethernet FP complies with these standards and conventions:

- IEEE 802.3
- Digital/Intel/Xerox (DIX)

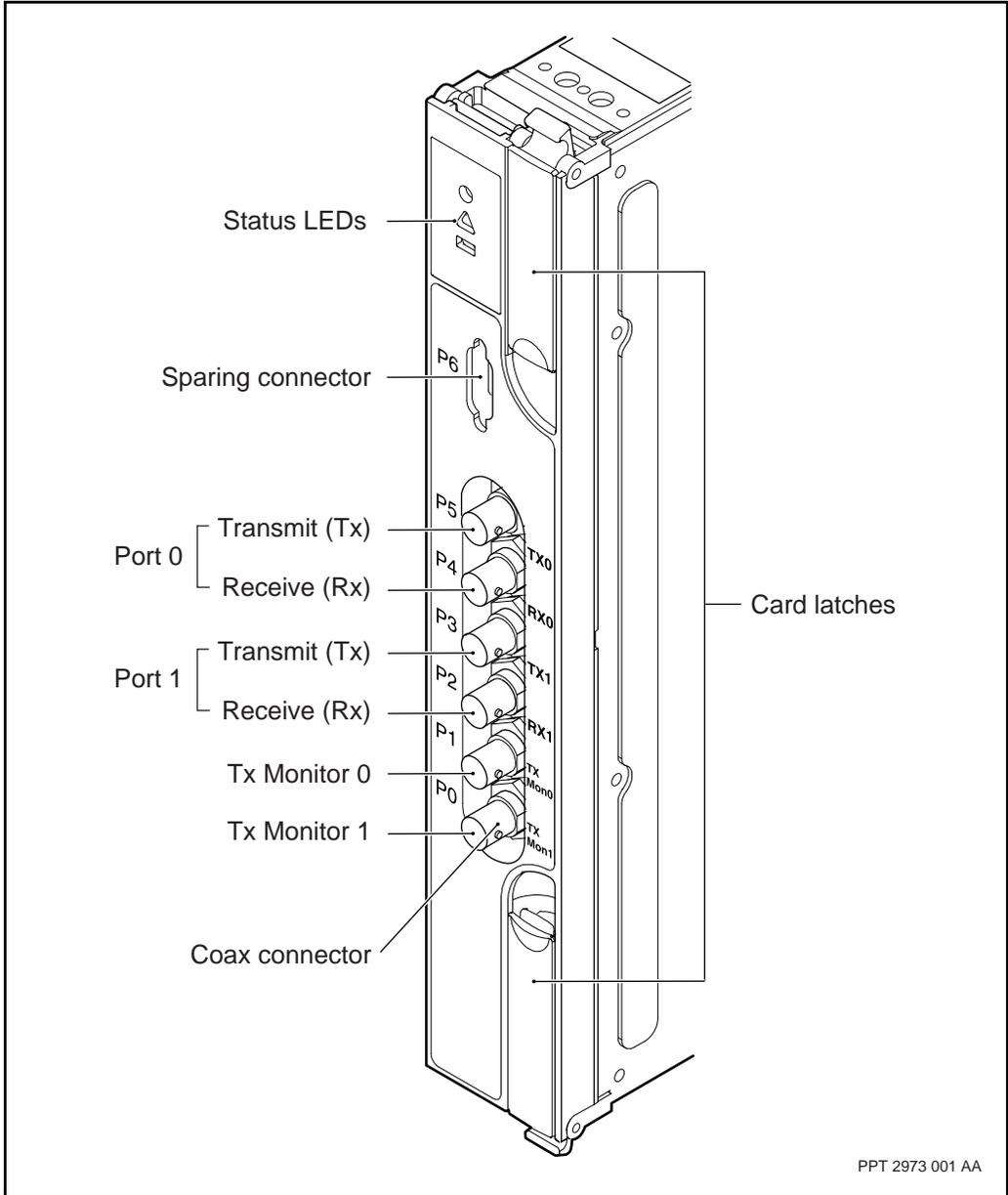
2-port DS3Ch TDM FP

For the interface information about the 2-port DS3 channelized time division multiplexing (TDM) FP, see:

- “Faceplate of a 2-port DS3Ch TDM FP with PEC NTHW91” (page 161)
- “2-port DS3Ch TDM line connections” (page 162)
- “2-port DS3Ch TDM cable assemblies” (page 162)
- “Assigning sparing panel connections for 2-port DS3C TDM FPs” (page 164)

The software name (card type) of the NTHW91 is 2pDS3cAal.

Figure 39
Faceplate of a 2-port DS3Ch TDM FP with PEC NTHW91



2-port DS3Ch TDM line connections

You can connect the lines (ports) of this DS3 FP directly to the far end network equipment or another DS3 FP, or indirectly through the 3-port DS3, E3, or E1 one-for-one sparing panel identified by PEC NTFP99AA or the 12-port DS3 fanout panel NTHW52. Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panel.

The connections can be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

2-port DS3Ch TDM cable assemblies

The maximum cable length for DS3Ch lines to customer equipment is 137 m (450 ft). The distance between the FP and the sparing panel is part of the total length.

The table “Cable assemblies for a DS3Ch TDM FP” (page 162) lists the available prefabricated cables. The cable assemblies with standard male BNC connectors at both ends can be connected to either another FP, the NTFP99AA sparing panel, the NTHW52 fanout panel, or other compatible equipment.

Table 26
Cable assemblies for a DS3Ch TDM FP

PEC	Description	Length
NTFP19AD	male straight BNC to male straight BNC	3.0 m (9.8 ft)
NTFP19AE	male straight BNC to male straight BNC	15 m (49 ft)
NTHR69	DB9 sparing control port	2.5 m (8 ft)
NTHR70	DB9 sparing control port	5 m (16 ft)
NTHR71	DB9 sparing control port	15 m (49 ft)

You can custom make your own traffic port cables to connect the FP to the other end connections by using the specifications in the table “Cable assembly parts for a 2-port DS3Ch TDM FP” (page 163). The port connections are identified in the figure “Faceplate of a 2-port DS3Ch TDM FP with PEC NTHW91” (page 161). Information about assigning port

connections is described in the processor card cabling chapter of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Table 27
Cable assembly parts for a 2-port DS3Ch TDM FP

Item	Description
at the FP faceplate, male coax connector	75-ohm straight or right-angle crimp-on male BNC plug (connector)
cable NT-734 or comparable cable such as RG-59/U	75-ohm coaxial cable with double shielded construction
at the sparing panel faceplate, a male connector 28P387-1 (straight) or 28P388 (right-angle) made by Specialty Connector Company, or a comparable one	75-ohm straight or right-angle crimp-on male BNC plug (connector)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Belden Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)
- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 2-port DS3Ch TDM FP with PEC NTHW91” (page 161) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 2-port DS3Ch TDM FP with PEC NTHW91” (page 161). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

For more information, see “Cables and cable management” (page 315).

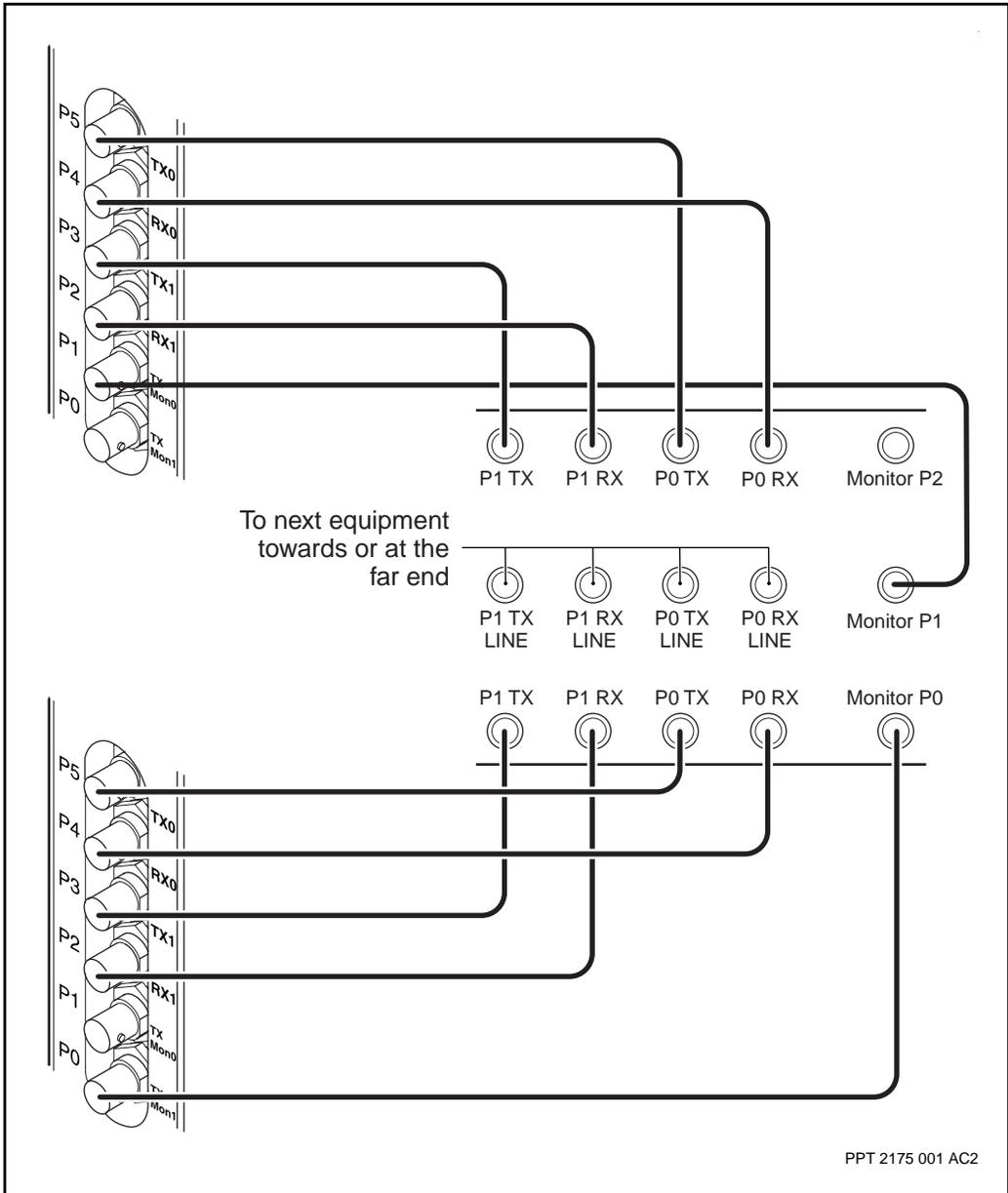
Assigning sparing panel connections for 2-port DS3C TDM FPs

The figure “Cable connections between 2-port DS3C TDM FPs and a 3-port sparing panel NTFP99” (page 165) shows the connection endpoints between the spared FPs and their sparing panel. It also identifies the endpoints at the sparing panel from the far-end or next-hop CPE.

A sparing panel has a transmit (Tx) and receive (Rx) pair for each port. When cabling Passport FPs and sparing panels, do Tx-to-Tx and Rx-to-Rx for all equipment from the FP up to the far-end termination of the FP connection.

The sparing panel NTFP99 can also be deployed as a one-for-one fanout panel (or patch panel) provided the connections are to the Main Tx and Rx ports.

Figure 40
Cable connections between 2-port DS3C TDM FPs and a 3-port sparing panel NTFP99



4-port DS3Ch FR FP

For the interface information about the 4-port DS3Ch FR FP, see:

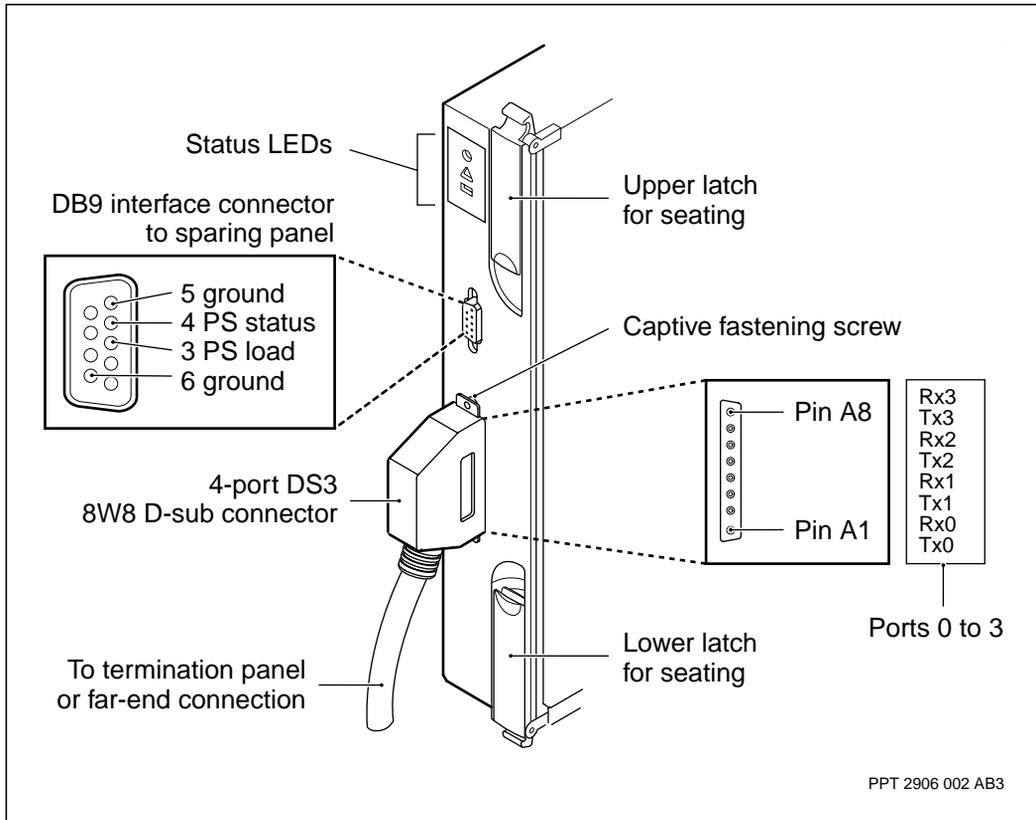
- “4-port DS3Ch FR identifiers” (page 166)
- “Faceplate of a 4-port DS3Ch FR FP with PEC NTHW88 or NTHW89” (page 167)
- “4-port DS3 FR FP line connections” (page 167)
- “4-port DS3 FR FP cable assemblies” (page 168)
- “Assigning sparing panel connections for 4-port DS3 FPs” (page 171)

Table 28
4-port DS3Ch FR identifiers

FP name	PQC6v2 (also known as PQC2)	PQC12	Software name (card type)
4-port DS3 channelized	NTHR88	NTHR89	4pDS3Ch

When a specific PEC is not mentioned, assume the text applies to both PQC versions of the card.

Figure 41
Faceplate of a 4-port DS3Ch FR FP with PEC NTHW88 or NTHW89



4-port DS3 FR FP line connections

You can connect the NTHR88 or NTHR89 directly to the far-end network equipment or another DS3 FP, or indirectly through a termination panel. Termination panels include the 12-port fanout panel NTHW52 or the one-for-six 12-port sparing panel NTQS31. Refer to the “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panels.

The connections can also be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

4-port DS3 FR FP cable assemblies

The maximum cable distance for DS3 lines to customer premises equipment (CPE) is 137 m (450 ft). The distance between the FP and the termination panel is part of the total length.

The table “Cable assemblies for a 4-port DS3 FR FP” (page 168) lists the available prefabricated cables.

Table 29
Cable assemblies for a 4-port DS3 FR FP

PEC	Description	Length
NTHR58	DS3 male 8W8 mini-coax to male BNC	2.5 m (8 ft)
NTHR59	DS3 male 8W8 mini-coax to male BNC	5 m (16 ft)
NTHR60	DS3 male 8W8 mini-coax to male BNC	15 m (49 ft)
NTHR72	DS3 male 8W8-to-8W8 male mini-coax	2.5 m (8 ft)
NTHR73	DS3 male 8W8-to-8W8 male mini-coax	5 m (16 ft)
NTHR74	DS3 male 8W8-to-8W8 male mini-coax	15 m (49 ft)
NTHR69	DS3 DB9 sparing control port	2.5 m (8 ft)
NTHR70	DS3 DB9 sparing control port	5 m (16 ft)
NTHR71	DS3 DB9 sparing control port	15 m (49 ft)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Beldon Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)

- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 4-port DS3Ch FR FP with PEC NTHW88 or NTHW89” (page 167) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 4-port DS3Ch FR FP with PEC NTHW88 or NTHW89” (page 167). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

The pinout of the traffic ports is shown in the figures “Faceplate of a 4-port DS3Ch FR FP with PEC NTHW88 or NTHW89” (page 167) and “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 170), and in the table “Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch FR FP” (page 171). Information about assigning port connections is described in the processor card cabling chapter of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 42
Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly

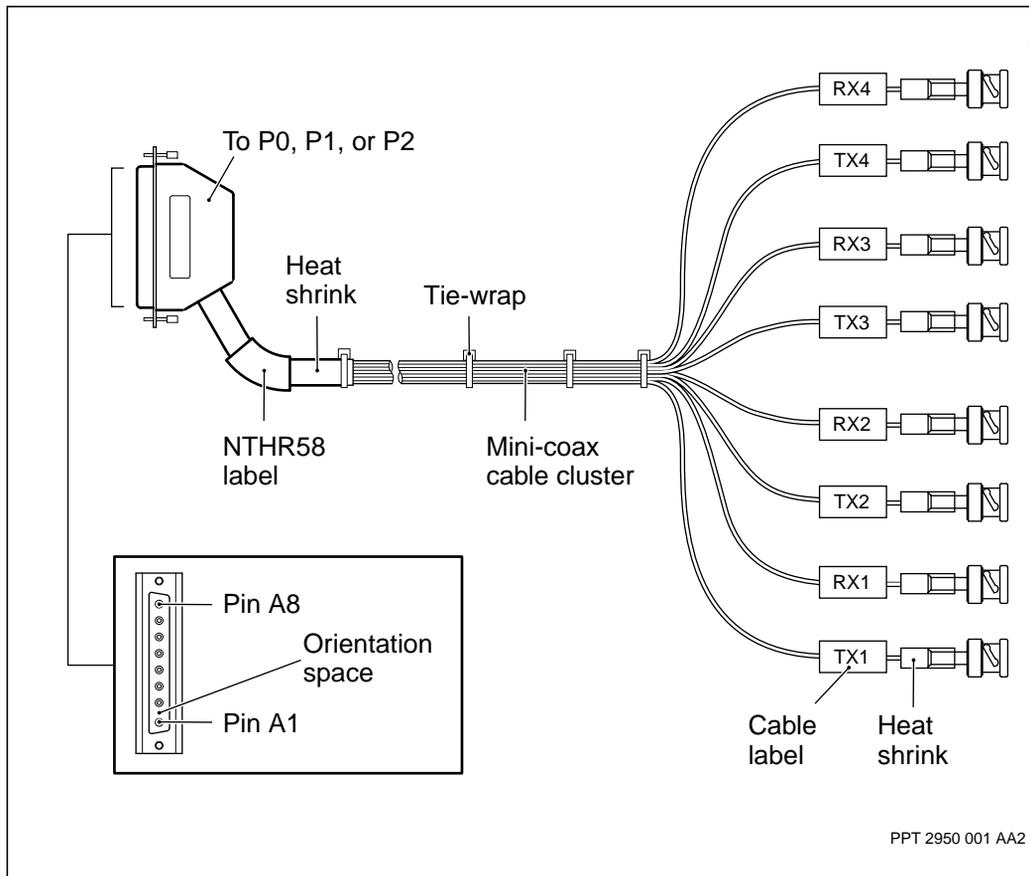


Table 30
Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch FR FP

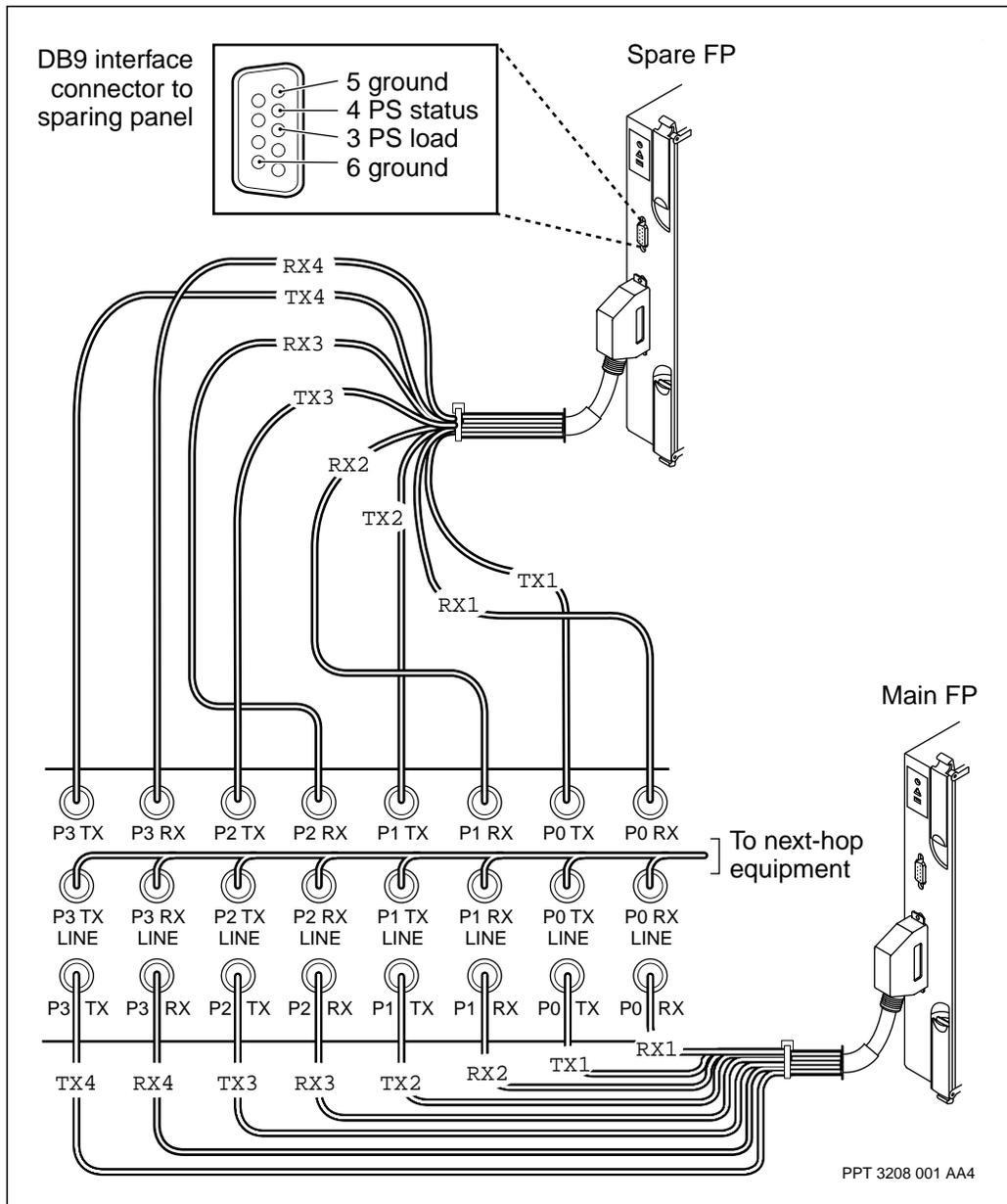
Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P0	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1

Assigning sparing panel connections for 4-port DS3 FPs

A sparing panel has a transmit (Tx) and receive (Rx) pair for each port. When cabling Passport FPs and sparing panels, do Tx-to-Tx and Rx-to-Rx for all equipment from the FP up to the far-end termination of the FP connection.

The figure “8W8-to-BNC cable connections between two 4-port DS3s and sparing panel NTHR79” (page 172) shows the connection endpoints between the spared FPs and identifies the endpoints at the sparing panel from the far-end or next-hop CPE, such as an EdgeLink 100.

Figure 43
8W8-to-BNC cable connections between two 4-port DS3s and sparing panel NTHR79

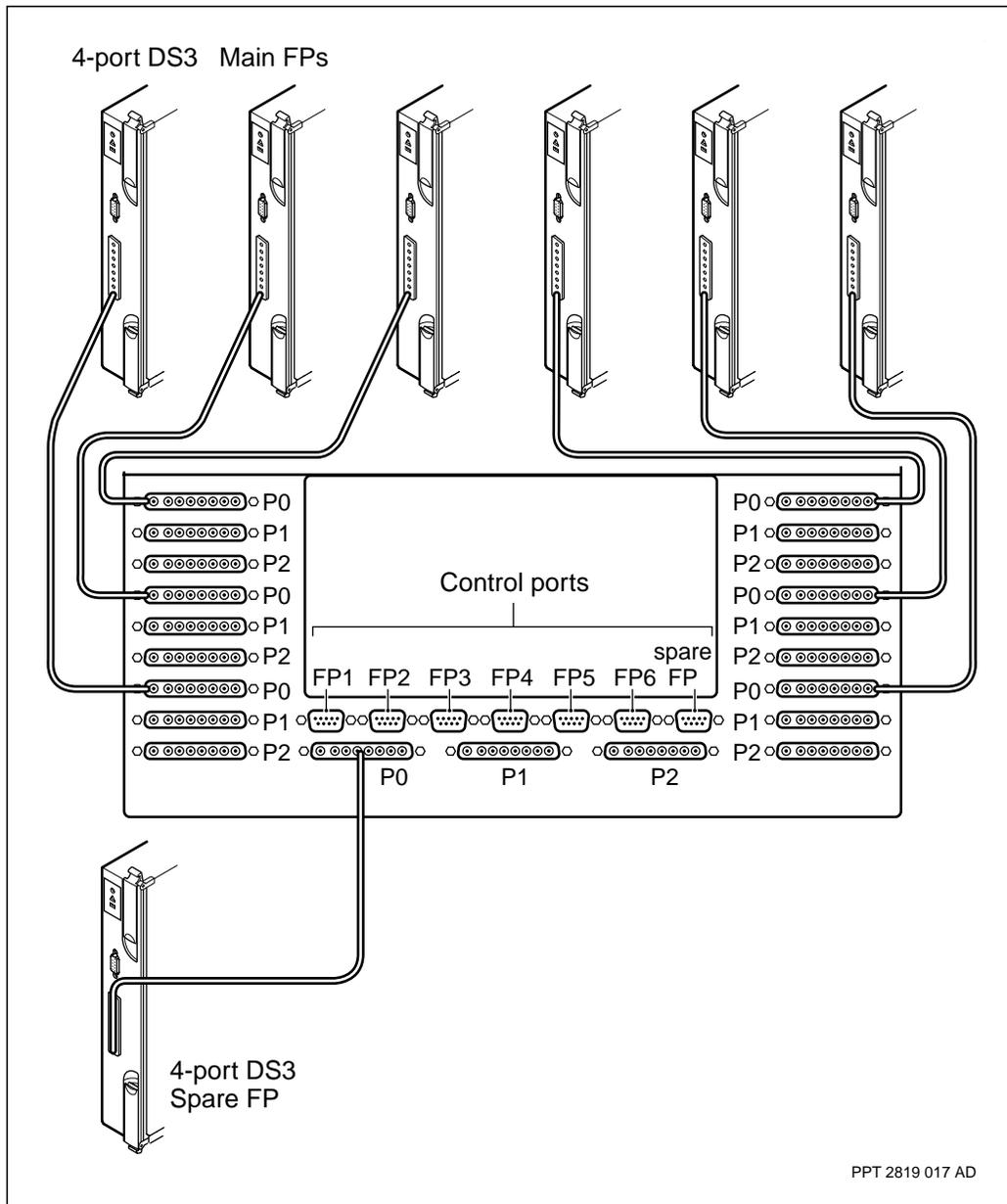


Up to six 4-port DS3 FPs can be spared by a seventh DS3 in a one-for-n configuration using the 12-port DS3 sparing panel NTQS31. Any of the DS3 FPs that support one-for-n sparing can be connected to the NTQS31. The following cabling criteria must be met.

- Each cable assembly must have an 8W8 connector at the sparing panel end. The prefabricated cable assemblies that can be used with the DS3 FPs are identified in each FP description in this chapter.
- All FPs must be in the same shelf, that is, share the same CPs.
- All FPs must connect to the same 8W8 port number on the sparing panel, for example, the figure “8W8-to-BNC cable connections between two 4-port DS3s and sparing panel NTHR79” (page 172) shows all connections on port zero (P0).
- If less than six DS3s are spared, the cabling on the sparing panel must be sequential from top to bottom on the sparing panel, then left to right without skipping a port connection.
- The sequence of FPs in a shelf do not necessarily have to be cabled in the same sequence to the sparing panel. For example, the figure “8W8-to-BNC cable connections between two 4-port DS3s and sparing panel NTHR79” (page 172) shows that the first FP is connected to the third sparing panel port number and the third FP is connected to the first sparing panel port number. It is logical to connect cables in sequence from their position in the shelf and in sequence on the sparing panel so that software configurations are easier to assign and identify.
- The software configuration (provisioning) of the one-for-n sparing must identify the correct slot and port numbers of each card relative to the sparing panel. No sparing panel port number can be skipped in favor of a subsequent connection.

The figure “8W8-to-BNC cable connections between two 4-port DS3s and sparing panel NTHR79” (page 172) is an example of connections. The control port cable connections are omitted to clearly indicate the traffic port connections.

Figure 44
Cable connections between seven 4-port DS3s each with 8W8s and sparing panel NTQS31



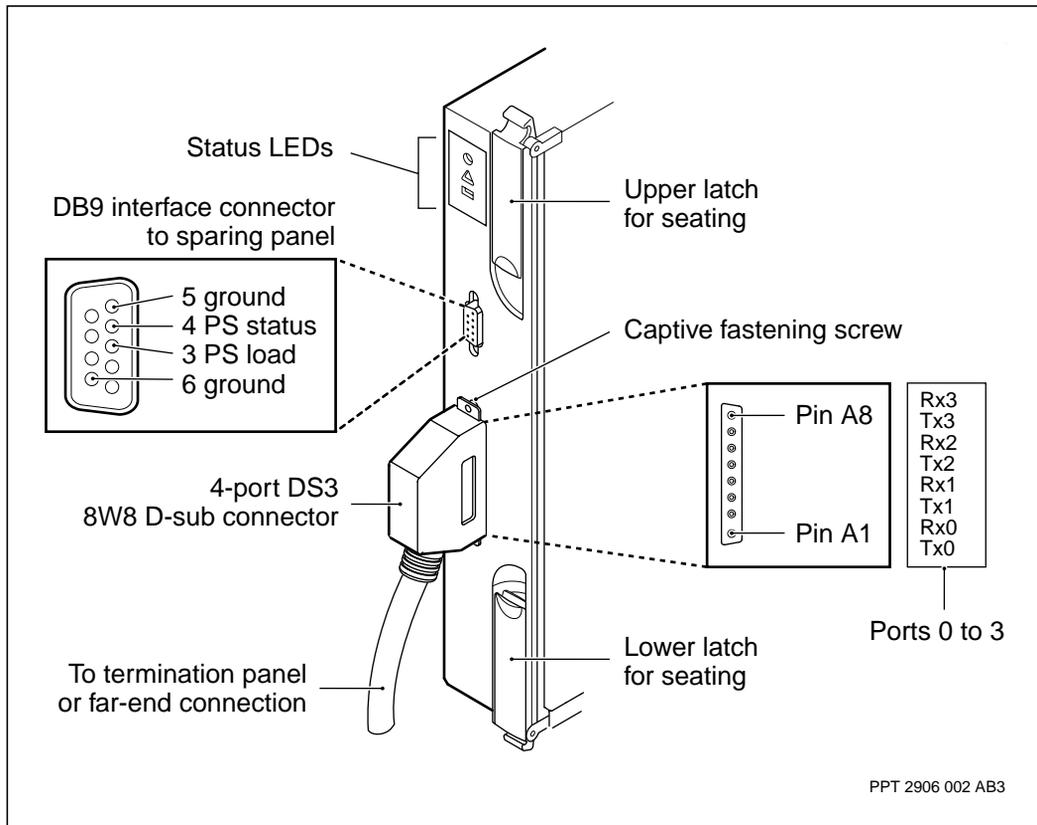
4-port DS3Ch ATM FP with IMA

For the interface information about the 4-port DS3Ch ATM FP with IMA, see:

- “Faceplate of a 4-port DS3Ch ATM FP with PEC NTHR31” (page 175)
- “4-port DS3Ch ATM FP with IMA line connections” (page 176)
- “4-port DS3Ch ATM FP with IMA cable assemblies” (page 176)

The software name (card type) of the NTHR31 is 4pDS3ChAtm.

Figure 45
Faceplate of a 4-port DS3Ch ATM FP with PEC NTHR31



4-port DS3Ch ATM FP with IMA line connections

You can connect the lines (ports) of this DS3 FP directly to the far end network equipment or another DS3 FP, or indirectly through a termination panel. Termination panels include the 12-port fanout panel NTHW52, the one-for-six 12-port sparing panel NTQS31, or the one-for-one 4-port sparing panel NTHR79. Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panels.

The connections can also be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

4-port DS3Ch ATM FP with IMA cable assemblies

The maximum cable distance for DS3 lines to customer premises equipment (CPE) is 137 m (450 ft). The distance between the FP and the termination panel is part of the total length.

The table “Cable assemblies for a 4-port DS3Ch ATM FP with IMA” (page 176) lists the available prefabricated cables.

Table 31
Cable assemblies for a 4-port DS3Ch ATM FP with IMA

PEC	Description	Length
NTHR58	DS3 male 8W8 mini-coax to male BNC	2.5 m (8 ft)
NTHR59	DS3 male 8W8 mini-coax to male BNC	5 m (16 ft)
NTHR60	DS3 male 8W8 mini-coax to male BNC	15 m (49 ft)
NTHR72	DS3 male 8W8-to-8W8 male mini-coax	2.5 m (8 ft)
NTHR73	DS3 male 8W8-to-8W8 male mini-coax	5 m (16 ft)
NTHR74	DS3 male 8W8-to-8W8 male mini-coax	15 m (49 ft)
NTHR69	DS3 DB9 sparing control port	2.5 m (8 ft)
NTHR70	DS3 DB9 sparing control port	5 m (16 ft)
NTHR71	DS3 DB9 sparing control port	15 m (49 ft)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Beldon Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)
- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 4-port DS3Ch ATM FP with PEC NTHR31” (page 175) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 4-port DS3Ch ATM FP with PEC NTHR31” (page 175). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

The pinout of the traffic ports is shown in the figures “Faceplate of a 4-port DS3Ch ATM FP with PEC NTHR31” (page 175) and “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 178), and in the table “Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch ATM FP” (page 179). Information about assigning port connections is described in the processor card cabling chapter of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 46
Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly

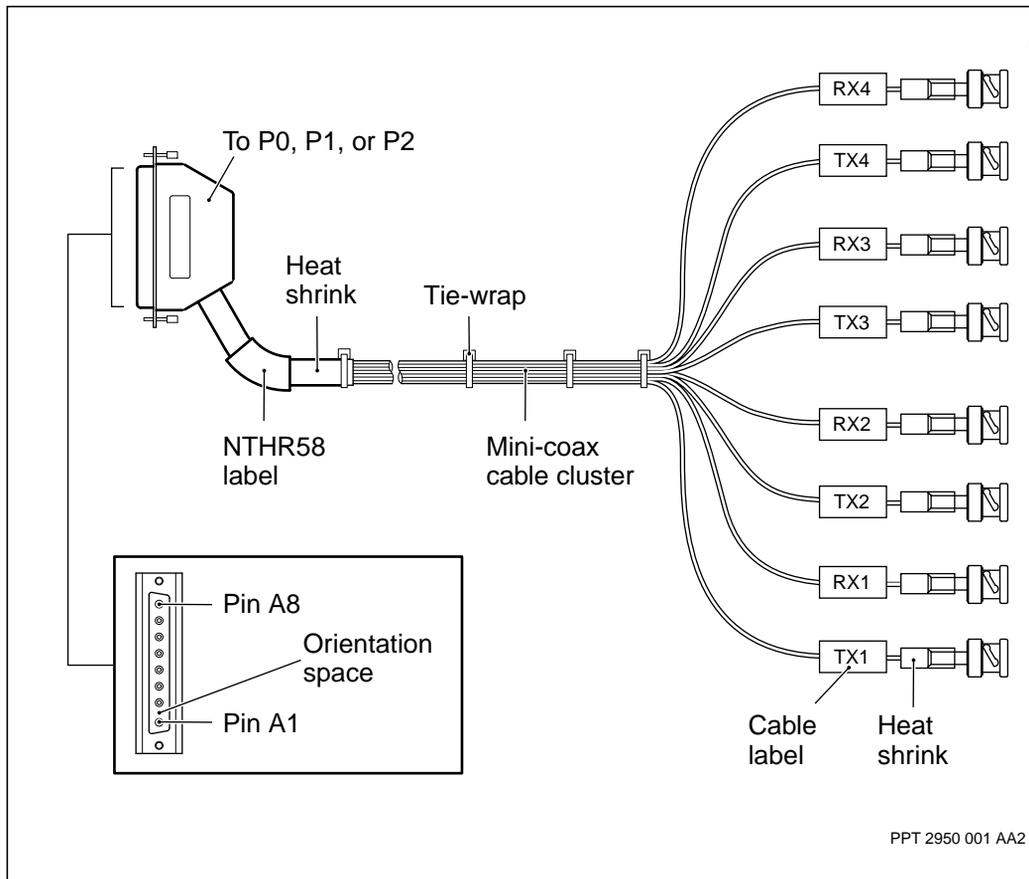


Table 32
Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch ATM FP

Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P0	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1

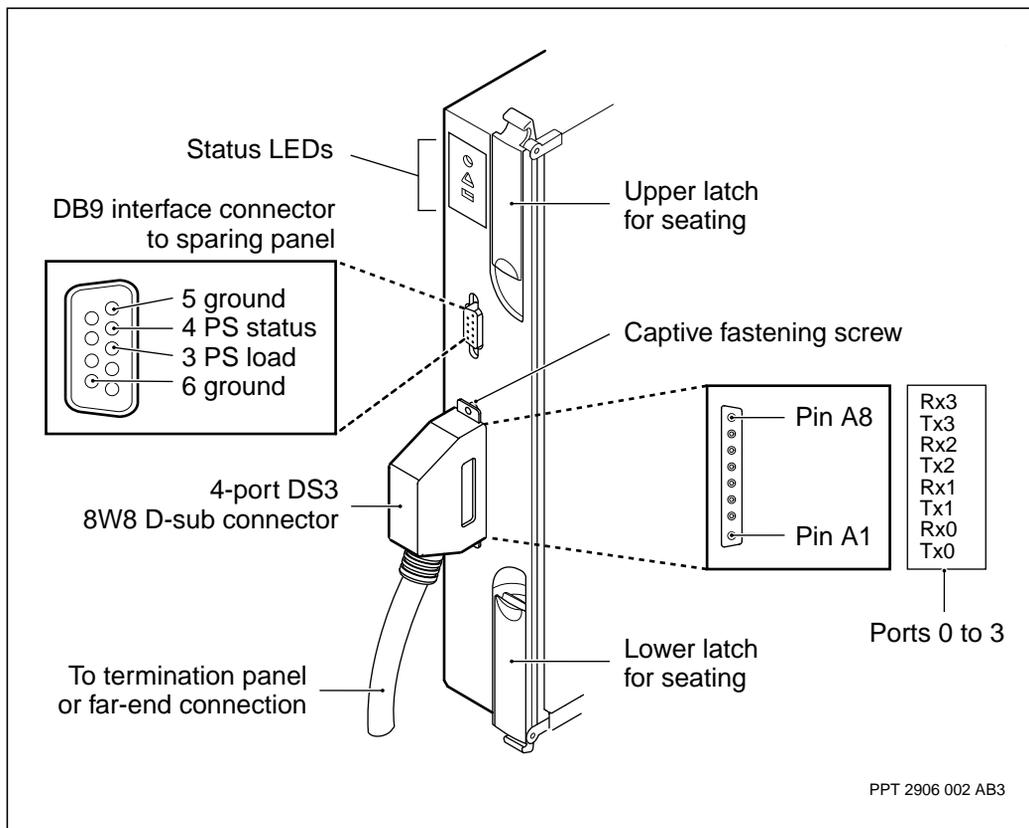
4-port DS3Ch FP with AAL1 CES

For the interface information about the 4-port DS3Ch FP with AAL1 CES, see:

- “Faceplate of a 4-port DS3Ch FP with AAL1 CES with PEC NTHR91” (page 180)
- “4-port DS3Ch FP with AAL1 CES line connections” (page 181)
- “4-port DS3Ch FP with AAL1 CES cable assemblies” (page 181)

The software name (card type) of the NTHR91 is 4pDS3ChAal1.

Figure 47
Faceplate of a 4-port DS3Ch FP with AAL1 CES with PEC NTHR91



4-port DS3Ch FP with AAL1 CES line connections

You can connect the lines (ports) of this DS3 FP directly to the far end network equipment or another DS3 FP, or indirectly through a termination panel. Termination panels include the 12-port fanout panel NTHW52, the one-for-six 12-port sparing panel NTQS31, or the one-for-one 4-port sparing panel NTHR79. Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panels.

The connections can also be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

4-port DS3Ch FP with AAL1 CES cable assemblies

The maximum cable distance for DS3 lines to customer premises equipment (CPE) is 137 m (450 ft). The distance between the FP and the termination panel is part of the total length.

The table “Cable assemblies for a 4-port DS3Ch FP with AAL1 CES” (page 181) lists the available prefabricated cables.

Table 33
Cable assemblies for a 4-port DS3Ch FP with AAL1 CES

PEC	Description	Length
NTHR58	DS3 male 8W8 mini-coax to male BNC	2.5 m (8 ft)
NTHR59	DS3 male 8W8 mini-coax to male BNC	5 m (16 ft)
NTHR60	DS3 male 8W8 mini-coax to male BNC	15 m (49 ft)
NTHR72	DS3 male 8W8-to-8W8 male mini-coax	2.5 m (8 ft)
NTHR73	DS3 male 8W8-to-8W8 male mini-coax	5 m (16 ft)
NTHR74	DS3 male 8W8-to-8W8 male mini-coax	15 m (49 ft)
NTHR69	DS3 DB9 sparing control port	2.5 m (8 ft)
NTHR70	DS3 DB9 sparing control port	5 m (16 ft)
NTHR71	DS3 DB9 sparing control port	15 m (49 ft)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Beldon Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)
- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 4-port DS3Ch FP with AAL1 CES with PEC NTHR91” (page 180) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 4-port DS3Ch FP with AAL1 CES with PEC NTHR91” (page 180). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

The pinout of the traffic ports is shown in the figures “Faceplate of a 4-port DS3Ch FP with AAL1 CES with PEC NTHR91” (page 180) and “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 183), and in the table “Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch FP” (page 184). Information about assigning port connections is described in the processor card cabling chapter of *241-1501-240 Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 48
Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly

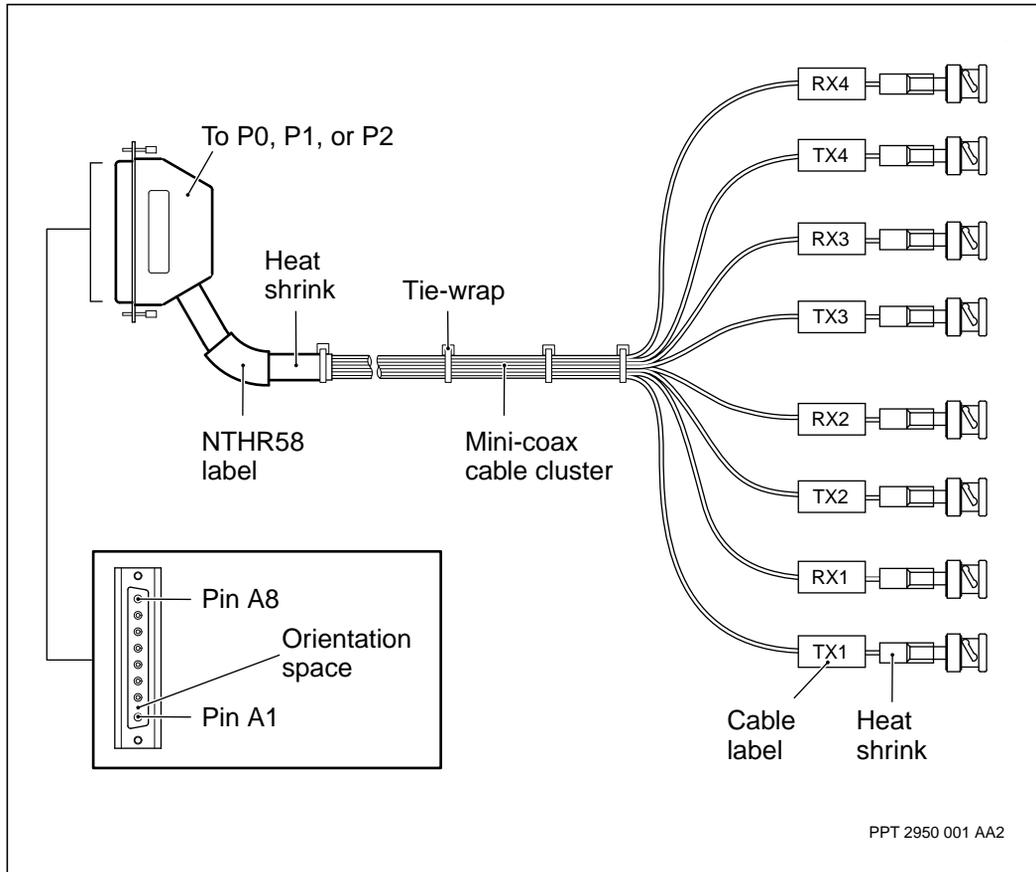


Table 34
Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch FP

Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P0	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1

12-port DS3 FP

For the interface information about the 12-port DS3 FP, see:

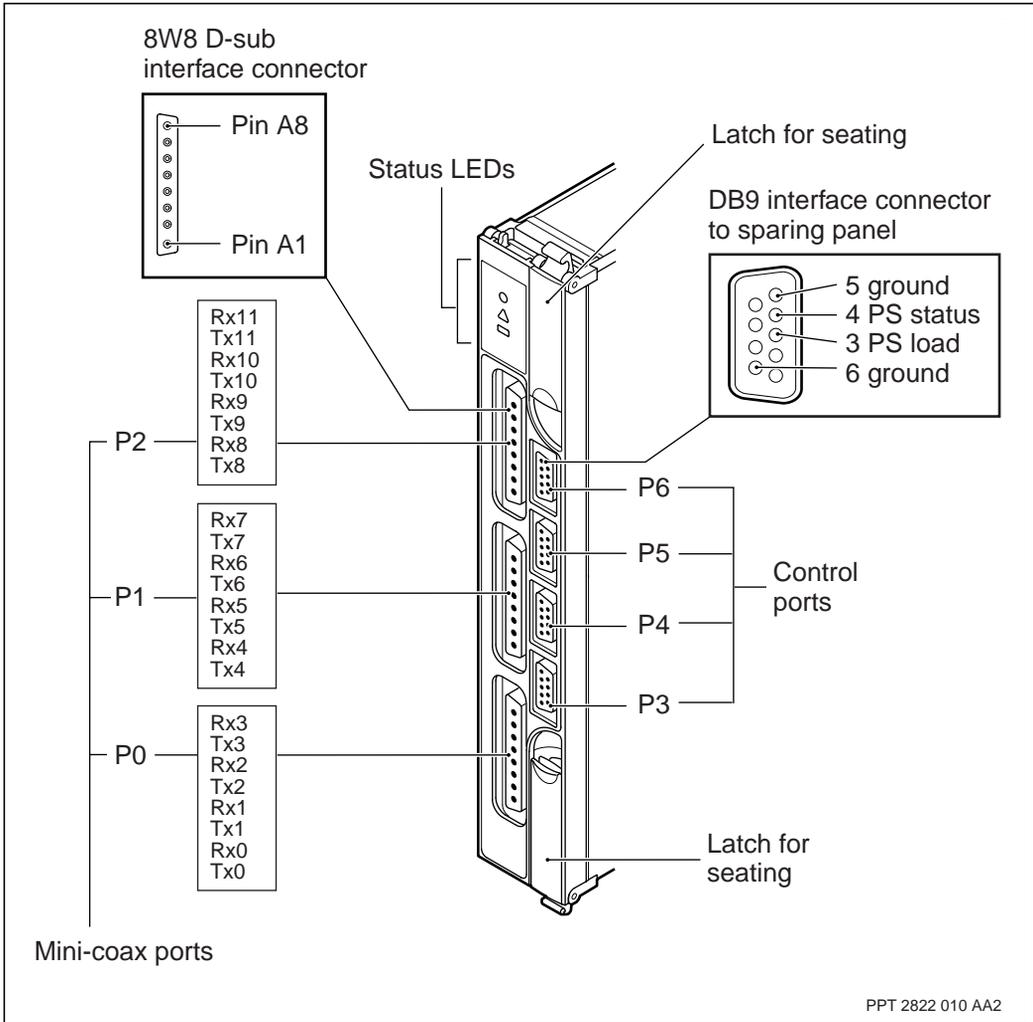
- “Faceplate of a 12-port DS3 FP with PEC NTHR23” (page 186)

The figure includes the mapping of port numbers to connector pins. Information on assigning port connections is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

- “12-port DS3 FP line connections” (page 187)
- “12-port DS3 FP cable assemblies” (page 187)

The software name (card type) of the NTHR23 is 12pDS3Atm. The DS version of this card shares the same PEC and software name.

Figure 49
Faceplate of a 12-port DS3 FP with PEC NTHR23



12-port DS3 FP line connections

You can connect the lines (ports) of this DS3 FP directly to the far end network equipment or another DS3 FP, or indirectly through the 12-port fanout panel NTHW52 or the one-for-six 12-port sparing panel NTQS31. Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panels.

The connections can also be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

When connecting a DS3 to a fanout panel, up to three DS3 8W8-to-BNC cable assemblies are required. When connecting a DS3 to a one-for-six sparing panel, up to three DS3 8W8-to-8W8 mini-coax cable assemblies are required from each FP. To operate the sparing panel, a single DS3 DB9 sparing control cable assembly is required.

12-port DS3 FP cable assemblies

Passport 15000 or 20000 uses mini-coax cables that are high-density 75-ohm BNC cables with 8W8 and BNC connectors. Each 8W8 connector is D-shaped with eight connections, four pairs of transmit (Tx) and receive (Rx) connections for four ports. Each 12-port DS3 FP accommodates three 8W8 connectors, labeled P0, P1, and P2. (Some 4-port DS3s have only one 8W8 connector.) The other end of the cable can have either

- another 8W8 connector intended for connection with sparing panel NTQS31
- a corresponding series of 8 standard BNCs intended for connection with a fanout panel (for example, NTHW52)

The maximum cable distance for DS3 lines to customer premises equipment (CPE) is 137 m (450 ft). The distance between the FP and the sparing panel or fanout panel is part of the total length.

Note: The insertion loss of the mini-coax cables is approximately double that of standard NT-734 cable, which will affect the maximum cable distance.

A 12-port DS3 uses three 4-port cable assemblies and three control port cables.

The table “Cable assemblies for a DS3 FP” (page 188) lists the available prefabricated cables.

Table 35
Cable assemblies for a DS3 FP

PEC	Description	Length
NTHR58	DS3 male 8W8 mini-coax to male BNC	2.5 m (8 ft)
NTHR59	DS3 male 8W8 mini-coax to male BNC	5 m (16 ft)
NTHR60	DS3 male 8W8 mini-coax to male BNC	15 m (49 ft)
NTHR72	DS3 male 8W8-to-8W8 male mini-coax	2.5 m (8 ft)
NTHR73	DS3 male 8W8-to-8W8 male mini-coax	5 m (16 ft)
NTHR74	DS3 male 8W8-to-8W8 male mini-coax	15 m (49 ft)
NTHR69	DS3 DB9 sparing control port	2.5 m (8 ft)
NTHR70	DS3 DB9 sparing control port	5 m (16 ft)
NTHR71	DS3 DB9 sparing control port	15 m (49 ft)

You can custom make your own control port cable using the following specifications:

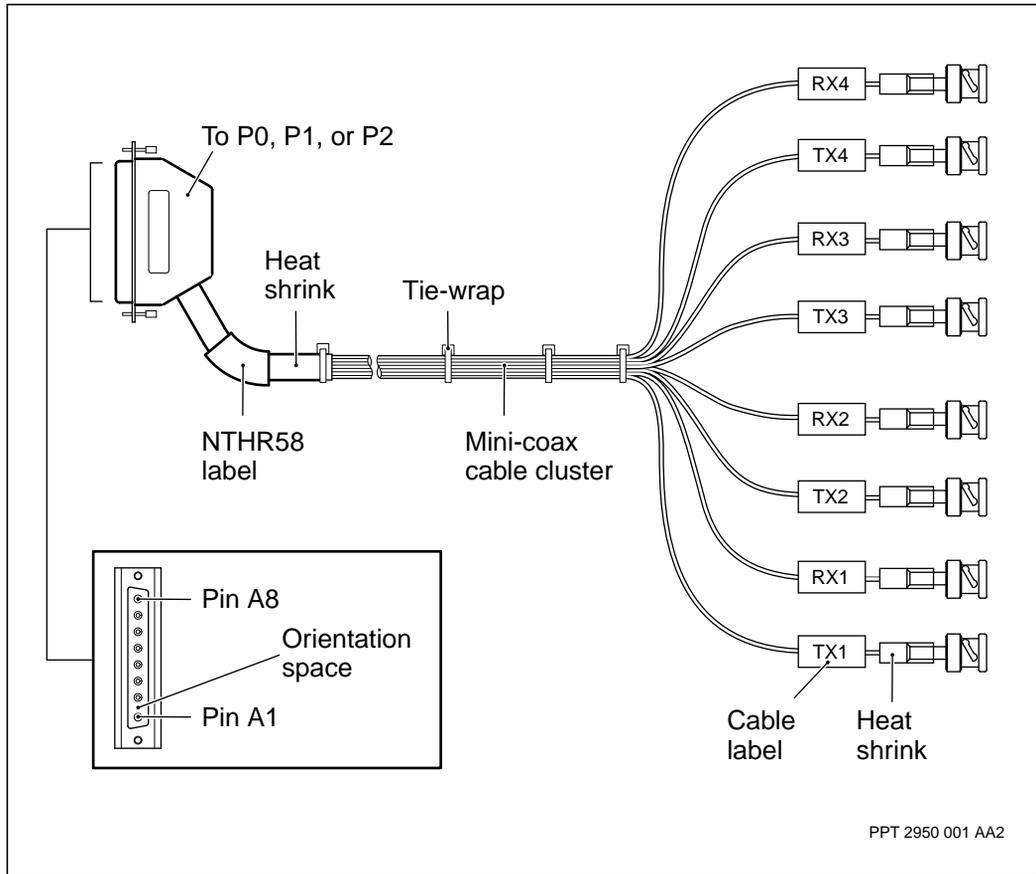
- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Belden Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)
- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 12-port DS3 FP with PEC NTHR23” (page 186) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 12-port DS3 FP with PEC NTHR23” (page 186). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

For the mapping of traffic port numbers to connector pins, see the figures “Faceplate of a 12-port DS3 FP with PEC NTHR23” (page 186) and “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 190), and the table “Mapping an 8W8 and BNC cable to a termination panel from a 12-port DS3 FP” (page 191). Information about assigning port connections is described in the processor card cabling chapter of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Note: Unlike the Passport 7400 series FP faceplates, the Passport 15000 or 20000 has the ports numbered from bottom to top. The reversal is required to accommodate the downwards cable management.

Figure 50
Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly



PPT 2950 001 AA2

Table 36
Mapping an 8W8 and BNC cable to a termination panel from a 12-port DS3 FP

Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P2	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1
P1	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1
P0	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1

Assigning sparing panel connections for a 12-port DS3 or E3 FP

Logically assign a connection from a specific slot on an FP to a specific connection on the sparing panel, and align it with a connection to each connection of all equipment between the sparing panel and the far-end final termination of the FP connection. Choose the sparing panel connections before doing the cabling procedure. Record each port connection at the faceplate of all equipment on a site record and on labels for the cables and panels. Some sparing panel faceplates have writable labels for each connection.

A sparing panel has a transmit (Tx) and receive (Rx) pair for each port. When cabling Passport FPs and sparing panels, do Tx-to-Tx and Rx-to-Rx for all equipment from the FP up to the far-end termination of the FP connection.

For the 12-port and 4-port cards that have the 8W8 mini-coax D-sub connectors on the faceplate, the actual port numbers are not indicated on the other end of the prefabricated signaling cables. The other end can be another 8W8 or a cluster of 8 BNC cables numbered 1 to 8. The pattern of pin (port) numbering is the same for all mini-coax connectors. Use the following to determine the port-to-port connections:

- the figure “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 170)
- the figure “Port mappings of the 8W8 cable connections of a 12-port DS3 or E3 FP” (page 193)
- the table “Mapping an 8W8 and BNC cable to a termination panel from a DS3Ch FR FP” (page 171)

Note that BNC 1 to 8 labels correspond to 8W8 pins A1 to A8 respectively, but the actual port number depends on whether the cable is plugged into P0, P1, or P2. In the figure “Port mappings of the 8W8 cable connections of a 12-port DS3 or E3 FP” (page 193), the port mappings of P0 apply to any of the 4-port FPs with the 8W8 mini-coax D-sub connectors.

The 12-port DS3 or E3 sparing panel NTQS31 can operate as a fanout panel for up to six DS3 or E3 FPs with 8W8 connectors, that is, with no sparing.

Figure 51
Port mappings of the 8W8 cable connections of a 12-port DS3 or E3 FP

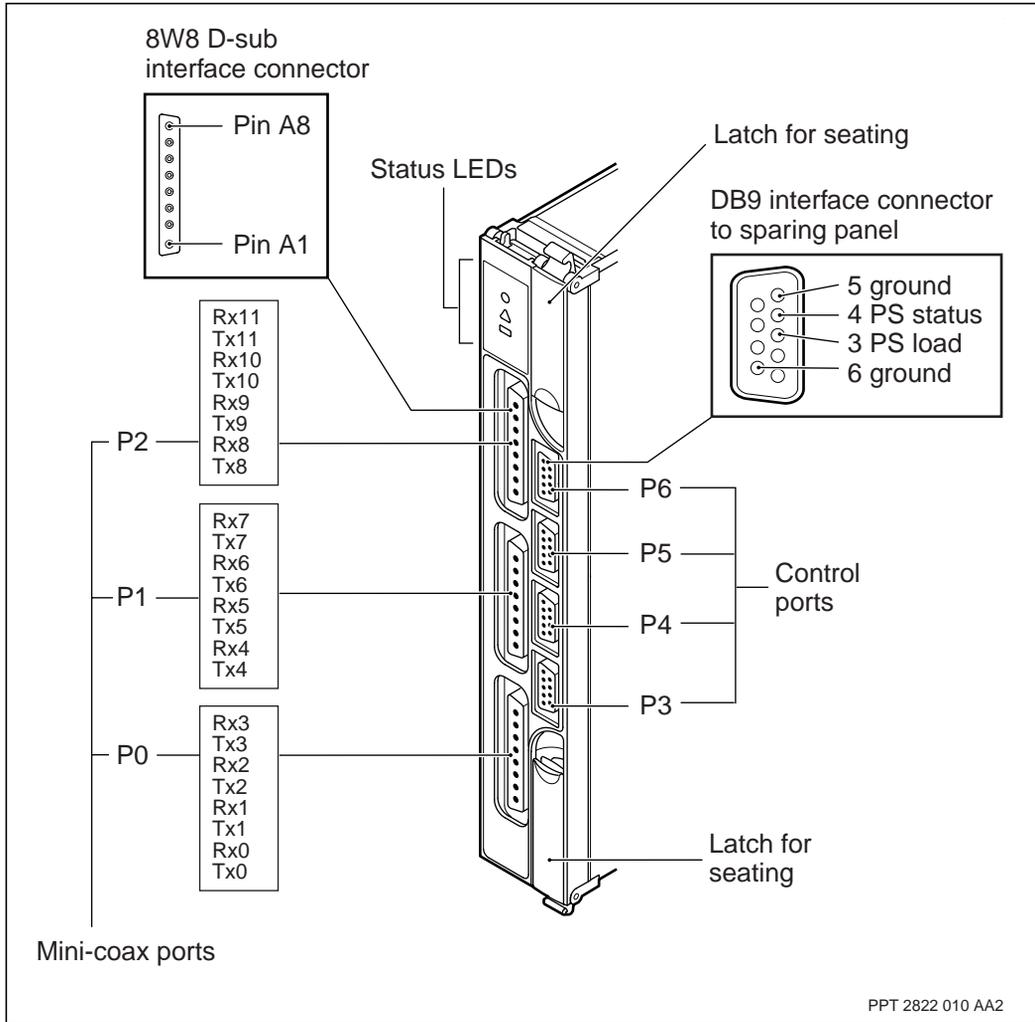


Table 37
Mapping of 8W8 and BNC connectors for ports P0, P1, and P2

Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P2	Rx 11	A8	BNC 8	<node_id>/<fp_slot_no>/P2/Rx11/A-BNC8
	Tx 11	A7	BNC 7	<node_id>/<fp_slot_no>/P2/Tx11/A-BNC7
	Rx 10	A6	BNC 6	<node_id>/<fp_slot_no>/P2/Rx10/A-BNC6
	Tx 10	A5	BNC 5	<node_id>/<fp_slot_no>/P2/Tx10/A-BNC5
	Rx 9	A4	BNC 4	<node_id>/<fp_slot_no>/P2/Rx9/A-BNC4
	Tx 9	A3	BNC 3	<node_id>/<fp_slot_no>/P2/Tx9/A-BNC3
	Rx 8	A2	BNC 2	<node_id>/<fp_slot_no>/P2/Rx8/A-BNC2
	Tx 8	A1	BNC 1	<node_id>/<fp_slot_no>/P2/Tx8/A-BNC1
P1	Rx 7	A8	BNC 8	<node_id>/<fp_slot_no>/P1/Rx7/A-BNC8
	Tx 7	A7	BNC 7	<node_id>/<fp_slot_no>/P1/Tx7/A-BNC7
	Rx 6	A6	BNC 6	<node_id>/<fp_slot_no>/P1/Rx6/A-BNC6
	Tx 6	A5	BNC 5	<node_id>/<fp_slot_no>/P1/Tx6/A-BNC5
	Rx 5	A4	BNC 4	<node_id>/<fp_slot_no>/P1/Rx5/A-BNC4
	Tx 5	A3	BNC 3	<node_id>/<fp_slot_no>/P1/Tx5/A-BNC3
	Rx 4	A2	BNC 2	<node_id>/<fp_slot_no>/P1/Rx4/A-BNC2
	Tx 4	A1	BNC 1	<node_id>/<fp_slot_no>/P1/Tx4/A-BNC1
P0	Rx 3	A8	BNC 8	<node_id>/<fp_slot_no>/P0/Rx3/A-BNC8
	Tx 3	A7	BNC 7	<node_id>/<fp_slot_no>/P0/Tx3/A-BNC7
	Rx 2	A6	BNC 6	<node_id>/<fp_slot_no>/P0/Rx2/A-BNC6
	Tx 2	A5	BNC 5	<node_id>/<fp_slot_no>/P0/Tx2/A-BNC5
	Rx 1	A4	BNC 4	<node_id>/<fp_slot_no>/P0/Rx1/A-BNC4
	Tx 1	A3	BNC 3	<node_id>/<fp_slot_no>/P0/Tx1/A-BNC3
	Rx 0	A2	BNC 2	<node_id>/<fp_slot_no>/P0/Rx0/A-BNC2
	Tx 0	A1	BNC 1	<node_id>/<fp_slot_no>/P0/Tx0/A-BNC1

12-port E3 ATM FP

For the interface information about the 12-port E3 ATM FP, see:

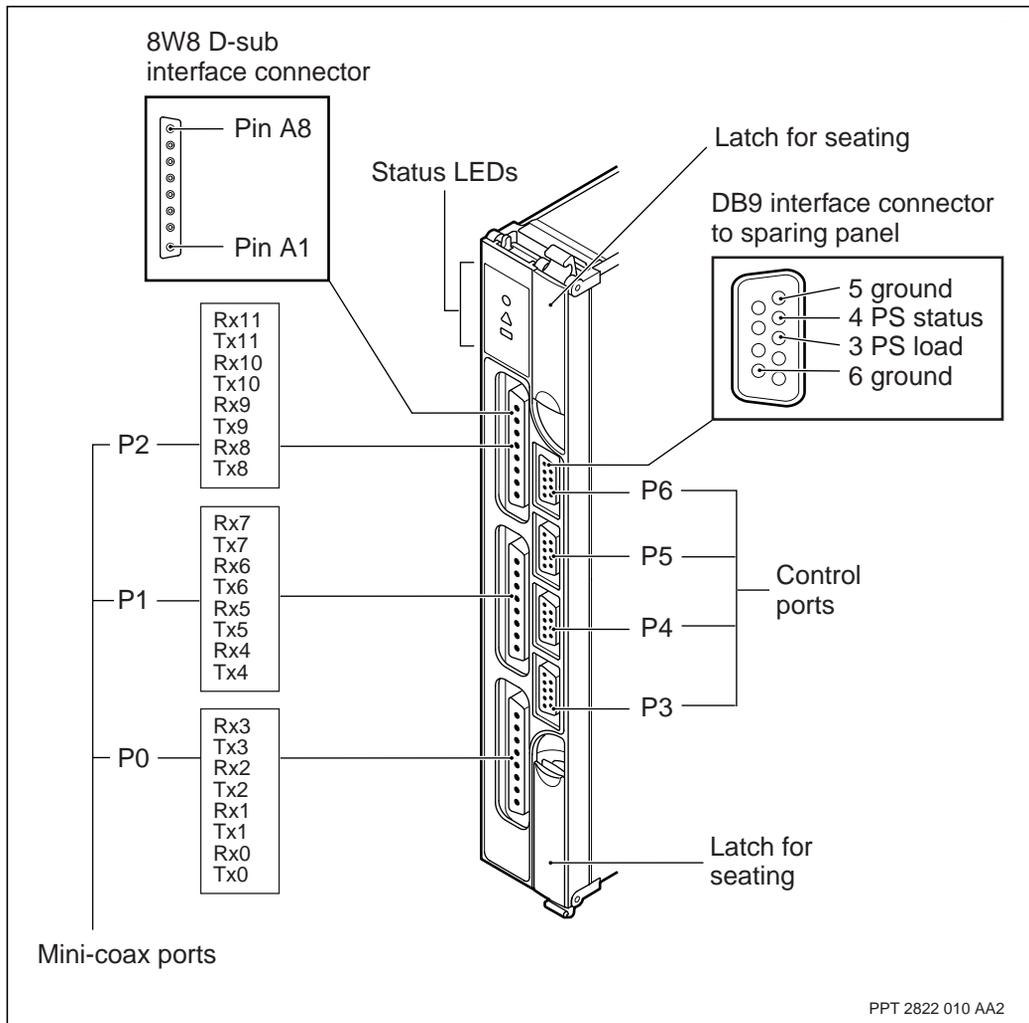
- “Faceplate of a 12-port DS3 FP with PEC NTHR23” (page 186)

The figure includes the mapping of port numbers to connector pins. Information on assigning port connections is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

- “12-port E3 FP line connections” (page 197)
- “12-port E3 FP cable assemblies” (page 197)

The software name (card type) of the NTHR23 is 12pDS3Atm. The DS version of this card shares the same PEC and software name.

Figure 52
Faceplate of a 12-port E3 FP with PEC NTHR25



12-port E3 FP line connections

You can connect the lines (ports) of this E3 FP directly to the far end network equipment or another E3 FP, or indirectly through the 12-port fanout panel NTHW52 or the one-for-six 12-port sparing panel NTQS31. Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the panels.

The connections can also be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

When connecting a E3 to a fanout panel, up to three E3 8W8-to-BNC mini-coax cable assemblies are required. When connecting a E3 to a one-for-six sparing panel, up to three E3 8W8-to-8W8 mini-coax cable assemblies are required from each FP. To operate the sparing panel, a single E3 DB9 sparing control cable assembly is required.

12-port E3 FP cable assemblies

Passport 15000 or 20000 uses mini-coax cables that are high-density 75-ohm BNC cables with 8W8 and BNC connectors. Each 8W8 connector is D-shaped with eight connections, four pairs of transmit (Tx) and receive (Rx) connections for four ports. Each 12-port E3 accommodates three 8W8 connectors, labeled P0, P1, and P2. (A 4-port E3 has only one 8W8 connector.) The other end of the cable can have either

- another 8W8 connector intended for connection with sparing panel NTHR39
- a corresponding series of 8 standard BNCs intended for connection with a fanout panel (for example, NTHW52)

The maximum cable length for unbalanced E3 lines to customer premises equipment (CPE) is 350 m (1148 ft). The distance between the FP and the sparing panel or fanout panel is part of the total length.

The insertion loss of a cable must not exceed 12 dB measured at 17184 kHz. For example, for NT-734 cable, an insertion loss of 12 dB at 17184 kHz is about 350 m (1148 ft) of cable.

Note: The insertion loss of the mini-coax cables is approximately double that of standard NT-734 cable, which will affect the maximum cable distance.

A 12-port E3 uses three 4-port cable assemblies and three control port cables.

The table “Cable assemblies for an E3 FP” (page 198) lists the available prefabricated cables.

Table 38
Cable assemblies for an E3 FP

PEC	Description	Length
NTHR58	E3 male 8W8 mini-coax to male BNC	2.5 m (8 ft)
NTHR59	E3 male 8W8 mini-coax to male BNC	5 m (16 ft)
NTHR60	E3 male 8W8 mini-coax to male BNC	15 m (49 ft)
NTHR72	E3 male 8W8-to-8W8 male mini-coax	2.5 m (8 ft)
NTHR73	E3 male 8W8-to-8W8 male mini-coax	5 m (16 ft)
NTHR74	E3 male 8W8-to-8W8 male mini-coax	15 m (49 ft)
NTHR69	E3 DB9 sparing control port	2.5 m (8 ft)
NTHR70	E3 DB9 sparing control port	5 m (16 ft)
NTHR71	E3 DB9 sparing control port	15 m (49 ft)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Beldon Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)

- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 12-port E3 FP with PEC NTHR25” (page 196) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 12-port E3 FP with PEC NTHR25” (page 196). The PS is the power supply. Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

For the mapping of traffic port numbers to connector pins, see the figures and “Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly” (page 200), and in the table “Mapping an 8W8 and BNC cable to a termination panel from a 12-port E3 FP” (page 201). Information about assigning port connections is described in the processor card cabling chapter of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Note: Unlike the Passport 7400 series FP faceplates, the Passport 15000 or 20000 has the ports numbered from bottom to top. The reversal is required to accommodate the downwards cable management.

Figure 53
Labels of mini-coax and BNC cable connections on a 4-port NTHR58 cable assembly

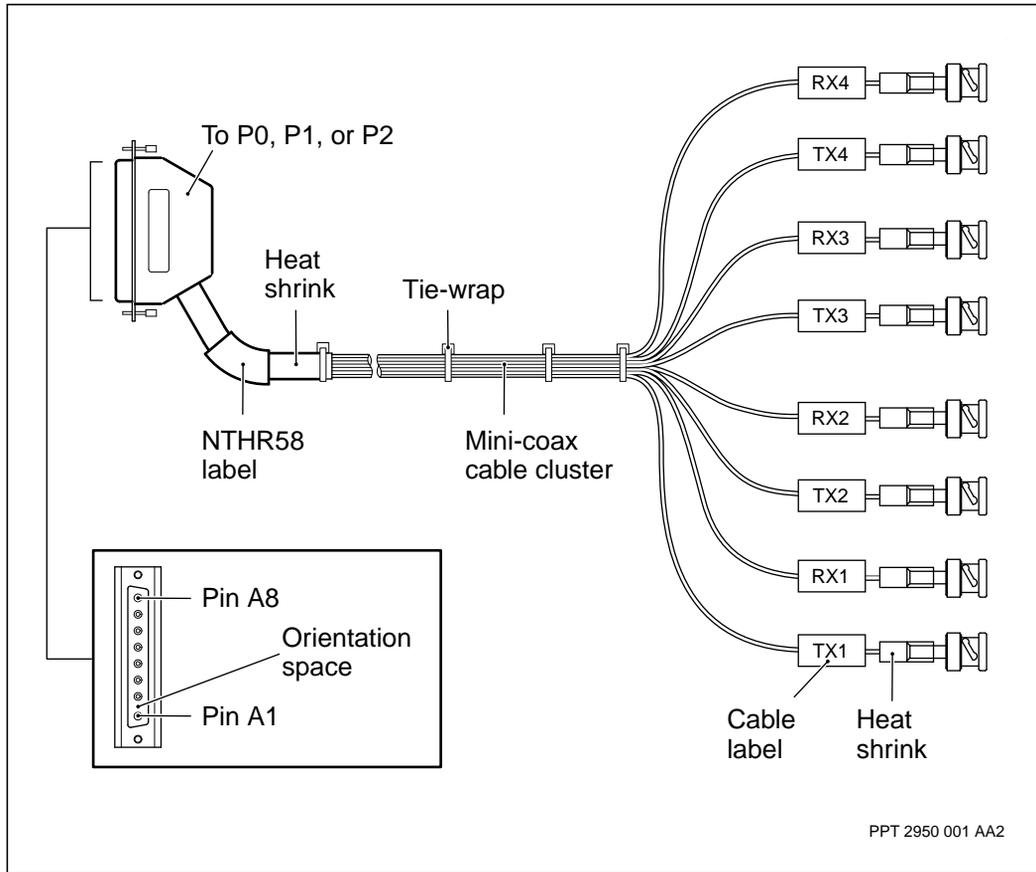


Table 39
Mapping an 8W8 and BNC cable to a termination panel from a 12-port E3 FP

Port on faceplate	8W8 pin function	8W8 pin number	BNC label provided	Suggested BNC connection label at the sparing or fanout panel
P2	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1
P1	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1
P0	Rx 4	A8	RX4	<node_id>/<fp_slot_no>/P0/Rx4
	Tx 4	A7	TX4	<node_id>/<fp_slot_no>/P0/Tx4
	Rx 3	A6	RX3	<node_id>/<fp_slot_no>/P0/Rx3
	Tx 3	A5	TX3	<node_id>/<fp_slot_no>/P0/Tx3
	Rx 2	A4	RX2	<node_id>/<fp_slot_no>/P0/Rx2
	Tx 2	A3	TX2	<node_id>/<fp_slot_no>/P0/Tx2
	Rx 1	A2	RX1	<node_id>/<fp_slot_no>/P0/Rx1
	Tx 1	A1	TX1	<node_id>/<fp_slot_no>/P0/Tx1

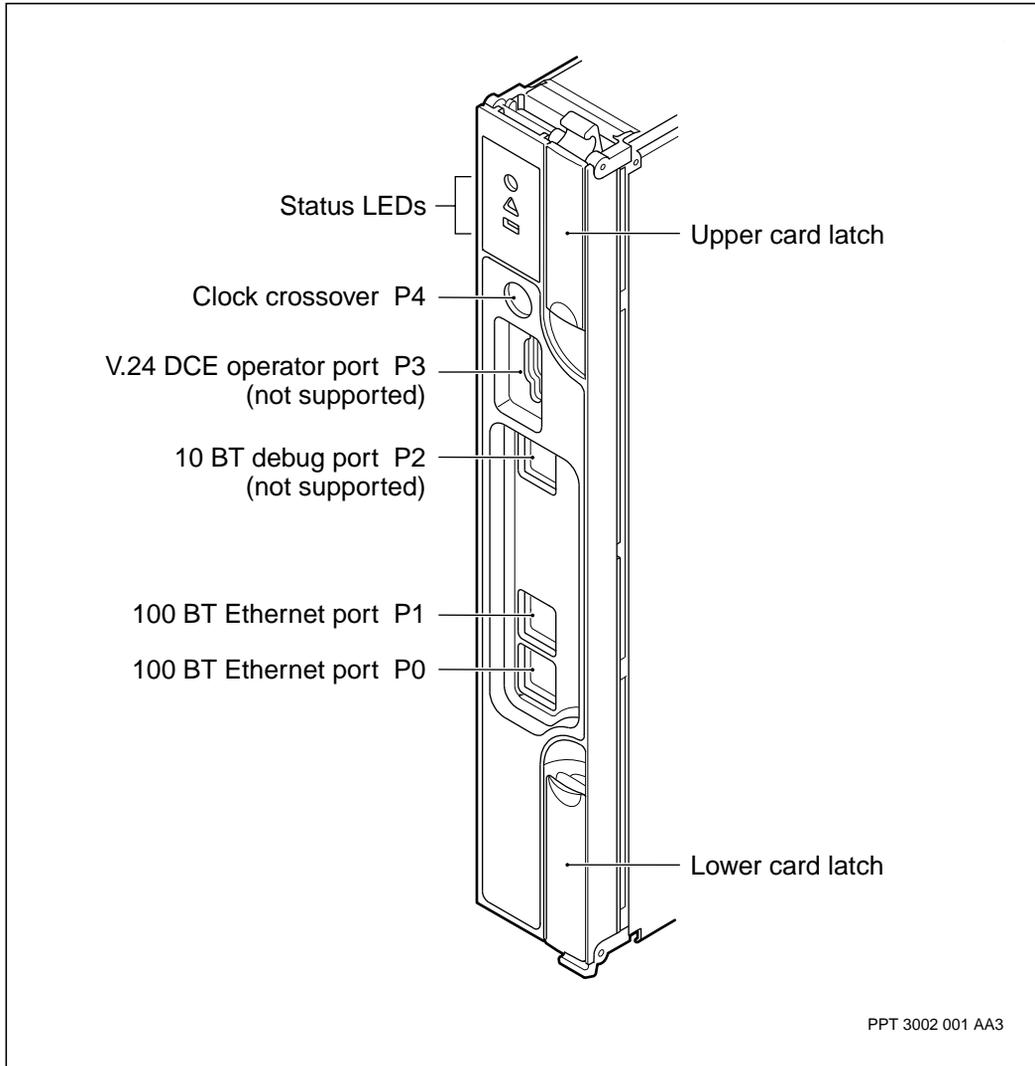
2-port general processor with disk

For the interface information about the 2-port GP with disk (2-port GPDsk), see:

- “Faceplate of a 2-port GPDsk with PEC NTHW10” (page 203)
- “2-port GPDsk components” (page 203)
- “2-port GPDsk pinout and signal names” (page 204)
- “100BaseT Ethernet cable assembly” (page 204)

The software name (card type) of the NTHW10 is 2pGPDsk.

Figure 54
Faceplate of a 2-port GPDsk with PEC NTHW10



2-port GPDsk components

The 2pGPDsk consists of a motherboard, a memory daughter card, and a power supply daughter card, with a hard disk mounted on the motherboard.

The 2pGPDsk connects to the shelf backplane, providing an interface to both fabric cards.

2-port GPDsk pinout and signal names

See the table “Ethernet connector pinouts” (page 158) for the faceplate connection assignments. The pinouts apply to both 10BaseT and 100BaseT connectors.

Note: The 10Base-T Ethernet debug port is not supported.

Table 40
Ethernet connector pinouts

Pin number	Signal name
1	Tx +
2	Tx -
3	Rx +
4	not used
5	not used
6	Rx -
7	not used
8	not used

100BaseT Ethernet cable assembly

The minimum grade of cable required for a 100BaseT Ethernet port is Category 5 unshielded twisted pair (UTP). Some installations may require a higher grade cable (for example, Enhanced Category 5 UTP cabling) to overcome cross-talk, immunity, and other noise problems.

Note: In order to meet Class B electromagnetic compatibility (EMC) requirements, use shielded twisted pair (STP) cabling.

4-port Gigabit Ethernet FP

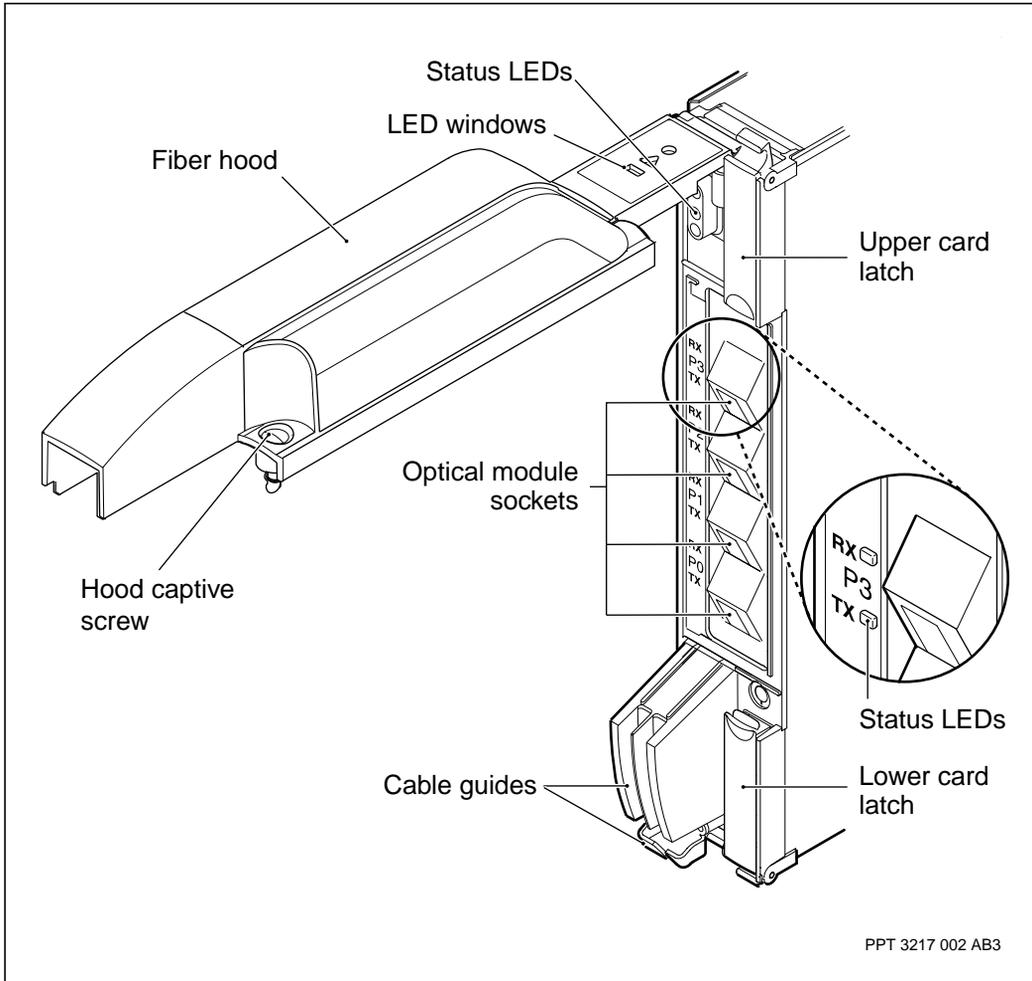
The 4-port Gigabit Ethernet (4pGe) FP provides four full-duplex Gigabit Ethernet ports (also known as optical module sockets). Separately ordered small form-factor pluggable (SFP) optical transceiver modules are required to provide optical signal reception and transmission. The 4pGe requires that an SFP module be plugged into each of its four optical module sockets (ports) in order for the card to operate. For the general description of what an SFP is, see “SFP optical module” (page 288).

For the interface information about the 4-port Gigabit Ethernet FP, see:

- “Faceplate of a 4-port Gigabit Ethernet FP with PEC NTHW49” (page 206); for the description of the port LEDs on the faceplate, see “Status LEDs of the Ethernet ports on an NTHW49” (page 359)
- “4-port Gigabit Ethernet cable assemblies” (page 206)
- “Custom-making an LC cable assembly for an NTHW49” (page 207)
- “SFP modules for an NTHW49” (page 208)

The software name (card type) of the NTHW49 is 4pGe.

Figure 55
Faceplate of a 4-port Gigabit Ethernet FP with PEC NTHW49



4-port Gigabit Ethernet cable assemblies

With a 4-port Gigabit Ethernet card (NTHW49), use single-mode (SM) or multimode duplex fiber cable with small-form duplex LC connectors at the FP end. Each port on the card requires a small-form pluggable (SFP) module

that plugs into the faceplate. The fiber cable plugs into the SFP. The version of SFP that you chose determines the type of fiber cable (SM or MM) that you will need. Refer to “SFP modules for an NTHW49” (page 208).

The signal distance with the gigabit Ethernet ports is described in “Custom-making an LC cable assembly for an NTHW49” (page 207).

Custom-making an LC cable assembly for an NTHW49

The sum of cable losses and connection losses from the FP to the far end termination depends on the installed and software-configured type of SFP optical transceiver. For a 1000BASE-SX SFP module, MM cable and connection losses must not exceed 7.5 dB. For a 1000BASE-LX SFP module, SM cable and connection losses must not exceed 10.5 dB. The losses in a transmission path from the fiber cable, splices, and connectors determine the distance that the FP can send a signal.

Make an LC cable assembly for an optical module for an NTHW49 FP using the following specifications:

- multimode (MM) fiber or single-mode (SM) fiber, depending on the type of optical module already installed
- duplex fiber cables (recommended to facilitate lesser cable densities) with colour-coded halves
- a core diameter of 50 microns or 62.5 microns for MM, and 9 microns for SM
- a cladding diameter of 125 microns
- a maximum MM cable length for 50 microns is 550 m (1,804 ft.) and for 62.5 microns is 275 m (902.27 ft.)
- a maximum SM cable length is 10 km (6.2 miles)
- duplex LC connectors at the FP end, and any other fiber connector you choose at the far end from the FP
- attenuation between end-points is not required for LX optical modules using single-mode cable
- see the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235) for the limitations of lengths of the cable neck parts

SFP modules for an NTHW49

More than one version of small-form pluggable (SFP) modules can be used per NTHW49 FP. The type of fiber cable must match the version of module, and all modules interface with small-form LC connectors.

The PEC versions of SFP modules that can be used with the NTHW49 are:

- NTHP01AB, 1000BASE-SX for multimode (MM) fiber cables for short reach (SR) up to 0.55 km (0.31 mi) when using 50/125 fiber or up to 0.275 km (0.17 mi) when using 62.5/125 fiber, and with a nominal wavelength of 850 nm
- NTHP01CB, 1000BASE-LX for single-mode (SM) fiber cables for intermediate reach (IR) up to 10 km (6.25 mi) and with a nominal wavelength of 1310 nm

The general description and purpose of SFPs is in “SFP optical module” (page 288).

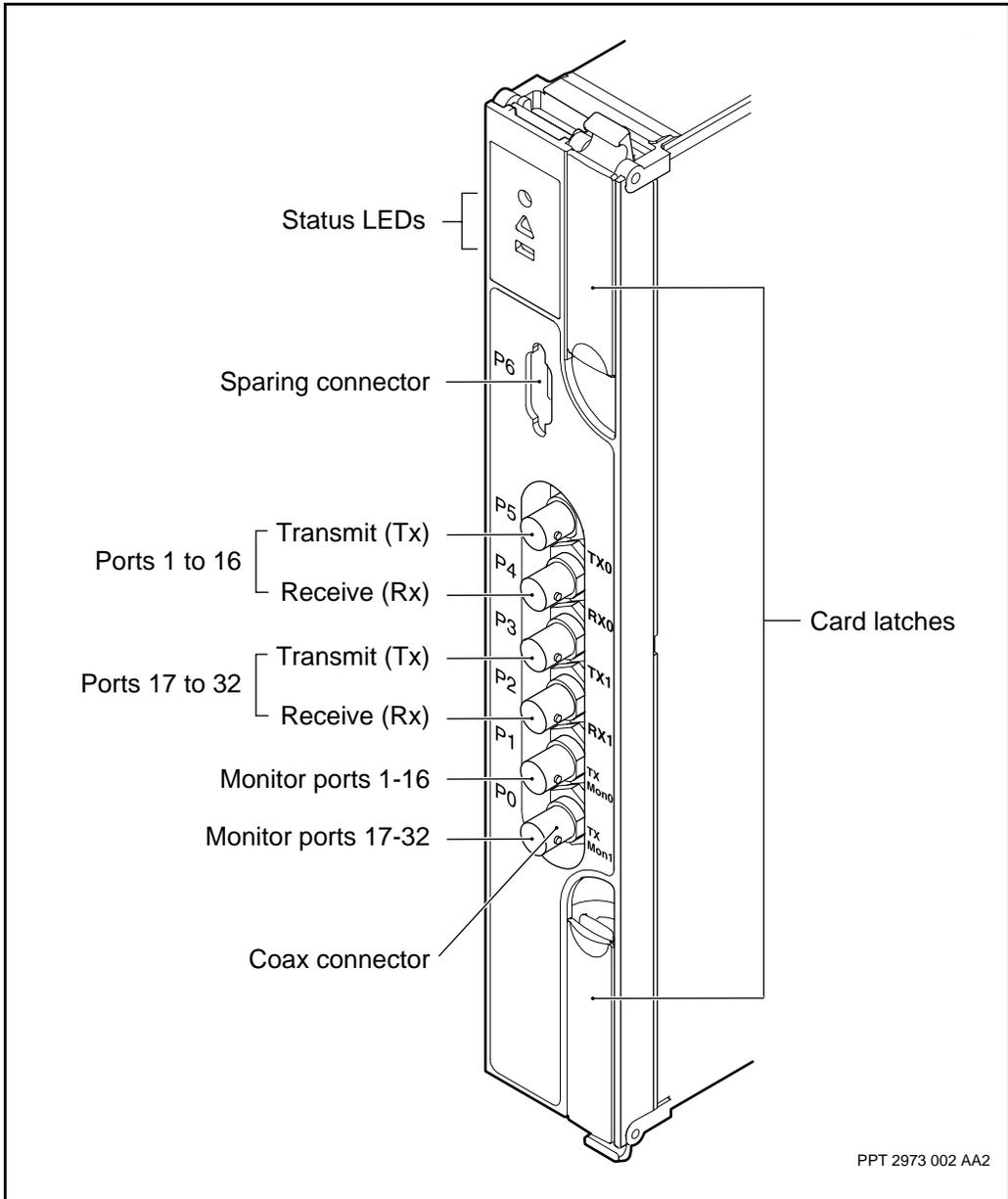
32-port E1 TDM FP

For the interface information about the 32-port E1 time division multiplexing (TDM) FP, see:

- “Faceplate of a 32-port E1 TDM with PEC NTHW92” (page 210)
- “32-port E1 TDM line connections” (page 211)
- “32-port E1 TDM cable assemblies” (page 211)
- “Assigning sparing panel connections for 32-port E1 TDM FPs” (page 213)

The software name (card type) of the NTHW92 is 32pE1Aal.

Figure 56
Faceplate of a 32-port E1 TDM with PEC NTHW92



32-port E1 TDM line connections

You can connect the lines (ports) of this E3 FP directly to the far end network equipment or another E3 FP, or indirectly through

- a multiport aggregate device identified by PEC NT0486
- the 3-port DS3, E3, or E1 one-for-one sparing panel NTFP99AA
- the 12-port DS3 fanout panel NTHW52

Refer to “Termination panels for FPs” (page 291) for the description, function, and capabilities of the device or the panels.

The connections can be made to equivalent non-Nortel Networks equipment provided the cabling criteria are met.

32-port E1 TDM cable assemblies

The maximum cable length for lines between the FP and the multiport aggregate device is 350 m (1150 ft). The distance between the FP and the sparing panel is part of the total length. The insertion loss of a cable must not exceed 12 dB measured at 17184 kHz.

The table “Cable assemblies for a 32-port TDM FP” (page 211) lists the available prefabricated cables. The cable assemblies with standard male BNC connectors at both ends can be connected to either another FP, the NTFP99AA sparing panel, the NTHW52 fanout panel, or other compatible equipment.

Table 41
Cable assemblies for a 32-port TDM FP

PEC	Description	Length
NTFP19AD	male straight BNC to male straight BNC	3.0 m (9.8 ft)
NTFP19AE	male straight BNC to male straight BNC	15 m (49 ft)
NTHR69	DB9 sparing control port	2.5 m (8 ft)
NTHR70	DB9 sparing control port	5 m (16 ft)
NTHR71	DB9 sparing control port	15 m (49 ft)

You can custom make your own traffic port cables to connect the FP to the other end connections by using the specifications in the table “Cable assembly parts for a 32-port E1 TDM FP” (page 212). The port connections are identified in the figure “Faceplate of a 32-port E1 TDM with PEC NTHW92” (page 210).

Table 42
Cable assembly parts for a 32-port E1 TDM FP

Item	Description
at the FP faceplate, a male coax connector	75-ohm straight or right-angle crimp-on male BNC plug (connector)
cable NT-734 or comparable cable such as RG-59/U	75-ohm coaxial cable with double shielded construction
at the sparing panel faceplate, a male connector 28P387-1 (straight) or 28P388 (right-angle) made by Specialty Connector Company, or a comparable one	75-ohm straight or right-angle crimp-on male BNC plug (connector)

You can custom make your own control port cable using the following specifications:

- tin-plated copper cable with 5 conductors at 7 strands of 32 AWG (0.0320 mm²) wire for each conductor, with an aluminum polyester shield, covered by poly vinyl chloride insulation (for example, Beldon Wire and Cable part number 9535)
- a resultant cable size of 24 AWG (0.205 mm²)
- a 45-degree downwards offset female DB9 connector with standard slotted fastening screws for the FP faceplate; see the orientation of the sparing D-sub connector in the figure “Faceplate of a 32-port E1 TDM with PEC NTHW92” (page 210) to determine the orientation of the downwards offset relative to the shape of the D
- a straight male DB9 connector with standard slotted fastening screws for the sparing panel faceplate

Refer to the inset of the control port in the figure “Faceplate of a 32-port E1 TDM with PEC NTHW92” (page 210). Both ends of the cable have the same pinout, and the control port pinout is the same for all DS3 and E3 cards.

For more information, see “Cables and cable management” (page 315).

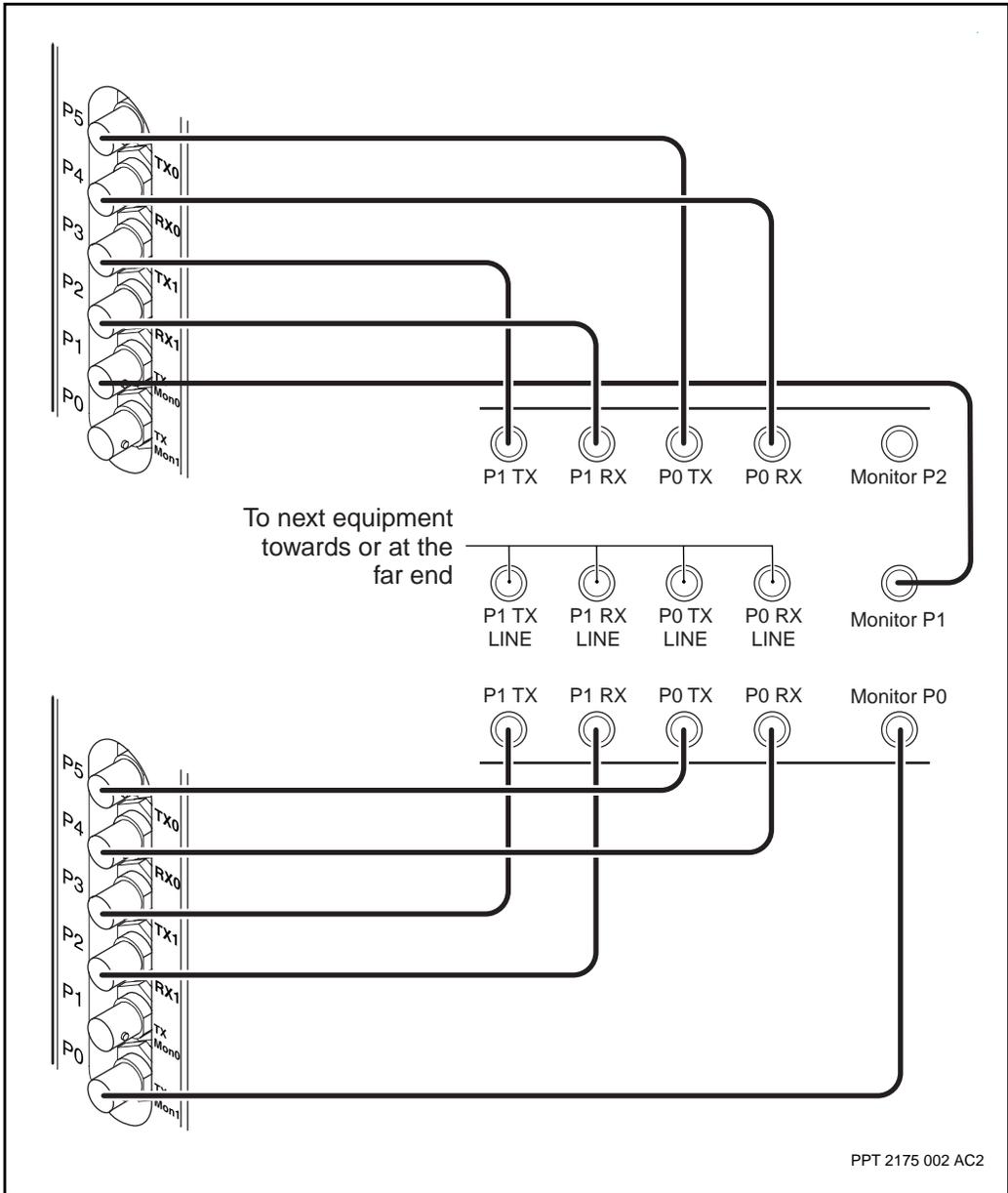
Assigning sparing panel connections for 32-port E1 TDM FPs

The 32-port E1 TDM function processor uses a sparing panel to support one-for-one sparing and multiport aggregate devices for customer equipment connections. The figure “Cable connections between two 32-port E1 TDM FPs and a 3-port sparing panel NTFP99” (page 214) shows the connection endpoints between the spared FPs and their sparing panel. It also identifies the endpoints at the sparing panel from the far-end or next-hop CPE, in this case from a multiport aggregate device.

A sparing panel has a transmit (Tx) and receive (Rx) pair for each port. When cabling Passport FPs and sparing panels, do Tx-to-Tx and Rx-to-Rx for all equipment from the FP up to the far-end termination of the FP connection.

The sparing panel NTFP99 can also be deployed as a one-for-one fanout panel (or patch panel) provided the connections are to the Main Tx and Rx ports Main.

Figure 57
Cable connections between two 32-port E1 TDM FPs and a 3-port spring panel NTFP99



PPT 2175 002 AC2

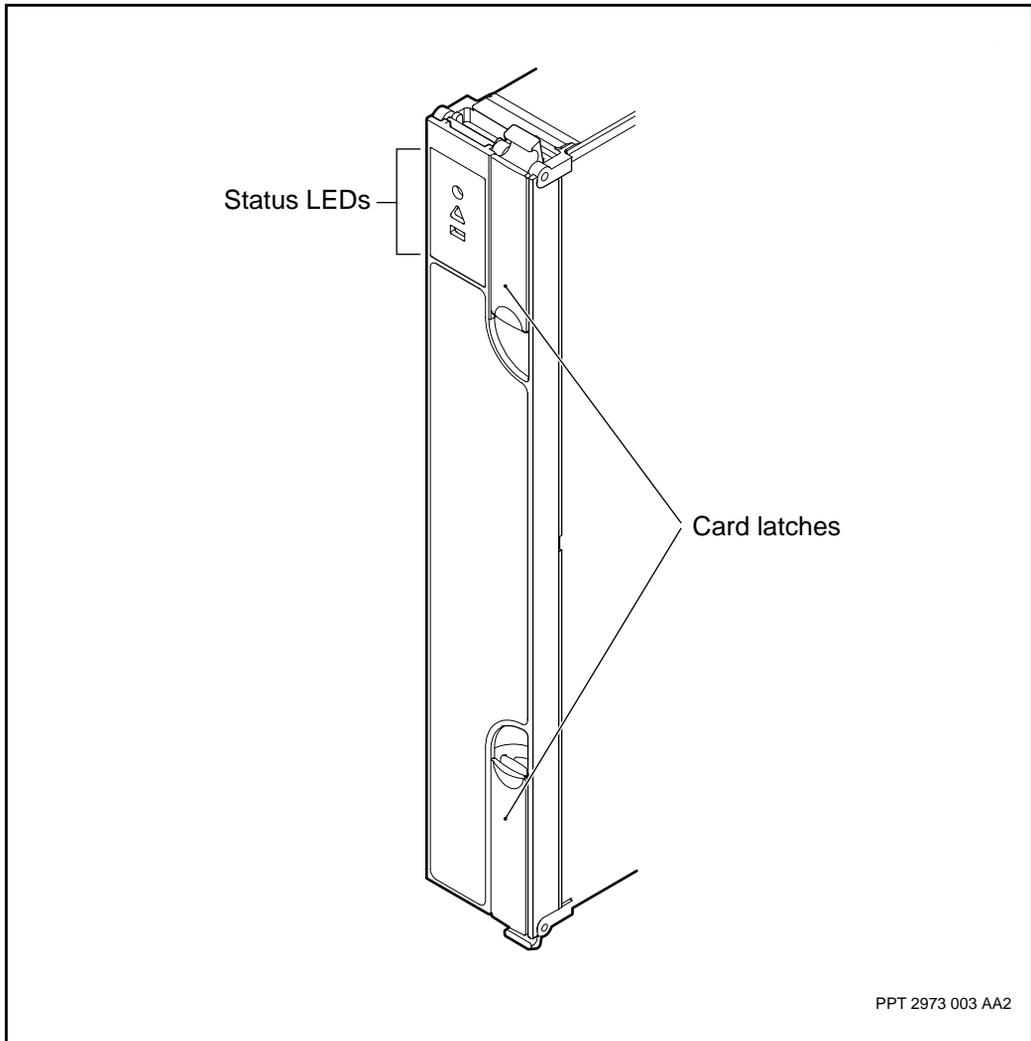
6-module packet server FP

The 6-module packet server service processor is a FP that provides extensive computing power through its six PCI mezzanine cards (PMC). Initially, the wireless service radio network controller (RNC) interface node uses the packet server FP to support radio bearer processing and protocol conversion. Using the capabilities of the packet server, the Passport 15000 or 20000 supports the development of wireless internet. In the future, other CPU-intensive applications will develop new uses for the card.

The product engineering code (PEC) of the 6-module packet server FP is NTHW18. The software name of the FP is 6mPktServSP.

See the figure “Faceplate of a 6-module packet server service processor with PEC NTHW18” (page 216).

Figure 58
Faceplate of a 6-module packet server service processor with PEC NTHW18



For more information on the 6mPktServSP FP, see these sections

- “6mPktServSP components” (page 217)
- “6mPktServSP sparing” (page 217)

- “6mPktServSP configuration” (page 217)

6mPktServSP components

The 6mPktServSP FP consists of

- a motherboard containing two PMCs, the ATM management hardware, and the processor block
- a PCI PMC daughter card containing four PMCs and the ATM segmentation and reassembly (SAR) processors
- a PUPS daughter card containing the 3.3 V and 5 V point-of-use power supplies (PUPS)

The 6mPktServSP connects to the shelf backplane, providing an interface to both fabric cards. The 6mPktServSP FP has no external ports.

In the wireless RNC application, the 6mPktServSP FP supports these functions

- high-touch bearer processing
- radio protocol handling
- macro-diversity handover
- ATM adaptation layer protocol conversion

6mPktServSP sparing

There is no sparing arrangement for the 6mPktServSP FP in its current usage. It is the responsibility of the application running on the FP to arrange software sparing. In the case of the wireless RNC interface node application, the master PMC module in the shelf, which is called the PMC Manager (PMC-M), has a standby PMC-M module. The standby PMC-M takes over the master functions if the main PMC-M fails.

6mPktServSP configuration

The 6mPktServSP FP has no external connections or ports that need configuration. The card type value <cardtype> for the FP is *6mPktServSP*.

4-port OC-3/STM-1 ATM FPs

For the interface information about the 4-port OC-3/STM-1 ATM FP, see:

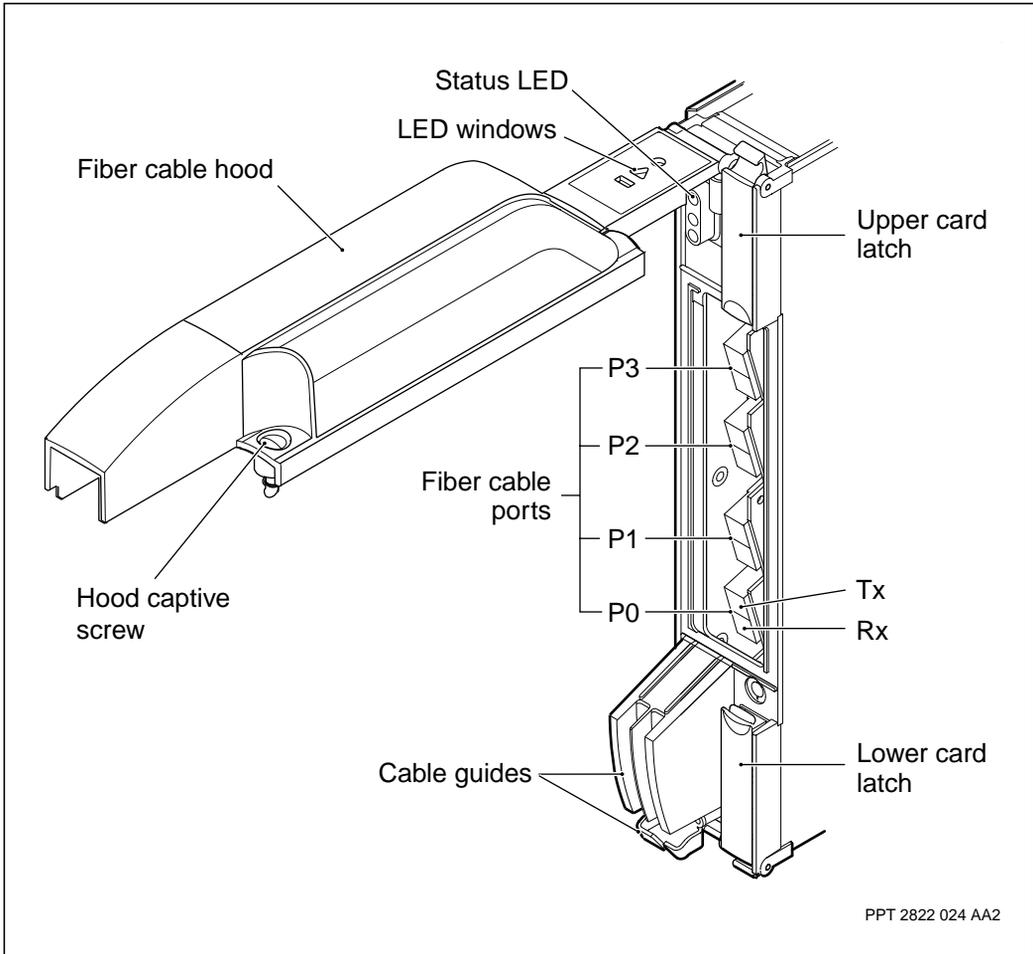
- “4-port OC-3/STM-1 FP identifiers” (page 218)
- “Faceplate of a 4-port OC-3/STM-1 ATM FP” (page 219)
- “4-port OC-3/STM-1 ATM FP cable assembly” (page 220)
- “4-port OC-3/STM-1 ATM FP optical interface characteristics” (page 220)

Table 43
4-port OC-3/STM-1 FP identifiers

FP name	PEC of PQC6v2 (or PQC2)	PEC of PQC12	Software name (card type)
4-port OC-3/STM-1 multimode ATM	NTHR17	NTHW05	4pOC3MmAtm
4-port OC-3/STM-1 single-mode intermediate reach ATM	NTHR21	NTHW15	4pOC3Smlr
Note: The CA vintage or higher is required to support hitless software migration and equipment protection features.			

When a specific identifier is not mentioned, the text applies to both PQC versions of the card.

Figure 59
Faceplate of a 4-port OC-3/STM-1 ATM FP



4-port OC-3/STM-1 ATM FP cable assembly

The fiber mode type must be the same as the FP mode type. You must provide the cable with attached connectors. Use single-mode (SM) fiber cable with single-mode FPs and multimode (MM) fiber cable with multimode FPs.

Multimode fiber cable must conform to ANSI/E1A/T1A-568. The multimode fibre cable must have a core diameter of 62.5 microns and a cladding diameter of 125 microns. The modal bandwidth is at least 500 MHz-km and the attenuation is less than 1.0 dB/km at 1300 nm.

Single-mode fiber cable must have a core diameter of 9 microns and a cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The OC-3 uses standard duplex SC connectors.

The sum of cable losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 10 dB for multimode cable and 12 dB for single-mode cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 2 km for multimode cable and 15 to 20 km for single-mode cable, depending on the losses due to splices and connectors.

4-port OC-3/STM-1 ATM FP optical interface characteristics

The optical interface characteristics for the 4-port OC-3/STM-1 ATM single-mode (SM) intermediate reach (IR) and multimode (MM) FP are shown in these tables

- “4-port OC-3/STM-1 ATM general interface characteristics” (page 221)
- “4-port OC-3/STM-1 ATM SM IR FP transmit characteristics” (page 221)
- “4-port OC-3/STM-1 ATM SM IR FP receive characteristics” (page 221)
- “4-port OC-3/STM-1 ATM MM FP transmit characteristics” (page 222)
- “4-port OC-3/STM-1 ATM MM FP receive characteristics” (page 222)

Table 44
4-port OC-3/STM-1 ATM general interface characteristics

General optical interface characteristics	
Faceplate connector	dual SC transceiver for simplex cable connectors
Bit rate	155.520 Mbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 45
4-port OC-3/STM-1 ATM SM IR FP transmit characteristics

Transmit characteristic	Value
Emission wavelength	1261 to 1360 nm
Attenuation	0 to 12 dB
Maximum dispersion	96 ps/nm
Maximum RMS spectral width	7.7 nm
Mean transmission power	-15 to -8 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	not applicable

Table 46
4-port OC-3/STM-1 ATM SM IR FP receive characteristics

Receive characteristic	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-28 dBm
Optical path power penalty	1 dB
Maximum received reflectance	not applicable

Table 47
4-port OC-3/STM-1 ATM MM FP transmit characteristics

Transmit characteristic	Value
Emission wavelength	1270 to 1380 nm
Attenuation	0 to 10 dB
Maximum dispersion	18 ps/nm
Maximum RMS spectral width	80 nm
Mean transmission power	-20 to -14 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	not applicable
Side node suppression ratio (SSR)	not applicable

Table 48
4-port OC-3/STM-1 ATM MM FP receive characteristics

Receive characteristic	Value
Maximum receive power (average)	-14 dBm
Minimum receive power (average)	-30 dBm
Optical path power penalty	1 dB
Maximum received reflectance	not applicable

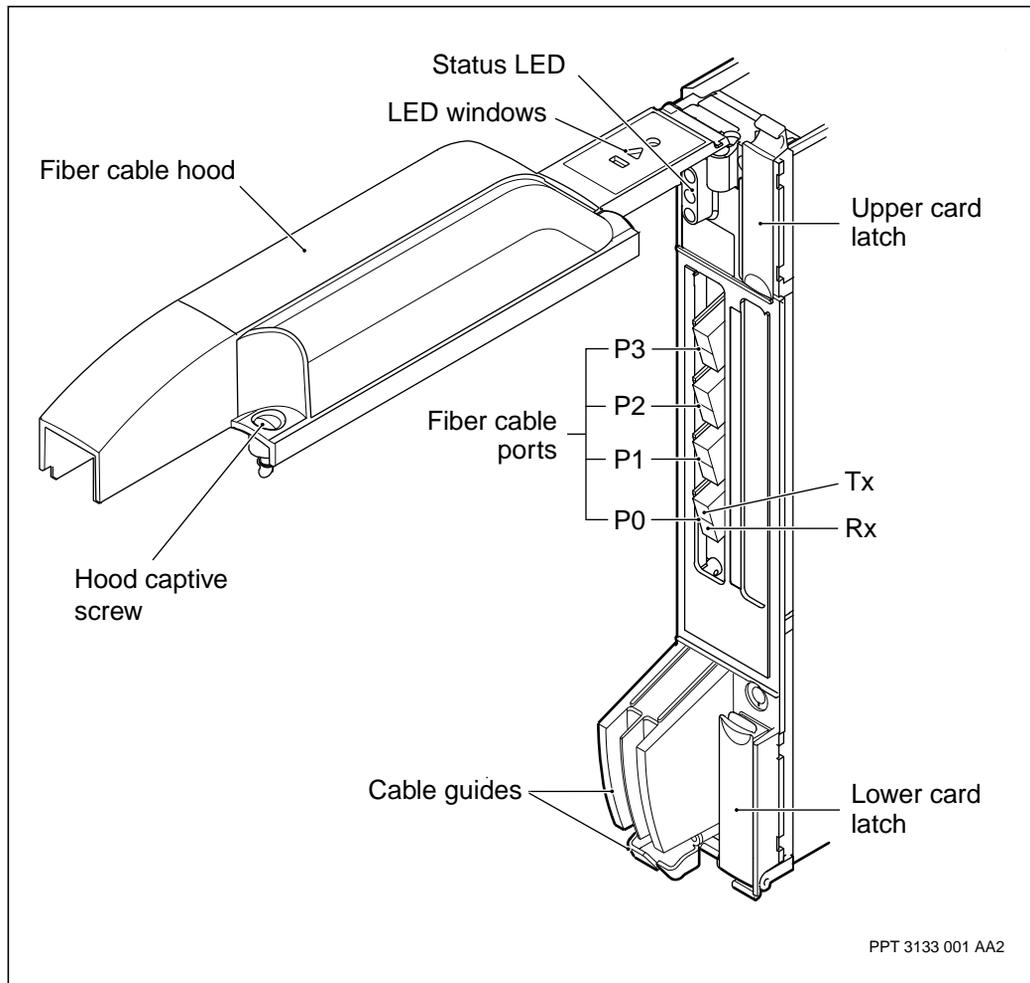
4-port OC-3/STM-1Ch TDM/CES FP

For the interface information about the 4-port OC-3/STM-1 channelized FP with time division multiplexing (TDM) for circuit emulation services (CES), see:

- “Faceplate of a 4-port OC-3/STM-1Ch TDM/CES FP with PEC NTHW70” (page 224)
- “4-port OC-3/STM-1Ch TDM/CES FP cable assembly” (page 225)
- “4-port OC-3/STM-1Ch TDM/CES FP optical interface characteristics” (page 225)

The software name (card type) of the NTHW70 is 4pOC3ChSmIr.

Figure 60
Faceplate of a 4-port OC-3/STM-1Ch TDM/CES FP with PEC NTHW70



PPT 3133 001 AA2

4-port OC-3/STM-1Ch TDM/CES FP cable assembly

Use only single-mode (SM) fiber cable with the 4-port OC-3/STM-1Ch TDM/CES FP. You must provide the cable with attached connectors.

Single-mode fiber cable must have a core diameter of 9 microns and a cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The 4-port OC-3/STM-1Ch TDM/CES FP uses standard duplex SC connectors.

The sum of cable losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for single-mode cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 15 to 20 km for single-mode cable, depending on the losses due to splices and connectors.

4-port OC-3/STM-1Ch TDM/CES FP optical interface characteristics

The optical interface characteristics for the 4-port OC-3/STM-1Ch single-mode (SM) TDM/CES FP are shown in these tables

- “4-port OC-3/STM-1Ch TDM/CES FP general interface characteristics” (page 225)
- “4-port OC-3/STM-1Ch TDM/CES FP transmit characteristics” (page 226)
- “4-port OC-3/STM-1Ch TDM/CES FP receive characteristics” (page 226)

Table 49
4-port OC-3/STM-1Ch TDM/CES FP general interface characteristics

General optical interface characteristics	
Faceplate connector	dual SC transceiver for simplex cable connectors
Bit rate	155.520 Mbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 50
4-port OC-3/STM-1Ch TDM/CES FP transmit characteristics

Transmit characteristic	Value
Emission wavelength	1260 nm to 1360 nm
Attenuation	0 to 12 dB
Maximum dispersion	96 ps/nm
Maximum RMS spectral width	7.7 nm
Mean transmission power	-15 to -8 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	not applicable

Table 51
4-port OC-3/STM-1Ch TDM/CES FP receive characteristics

Receive characteristic	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-31 dBm
Optical path power penalty	not applicable
Maximum received reflectance	not applicable

16-port OC-3/STM-1 ATM FP with MT-RJ connectors

For the interface information about the 16-port OC-3/STM-1 FP with MT-RJ connectors, see:

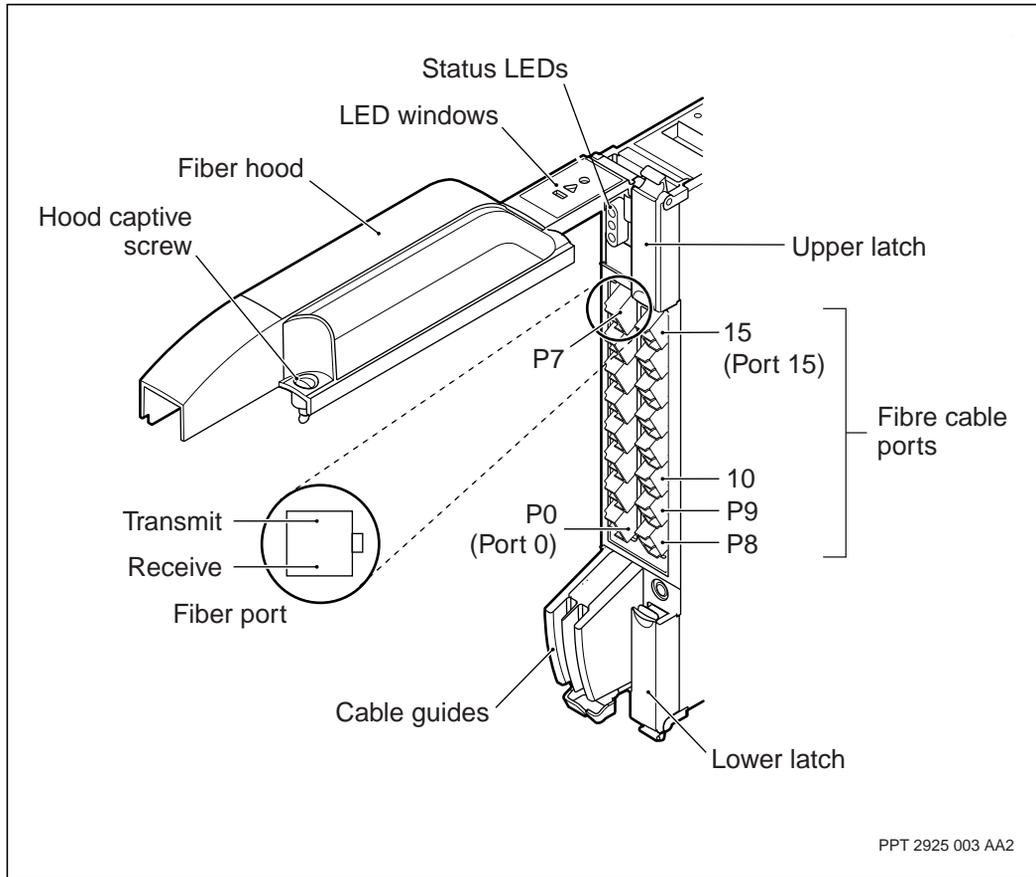
- “Faceplate of a 16-port OC-3/STM-1 ATM FP with MT-RJ connectors with PEC NTHW21” (page 228)

Note: If your card has PEC NTHW31, see “16-port OC-3/STM-1 ATM FP with LC connectors” (page 231)

- “Cable assemblies for an NTHW21” (page 229)
- “Optical interface characteristics for an NTHW21” (page 229)

The software name (card type) of the NTHW21 is 16pOC3SmIrAtm.

Figure 61
Faceplate of a 16-port OC-3/STM-1 ATM FP with MT-RJ connectors with PEC NTHW21



Cable assemblies for an NTHW21

The fiber mode type must be the same as the FP mode type. You must provide the cable with attached connectors.

With an NTHW21 FP, use single-mode (SM) fiber cable with a core diameter of 9 microns and a cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

Use SM MT-RJ female (non-pinned) connectors at the FP end. Both the transmit and the receive ports are in the same connector.

The sum of cable losses and connector losses from the FP to the far end termination must not exceed 12 dB for SM cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to the far end is 15 to 20 km for SM cable, depending on the losses due to splices and connectors.

Optical interface characteristics for an NTHW21

The optical interface characteristics for a 16-port OC-3/STM-1 single-mode (SM) intermediate reach (IR) FP with MT-RJ connectors that has PEC NTHW21 are shown in these tables:

- “General interface characteristics for an NTHW21” (page 229)
- “Transmit characteristics for an NTHW21” (page 230)
- “Receive characteristics for an NTHW21” (page 230)

Table 52
General interface characteristics for an NTHW21

General optical interface characteristics	
Faceplate connector	duplex MTRJ male (pinned) transceiver
Bit rate	155.520 Mbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 53
Transmit characteristics for an NTHW21

Transmit characteristic	Value
Emission wavelength	1261 nm to 1360 nm
Attenuation	0 to 12 dB
Maximum dispersion	96 ps/nm
Maximum RMS spectral width	7.7 nm
Mean transmission power	-15 to -8 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	not applicable

Table 54
Receive characteristics for an NTHW21

Receive characteristic	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-28 dBm
Optical path power penalty	1 dB
Maximum received reflectance	not applicable

16-port OC-3/STM-1 ATM FP with LC connectors

For the interface information about the 16-port OC-3/STM-1 FP with LC connectors, see:

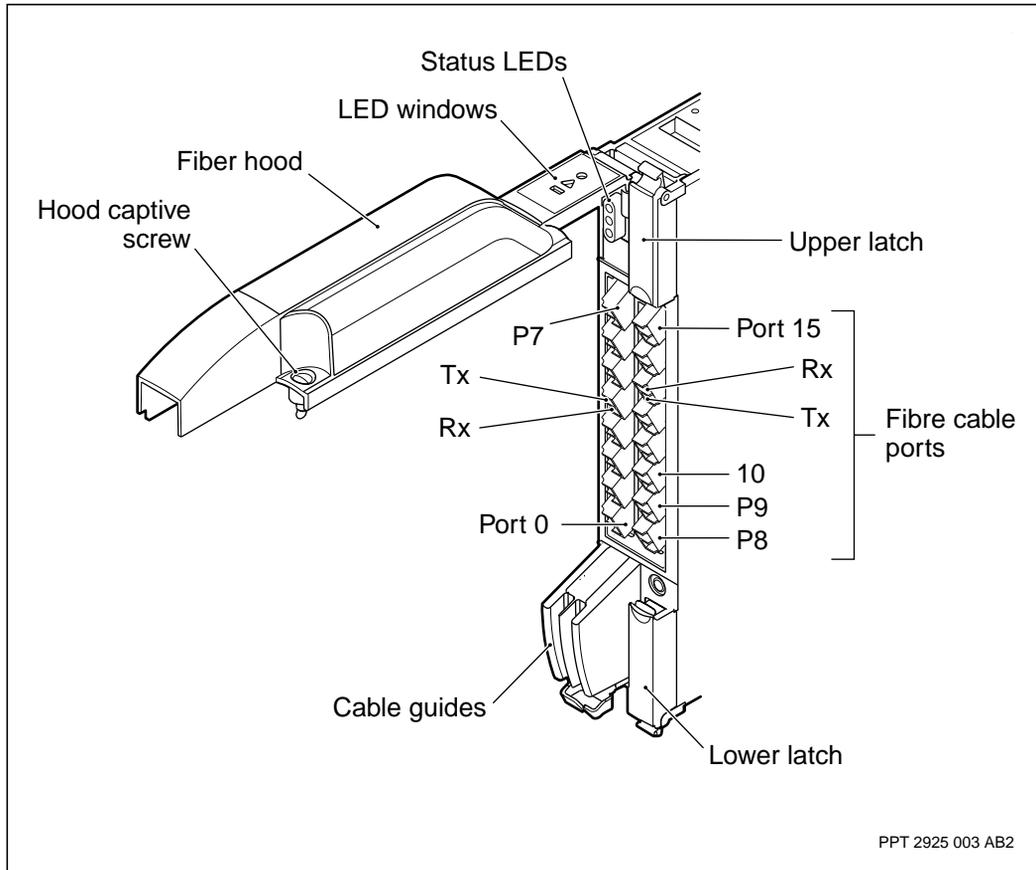
- “Faceplate of a 16-port OC-3/STM-1 ATM FP with LC connectors with PEC NTHW31” (page 232)

Note: If your card has PEC NTHW21, see “16-port OC-3/STM-1 ATM FP with MT-RJ connectors” (page 227).

- “Cable assemblies for an NTHW31” (page 233)
- “Optical interface characteristics for an NTHW31” (page 235)

The software name (card type) of the NTHW31 is 16pOC3SmIrAtm.

Figure 62
Faceplate of a 16-port OC-3/STM-1 ATM FP with LC connectors with PEC NTHW31



Cable assemblies for an NTHW31

With an NTHW31 FP, use single-mode (SM) fiber cable with small-form LC connectors at the FP end.

The sum of cable losses and connector losses from the FP to the far end termination must not exceed 12 dB for SM cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to the far end is 15 to 20 km for SM cable, depending on the losses due to splices, repeaters, and connectors.

You must custom make your cable assemblies. Follow the specifications in “Cable specifications for custom-making an LC cable assembly” (page 276).

Cable specifications for custom-making LC cable assemblies

Make an LC cable assembly using the following specifications. Refer also to the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235).

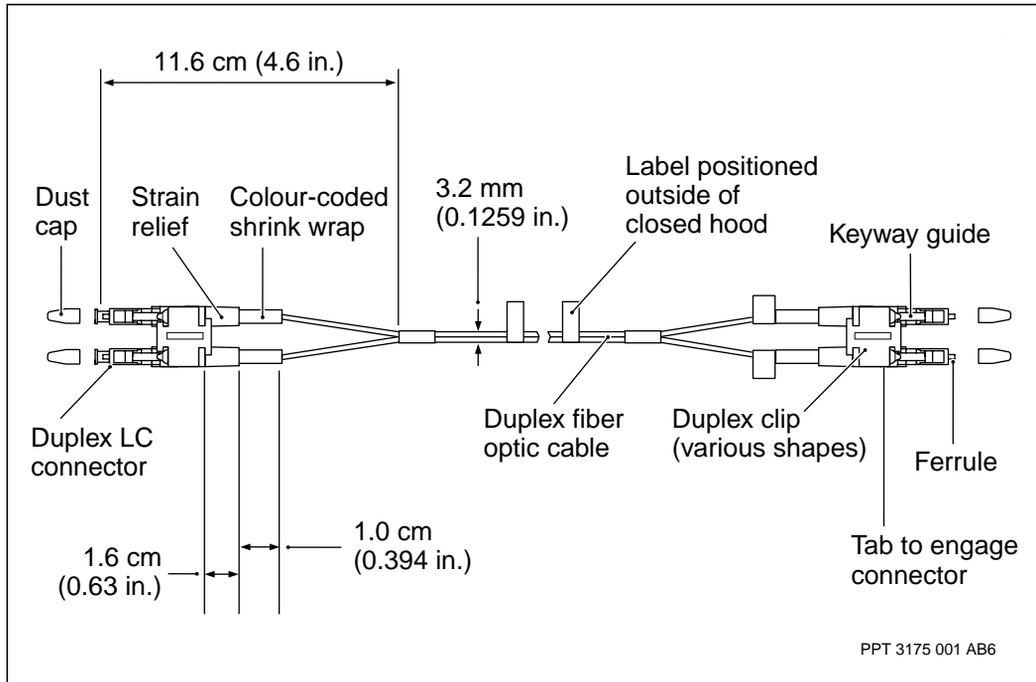
- Use single-mode (SM) fiber with a core diameter of 9 microns and a cladding diameter of 125 microns.
- Use duplex fiber cables to provide lesser cable volumes and easier cable management under the hood.
- The outside diameter of one SM cable must not exceed 1.6 mm (0.0629 inch). The combined outside width of two cables zipped together to make a duplex cable must not exceed 3.2 mm (0.1259 inch) as shown in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235). The thinner cable allows the fiber hood on the faceplate to close over the entire cluster of cables without pinching them and can allow the duplex cable to be ravelled onto the tray of a fiber management unit (NTHW50).

Note: Ladder rackable cable (especially at 3.0 mm) cannot be used.

- Use duplex small-form LC connectors at the FP end especially since the Tx and Rx transceivers are opposite on each side of the faceplate, and any other fiber connector you choose at the next hop from the FP.

- Use color-coded shrink wrap at the connectors to indicate parallel Tx and Rx connections of the ends. The total length of the shrink wrap should not exceed 2.6 cm (1.0 inch). The shrink wrap should extend from the rear of the connector through the strain relief (neck reinforcement) with up to 1.0 cm (0.394 in.) exposed, as indicated in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235).
- After each connector, add a stiff strain relief no longer than 1.6 cm (0.63 in.), as indicated in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235). Applying a coating of resilient gap filler between the cable and the strain relief is determined by the manufacturer of the cable assembly.
- The combined measurements of connector, strain relief, and shrink wrap must accommodate the curve of the hood on the FP faceplate so that the hood can be closed without pinching any cables.
- Cables should be manufactured and verified to comply with Telcordia GR-326 specifications.
- If required, use an attenuation less than 0.5 dB/km at 1300 nm.

Figure 63
The LC cable assembly with duplex connectors and duplex cables



Optical interface characteristics for an NTHW31

The optical interface characteristics for a 16-port OC-3/STM-1 ATM single-mode (SM) intermediate reach (IR) FP with LC connectors that has PEC NTHW31 are shown in these tables:

- “General interface characteristics for an NTHW31” (page 236)
- “Transmit characteristics for an NTHW31” (page 236)
- “Receive characteristics for an NTHW31” (page 237)

Table 55
General interface characteristics for an NTHW31

General optical interface characteristics	
Faceplate connector	duplex small-form LC transceiver for duplex fiber cables
Bit rate	155.54 Mbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 56
Transmit characteristics for an NTHW31

Transmit characteristic	Minimum	Maximum	Unit
Emission wavelength	1261	1360	nm
Attenuation	0	12	dB
Maximum dispersion	96	96	ps/nm
Maximum RMS spectral width	not applicable	7.7	m
Mean transmission power	-15	-8	dBm
Minimum extinction ratio	8.2	not applicable	dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2 Compliant with ITU G.957 and Telcodia TR-NWT-000253		
Side node suppression ratio (SSR)	not applicable	not applicable	

Table 57
Receive characteristics for an NTHW31

Receive characteristic	Minimum	Maximum	Unit
Receive power (average)	-28	-8	dBm
Receive sensitivity at eye center (average)		-31.8	dBm
Receive sensitivity at window edge (average)		-31	dBm
Receive power (average)	-28	-8	dBm
Optical path power penalty	1	1	dB
Maximum received reflectance	not applicable	not applicable	

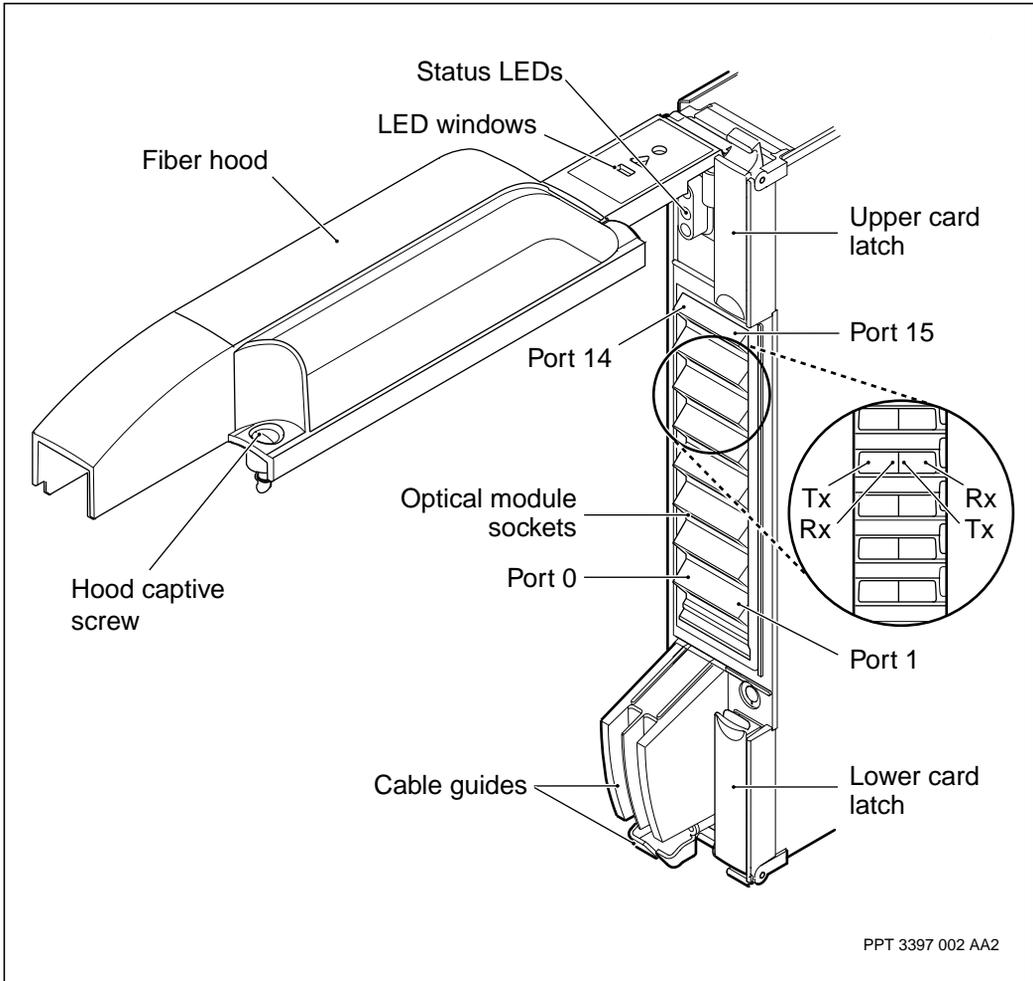
16-port OC-3/STM-1 POS and ATM FP

The 16-port OC-3/STM-1 packet over SONET (POS) and asynchronous transfer mode (ATM) function processor (FP) requires control processor 3 (CP3) cards in the same shelf to enable operation. For the interface information about the 16-port OC-3/STM-1 POS and ATM FP, see:

- “Faceplate of a 16-port OC-3/STM-1 POS and ATM FP with PEC NTHW44” (page 239)
- “Cable assemblies for an NTHW44” (page 240)
- “SFP modules for an NTHW44” (page 240)
- “Cable specifications for custom-making LC cable assemblies” (page 244)
- “Optical interface characteristics for an NTHW44” (page 241)

The software name (card type) of the NTHW44 is 16pOC3PosAtm.

Figure 64
Faceplate of a 16-port OC-3/STM-1 POS and ATM FP with PEC NTHW44



Cable assemblies for an NTHW44

With the NTHW44 card, use single-mode (SM) or multimode (MM) duplex fiber cable with small-form duplex LC connectors at the FP end. Each port on the card requires a small-form pluggable (SFP) module that plugs into the faceplate. The fiber cable plugs into the SFP. The version of SFP that you chose determines the type of fiber cable (SM or MM) that you will need. Refer to “SFP modules for an NTHW44” (page 240).

When dual NTHW44 cards are configured in software for Y-protection, see “Specifications for Y-splitter cable assemblies for Y-protection” (page 246).

The sum of cable losses and connection losses from the FP to the far end termination depends on the installed and software-configured type of SFP optical transceiver. For an OC-3 SR-0 SFP module, MM cable and connection losses must not exceed 10 dB. For an OC-3 IR-1/S-1.1 SFP module, SM cable and connection losses must not exceed 12 dB. For an OC-3 LR-1/L-1.1 SFP module, SM cable and connection losses must be between 10 to 28 dB, and if less than 10 dB the connection needs an optical attenuator. The losses in a transmission path from the fiber cable, splices, and connectors determine the distance the FP can send a signal.

You must custom make your cable assemblies. Follow the specifications in “Cable specifications for custom-making LC cable assemblies” (page 244).

SFP modules for an NTHW44

More than one version of SFP module can be used per FP. The type of fiber cable must match the version of module, and all modules interface with small-form LC connectors. The PEC versions of SFP modules that can be used with the NTHW44 are:

- NTPP02AD for MM fiber cables for short reach (SR-0) up to 2 km (1.2 mi) and with a nominal wavelength of 1310 nm
- NTPP02CD for SM cables for intermediate reach (IR-1/S-1.1) up to 15 km (9.3 mi) and with a nominal wavelength of 1310 nm
- NTPP02ED for SM cables for long reach (LR-1/L-1.1) up to 40 km (24.8 mi) and with a nominal wavelength of 1310 nm

The general description and purpose of SFPs is in “SFP optical module” (page 288).

The descriptions of cable assemblies are in “Cable assemblies for an NTHW44” (page 240) and “Cable specifications for custom-making LC cable assemblies” (page 244).

Optical interface characteristics for an NTHW44

The optical interface characteristics for a 16-port OC-3/STM-1 POS and ATM FP that has PEC NTHW44 are shown in these tables:

- “General interface characteristics for an NTHW44” (page 241)
- “Transmit characteristics for an NTHW44 with MM SR-0 SFP modules” (page 242)
- “Receive characteristics for an NTHW44 with MM SR-0 SFP modules” (page 242)
- “Transmit characteristics for an NTHW44 with SM IR-1/S-1.1 SFP modules” (page 242)
- “Receive characteristics for an NTHW44 with SM IR-1/S-1.1 SFP modules” (page 243)
- “Transmit characteristics for an NTHW44 with SM LR-1/L-1.1 SFP modules” (page 243)
- “Receive characteristics for an NTHW44 with SM LR-1/L-1.1 SFP modules” (page 244)

Table 58
General interface characteristics for an NTHW44

General optical interface characteristics	
Faceplate connector	SFP duplex LC (duplex small-form LC transceiver for duplex fiber cables)
Bit rate	155.52 Mbit/s per port simultaneously
Line encoding	binary non-return-to-zero (NRZ)

Table 59
Transmit characteristics for an NTHW44 with MM SR-0 SFP modules

Transmit characteristic	Minimum	Maximum	Unit
Emission wavelength	1270	1380	nm
Attenuation	0	10	dB
Maximum dispersion	not applicable	18	ps/nm
Maximum RMS spectral width	not applicable	80	nm
Mean transmission power for multimode (MM)	-20	-14	dBm
Extinction ratio	8.2	not applicable	dB
Eye pattern mask	not applicable	not applicable	
Side node suppression ratio (SSR)	not applicable	not applicable	

Table 60
Receive characteristics for an NTHW44 with MM SR-0 SFP modules

Receive characteristic	Minimum	Maximum	Unit
Receive power for single-mode intermediate reach (IR)	-30	-14	dBm
Optical path power penalty	not applicable	1	dB
Maximum received reflectance	not applicable	not applicable	

Table 61
Transmit characteristics for an NTHW44 with SM IR-1/S-1.1 SFP modules

Transmit characteristic	Minimum	Maximum	Unit
Emission wavelength	1261	1360	nm
Attenuation	0	12	dB
Maximum dispersion	not applicable	96	ps/nm
(Sheet 1 of 2)			

Table 61 (continued)**Transmit characteristics for an NTHW44 with SM IR-1/S-1.1 SFP modules**

Transmit characteristic	Minimum	Maximum	Unit
Maximum RMS spectral width	not applicable	7.7	nm
Mean transmission power for single-mode (SM) intermediate reach (IR)	-15	-8	dBm
Minimum extinction ratio	8.2	not applicable	dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2		
Side node suppression ratio (SSR)	not applicable	not applicable	
(Sheet 2 of 2)			

Table 62**Receive characteristics for an NTHW44 with SM IR-1/S-1.1 SFP modules**

Receive characteristic	Minimum	Maximum	Unit
Receive power for single-mode intermediate reach (IR)	-28	-8	dBm
Optical path power penalty	not applicable	1	dB
Maximum received reflectance	not applicable	not applicable	

Table 63**Transmit characteristics for an NTHW44 with SM LR-1/L-1.1 SFP modules**

Transmit characteristic	Minimum	Maximum	Unit
Emission wavelength	1263	1360	nm
Attenuation	10	28	dB
Maximum dispersion	not applicable	not applicable	ps/nm
Maximum RMS spectral width	not applicable	not applicable	
(Sheet 1 of 2)			

Table 63 (continued)
Transmit characteristics for an NTHW44 with SM LR-1/L-1.1 SFP modules

Transmit characteristic	Minimum	Maximum	Unit
Mean transmission power for single-mode (SM) long reach (LR)	-5	0	dBm
Minimum extinction ratio	10	not applicable	dB
Eye pattern mask	Compliant with Telcordia GR-253-CORE and ITU G.957		
Side node suppression ratio (SSR)	30	not applicable	dB
(Sheet 2 of 2)			

Table 64
Receive characteristics for an NTHW44 with SM LR-1/L-1.1 SFP modules

Receive characteristic	Minimum	Maximum	Unit
Receive power for single-mode (SM) long reach (LR)	-34	-10	dBm
Optical path power penalty	not applicable	1	dB
Maximum received reflectance	not applicable	not applicable	

Cable specifications for custom-making LC cable assemblies

Make an LC cable assembly using the following specifications. Refer also to the figure “The LC cable assembly with duplex connectors and duplex cables” (page 246).

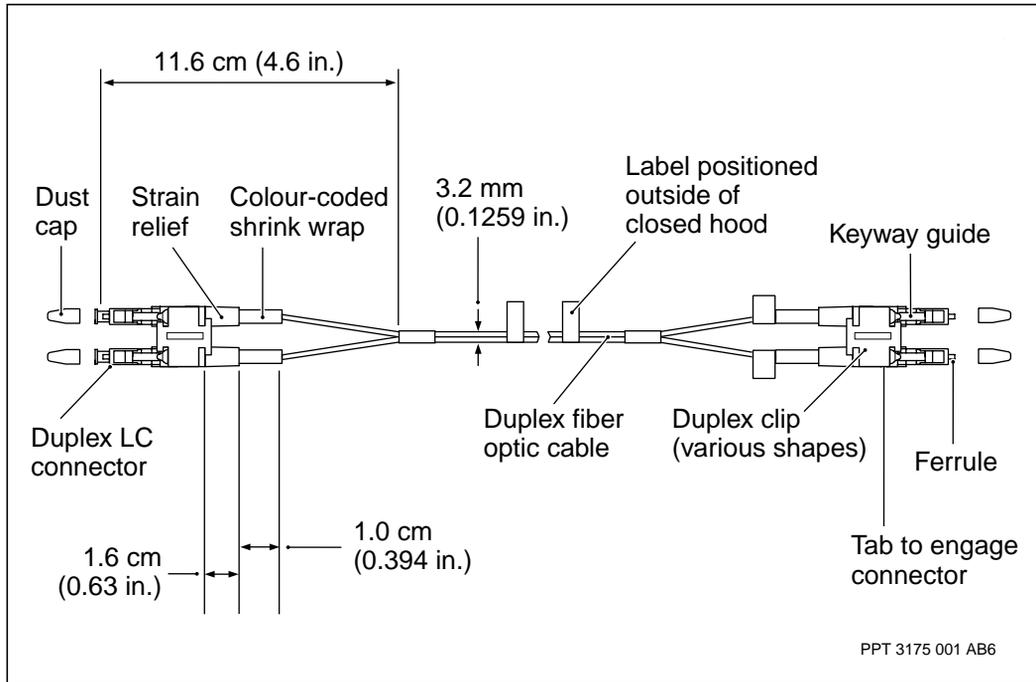
- Use multimode (MM) fiber with a core diameter of 50 microns or 62.5 microns and a cladding diameter of 125 microns.
- Use single-mode (SM) fiber with a core diameter of 9 microns and a cladding diameter of 125 microns.
- Use duplex fiber cables to provide lesser cable volumes and easier cable management under the hood.

- The outside diameter of one SM cable must not exceed 1.6 mm (0.0629 inch). The combined outside width of two cables zipped together to make a duplex cable must not exceed 3.2 mm (0.1259 inch) as shown in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235). The thinner cable allows the fiber hood on the faceplate to close over the entire cluster of cables without pinching them and can allow the duplex cable to be ravelled onto the tray of a fiber management unit (NTHW50).

Note: Ladder rackable cable (especially at 3.0 mm) cannot be used.

- Use duplex small-form LC connectors at the FP end especially since the Tx and Rx transceivers are side-by-side in the faceplate, and any other fiber connector you choose at the next hop from the FP.
- Use color-coded shrink wrap at the connectors to indicate parallel Tx and Rx connections of the ends. The total length of the shrink wrap should not exceed 2.6 cm (1.0 inch). The shrink wrap should extend from the rear of the connector through the strain relief (neck reinforcement) with up to 1.0 cm (0.394 in.) exposed, as indicated in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235).
- After each connector, add a stiff strain relief no longer than 1.6 cm (0.63 in.), as indicated in the figure “The LC cable assembly with duplex connectors and duplex cables” (page 235). Applying a coating of resilient gap filler between the cable and the strain relief is determined by the manufacturer of the cable assembly.
- The combined measurements of connector, strain relief, and shrink wrap must accommodate the curve of the hood on the FP faceplate so that the hood can be closed without pinching any cables.
- Cables should be manufactured and verified to comply with Telcordia GR-326 specifications.

Figure 65
The LC cable assembly with duplex connectors and duplex cables



Specifications for Y-splitter cable assemblies for Y-protection

A fiber optical Y-splitter cable connects two adjacent NTHW44 FPs to a single fiber optical interface at the far end. See the figure “The connection setup of a fiber optical duplex Y-splitter cables used for Y-protection” (page 248). The far end can be:

- another NTHW44 in a Passport 15000 or 20000
- an OC-3 in any other Passport
- a non-Passport card

You must use Y-splitter cables that have been made according to the following specifications, criteria, and considerations.

- Use the same specifications as listed in “Cable specifications for custom-making LC cable assemblies” (page 244) except you can only use the duplex single-mode (SM) type. At the FP end of the cables, you must use small-form LC connectors. At the single end of the cable (the far end from the FPs), the connectors are determined by whatever type of optical interface you have for that port. Nortel Networks does not support mixing single-mode and multimode at opposite ends of a connection. If you must have MM at the far end:
 - keep the total distance of the path less than 100 m (328 ft)
 - use an appropriate attenuator on the receive (Rx) port (the 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade* has the procedure for handling attenuators)
- Use only the small-form pluggable (SFP) optical module with PEC NTHW02CD, as described in “SFP modules for an NTHW44” (page 240). Refer also to the figure “An example of a fiber optical duplex Y-splitter cable assembly used for Y-protection” (page 249).
- The Y-splitter cable coupler must provide an equal split of the optical signals, where each split signal meets or exceeds physical layer requirements for intermediate reach (IR) under Telcordia GR253. The legs of the cable after the split must be equal in length.
- The position of the coupler on each cable relative to all three ends of the cable is critical for having effective cable management. Plan the length of each installed cable especially between the port on the installed FP and along the absolute cable path up to the nearest cable management bracket so that its coupler:
 - will not reside under an FP hood or anywhere across the front of the shelf
 - will not reside in a drawer of the fiber management unit (NTHW50)
 - resides on the side of the NEBS 2000 frame or equivalent mounting apparatus, or beyond, but not through or on any of the cable management brackets

- You must address appropriate power budgeting of the FP lasers when mixing single-mode (SM) and multimode (MM) signals. The attenuation for the Y-splitter cable cannot exceed 10 db when multimode is receiving from single-mode. When connecting optical interface cards, Nortel Networks does not recommend mixing single-mode and multimode, especially when a distance greater than 100 m (328 ft) causes various kinds of signal degradations.

Note: Since the coupler (splitter) typically attenuates the signal, you must also address the power budgeting between SM interfaces throughout the connection.

The behaviour of FPs when cabled with Y-splitter cable assemblies is described in 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide* in the section about understanding Y-protection for dual FPs.

Figure 66
The connection setup of a fiber optical duplex Y-splitter cables used for Y-protection

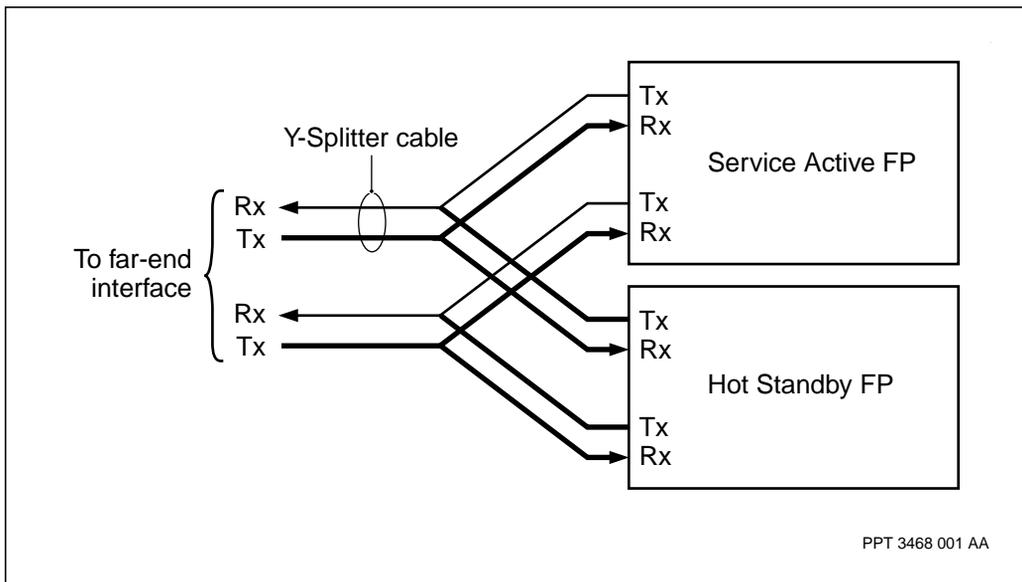
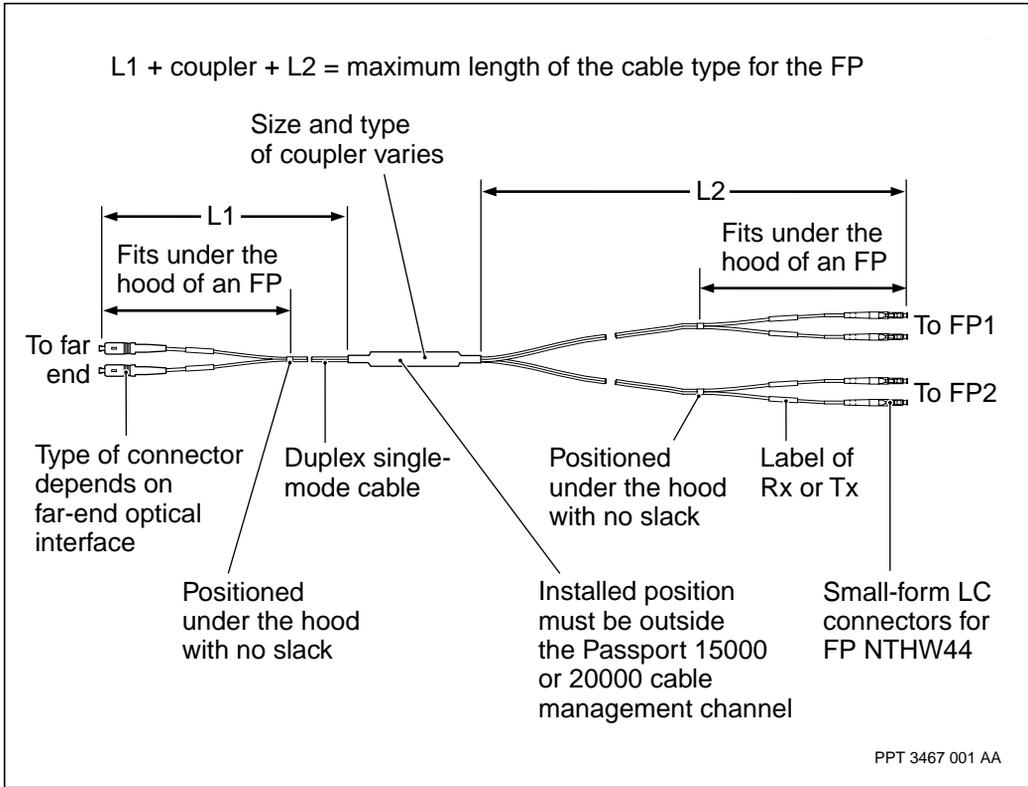


Figure 67
An example of a fiber optical duplex Y-splitter cable assembly used for Y-protection



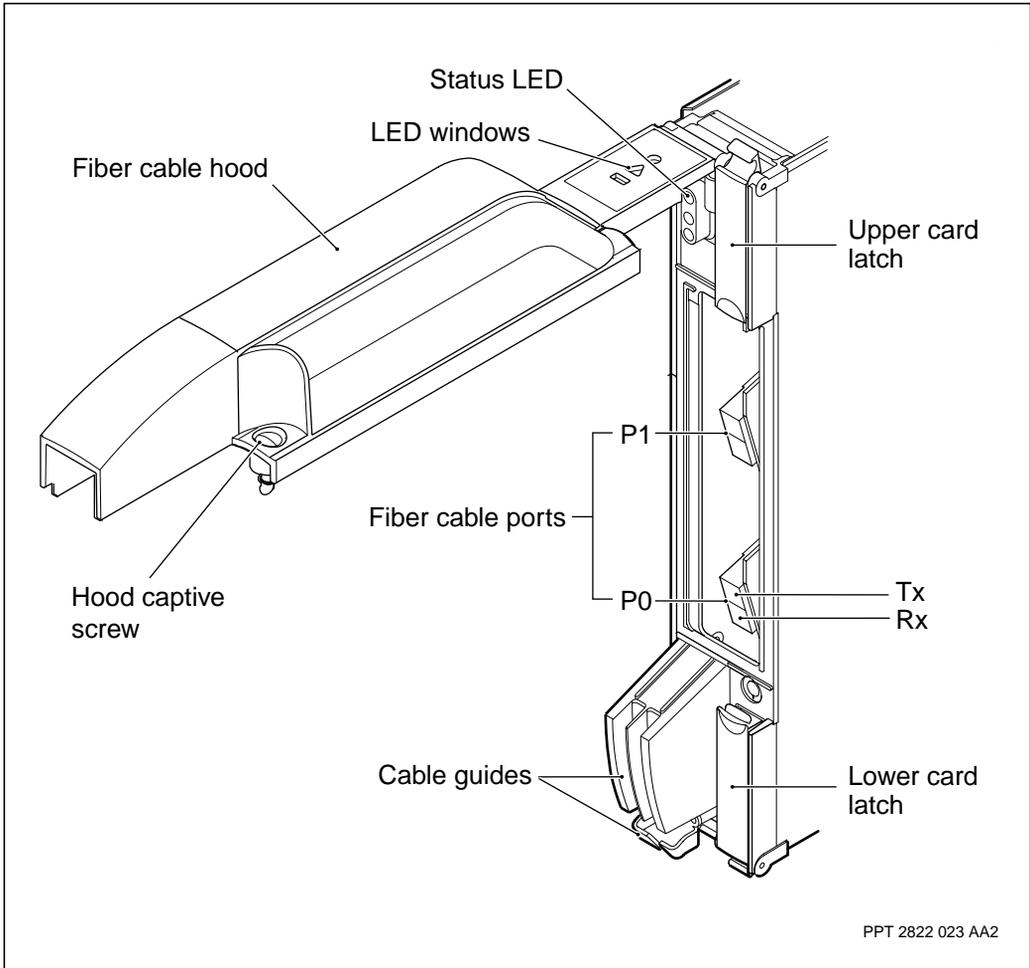
1-port OC-12/STM-4 FP

For the interface information about the 1-port OC-12/STM-4 FP, see:

- “Faceplate of a 1-port OC-12/STM-4 FP with PEC NTHR29” (page 251)
- “1-port OC-12/STM-4 FP cable assembly” (page 252)
- “1-port OC-12/STM-4 FP optical interface characteristics” (page 252)

The software name (card type) of the NTHR29 is 1pOC12SmLrAtm.

Figure 68
Faceplate of a 1-port OC-12/STM-4 FP with PEC NTHR29



1-port OC-12/STM-4 FP cable assembly

Use only single-mode (SM) fiber cable with the 1-port OC-12/STM-4 FP. You must provide the cable with attached connectors.

The SM fiber cable must have a core diameter of 9 microns and cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The OC-12 uses standard duplex SC connectors.

The sum of cable splice losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for SM cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 15 to 20 km for SM cable, depending on the losses due to splices and connectors.

1-port OC-12/STM-4 FP optical interface characteristics

The optical interface characteristics for the 1-port OC-12/STM-4 single-mode (SM) long reach (LR) FP are shown in these tables

- “1-port OC-12/STM-4 FP general interface characteristics” (page 252)
- “1-port OC-12/STM-4 SM LR FP transmit characteristics” (page 253)
- “1-port OC-12/STM-4 SM LR FP receive characteristics” (page 253)

Table 65

1-port OC-12/STM-4 FP general interface characteristics

General optical interface characteristics	
Faceplate connector	dual SC transceiver for simplex cable connectors
Bit rate	622 Mbit/s
Line encoding	Binary non-return-to-zero (NRZ)

Table 66
1-port OC-12/STM-4 SM LR FP transmit characteristics

Transmit characteristics	Value
Emission wavelength	1280 to 1335 nm
Attenuation	0 - 12 dB
Maximum dispersion	not applicable
Maximum RMS spectral width	1 nm (full spectral width at 20 dB)
Mean transmission power	+2 to -3 dBm
Minimum extinction ratio	10 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	30 dB

Table 67
1-port OC-12/STM-4 SM LR FP receive characteristics

Receive characteristics	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-28 dBm
Optical path power penalty	1 dB
Maximum received reflectance	-14 dB

4-port OC-12/STM-4 ATM FP

For the interface information about the 4-port OC-12/STM-4 ATM FP, see:

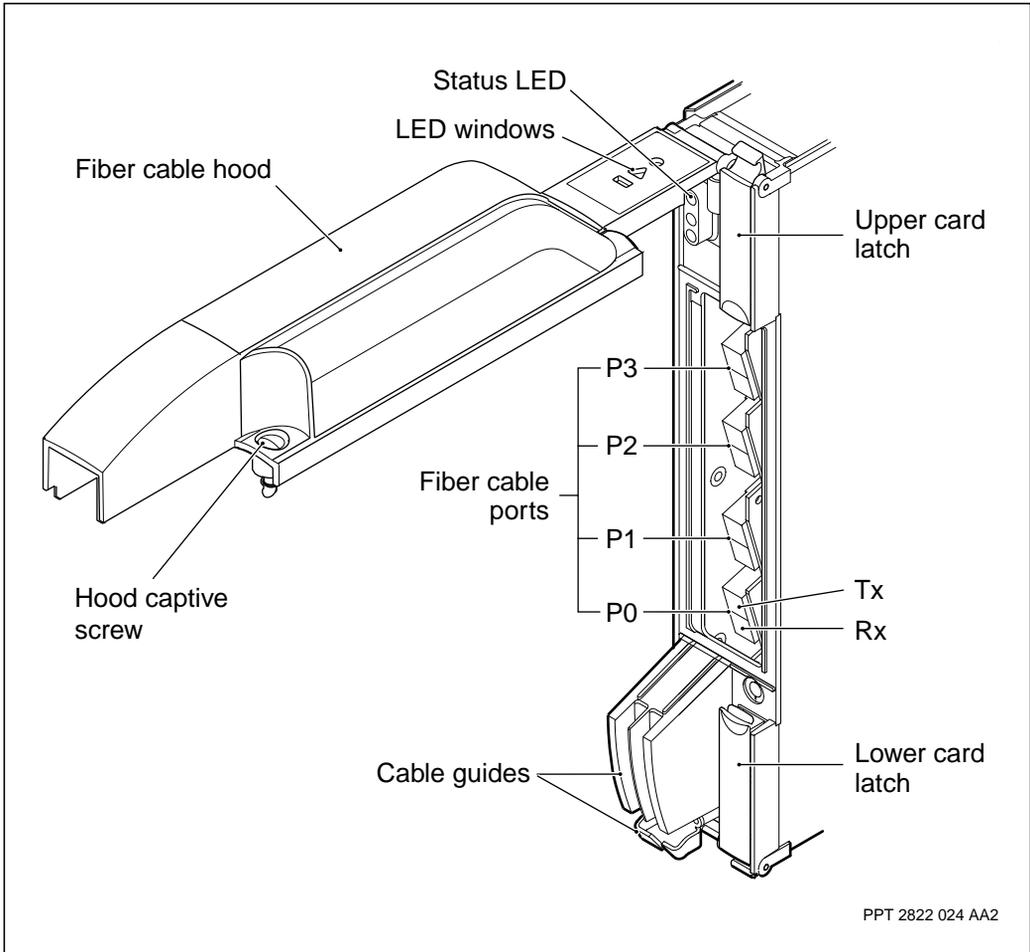
- “4-port OC-12/STM-4 ATM identifiers” (page 254).
- “Faceplate of a 4-port OC-12/STM-4 ATM FP with PEC NTHW11 or NTHW86” (page 255)
- “4-port OC-12/STM-4 ATM FP cable assembly” (page 256)
- “4-port OC-12/STM-4 ATM FP optical interface characteristics” (page 256)

Table 68
4-port OC-12/STM-4 ATM identifiers

FP	PQC6v2 (also known as PQC2)	PQC12	Software name (card type)
4-port OC-12/STM-4	NTHW11	NTHW86	4pOC12SmlrAtm

When a specific PEC is not mentioned, assume the text applies to both PQC versions of the card.

Figure 69
Faceplate of a 4-port OC-12/STM-4 ATM FP with PEC NTHW11 or NTHW86



4-port OC-12/STM-4 ATM FP cable assembly

Use only single-mode (SM) fiber cable with the 4-port OC-12/STM-4 ATM FP. You must provide the cable with attached connectors.

The single-mode fiber cable must have a core diameter of 9 microns and cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The OC-12 uses standard duplex SC connectors.

The sum of cable splice losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for single-mode cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 15 to 20 km for single-mode cable, depending on the losses due to splices and connectors.

4-port OC-12/STM-4 ATM FP optical interface characteristics

The optical interface characteristics for the 4-port OC-12/STM-4 ATM single-mode (SM) intermediate reach (IR) FP are shown in these tables

- “4-port OC-12/STM-4 ATM FP general interface characteristics” (page 256)
- “4-port OC-12/STM-4 SM IR ATM FP transmit characteristics” (page 257)
- “4-port OC-12/STM-4 SM IR ATM FP receive characteristics” (page 257)

Table 69

4-port OC-12/STM-4 ATM FP general interface characteristics

General optical interface characteristics	
Faceplate connector	dual SC transceiver for simplex cable connectors
Bit rate	622 Mbit/s
Line encoding	Binary non-return-to-zero (NRZ)

Table 70
4-port OC-12/STM-4 SM IR ATM FP transmit characteristics

Transmit characteristics	Minimum	Maximum	Unit
Transmission laser power	-15	-8	dBm
Emission wavelength (center) nominal 1310 nm	1274	1356	nm
Maximum optical path attenuation	0	12	dB
Maximum dispersion	not applicable	not applicable	
Spectral width	not applicable	2.5	nm
Extinction ratio	8.2	not applicable	dB
SONET eye pattern mask	Compliant with Telcordia GR-253 and ITU-T G.957		
Jitter generation	Compliant with Telcordia GR-253 and ITU-T G.958		
Side node suppression ratio (SSR)	not applicable	not applicable	

Table 71
4-port OC-12/STM-4 SM IR ATM FP receive characteristics

Receive characteristics	Minimum	Maximum	Unit
Receive laser power	-28	-8	dBm
Sensitivity	not applicable	-28	dBm
Overload	-8	not applicable	dBm
Center wavelength	1261	1580	nm
Optical path power penalty	not applicable	1	dB
Maximum received reflectance	not applicable	-27	dB
Jitter tolerance	Compliant with Telcordia GR-253 and ITU-T G.958		

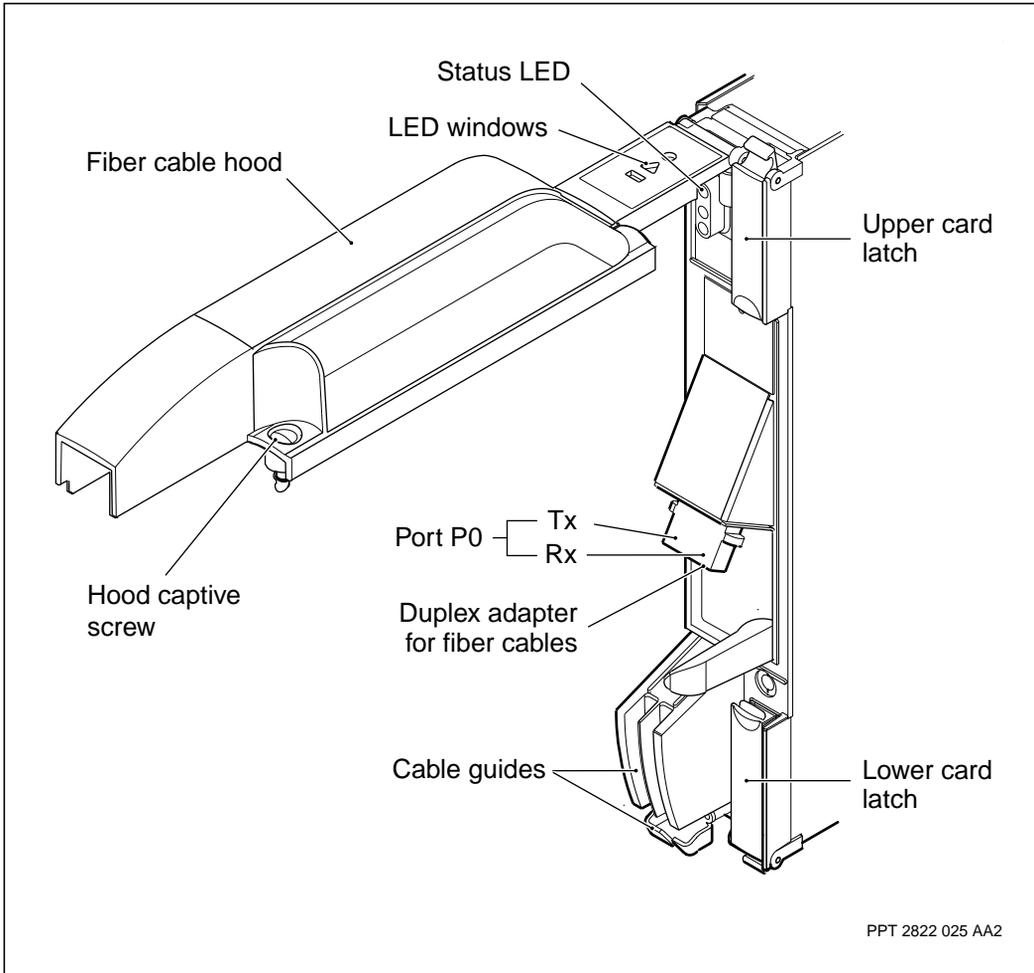
1-port OC-48/STM-16 ATM FP with APS

For the interface information about the 1-port OC-48/STM-16 FP with APS, see:

- “Faceplate of a 1-port OC-48/STM-16 ATM FP with APS with PEC NTHW01” (page 259)
- “1-port OC-48/STM-16 ATM FP with APS cable assembly” (page 260)
- “1-port OC-48/STM-16 ATM FP with APS optical interface characteristics” (page 260)

The software name (card type) of the NTHW01 is 1pOC48ChSmIrAtm.

Figure 70
Faceplate of a 1-port OC-48/STM-16 ATM FP with APS with PEC NTHW01



1-port OC-48/STM-16 ATM FP with APS cable assembly

Use only single-mode (SM) fiber cable with the 1-port OC-48/STM-16 ATM FP with APS. You must provide the cable with attached connectors.

The single-mode fiber cable must have a core diameter of 9 microns and cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The OC-48/STM-16 ATM FP uses standard duplex SC connectors.

The sum of cable splice losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for single-mode intermediate-reach cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is typically less than 34 km (21 miles) for single-mode intermediate reach cable with 0.35 dB/km fiber, and depending on the losses due to splices and connectors.

1-port OC-48/STM-16 ATM FP with APS optical interface characteristics

The optical interface characteristics for the 1-port OC-48/STM-16 ATM FP with APS are shown in these tables

- “1-port OC-48/STM-16 ATM FP general interface characteristics” (page 260)
- “1-port OC-48/STM-16 ATM FP transmit characteristics” (page 261)
- “1-port OC-48/STM-16 ATM FP receive characteristics” (page 261)

Table 72
1-port OC-48/STM-16 ATM FP general interface characteristics

General optical interface characteristics	
Faceplate connector	duplex SC adapter
Bit rate	2.488 Gbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 73
1-port OC-48/STM-16 ATM FP transmit characteristics

Transmit characteristics	Minimum	Maximum	Unit
Emission wavelength	1260	1360	nm
Attenuation	0	12	dB
Maximum dispersion	n/a	n/a	
Spectral width	n/a	n/a	
Mean transmission power (launch)	-5.0	0.0	dBm
Extinction ratio	8.2		dB
SONET eye pattern mask	Compliant with Telcordia GR-253 and ITU-T G.957		
Jitter generation	Compliant with Telcordia GR-253 and ITU-T G.958		
Side node suppression ratio (SSR)	n/a	n/a	

Table 74
1-port OC-48/STM-16 ATM FP receive characteristics

Receive characteristics	Minimum	Maximum	Unit
Sensitivity		-18	dBm
Overload	0.0		dBm
Optical path power penalty		1	dB
Received reflectance		-27	dB
Jitter tolerance and transfer	Compliant with Telcordia GR-253 and ITU-T G.958		

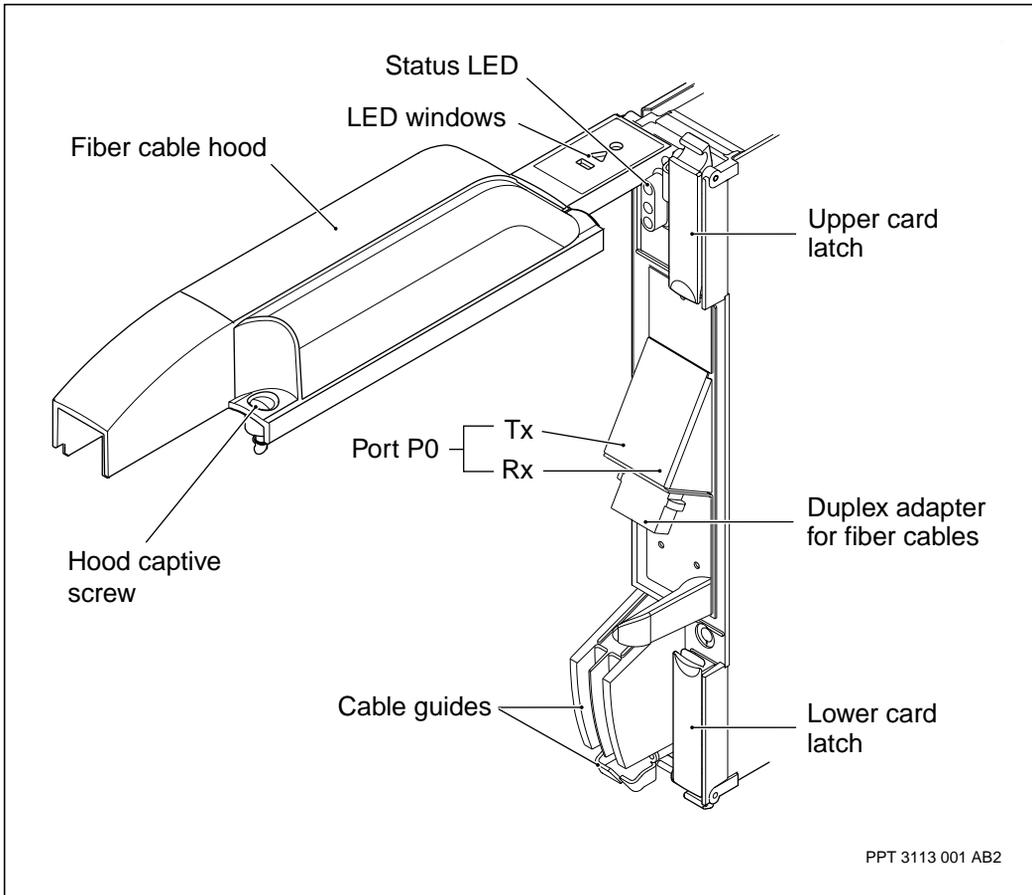
1-port OC-48/STM-16 POS FP

For the interface information about the 1-port OC-48/STM-16 POS FP, see:

- “Faceplate of a 1-port OC-48/STM-16 POS FP with PEC NTHW39” (page 263)
- “1-port OC-48/STM-16 POS FP cable assembly” (page 263)
- “1-port OC-48/STM-16 POS FP optical interface characteristics” (page 264)

The software name (card type) of the NTHW39 is 1pOC48SmIrPos.

Figure 71
Faceplate of a 1-port OC-48/STM-16 POS FP with PEC NTHW39



1-port OC-48/STM-16 POS FP cable assembly

Use only single-mode (SM) fiber cable with the 1-port OC-48/STM-16 POS FP. You must provide the cable with attached connectors.

The single-mode fiber cable must have a core diameter of 9 microns and cladding diameter of 125 microns. The attenuation must be less than 0.5 dB/km at 1310 nm.

The OC-48/STM-16 POS FP uses standard duplex SC connectors.

The sum of all fiber splice losses, fiber attenuation losses, and connector losses from the FP to its intended destination must not exceed 8 dB. The maximum intended optical link length for the single-mode (SM) short reach (SR) 1-port OC-48/STM-16 POS FP is 2 km (1.25 miles).

A repeater is required for distances that are greater than 2 km (1.25 miles) and/or when the link loss in the transmission path is greater than 8 dB.

1-port OC-48/STM-16 POS FP optical interface characteristics

The optical interface characteristics for the 1-port OC-48/STM-16 POS single-mode (SM) short reach (SR) FP are shown in these tables

- “1-port OC-48/STM-16 POS FP general interface characteristics” (page 264)
- “1-port OC-48/STM-16 POS SM SR FP transmit characteristics” (page 264)
- “1-port OC-48/STM-16 POS SM SR FP receive characteristics” (page 265)

Table 75
1-port OC-48/STM-16 POS FP general interface characteristics

General optical interface characteristics	
Faceplate connector	duplex SC adapter
Bit rate	2.488 Gbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 76
1-port OC-48/STM-16 POS SM SR FP transmit characteristics

Transmit characteristics	Minimum	Maximum	Unit
Emission wavelength	1265	1360	nm
Maximum dispersion	n/a	n/a	
Spectral width	n/a	4	nm
(Sheet 1 of 2)			

Table 76 (continued)
1-port OC-48/STM-16 POS SM SR FP transmit characteristics

Transmit characteristics	Minimum	Maximum	Unit
Mean transmission power (launch)	-10.0	-3.0	dBm
Extinction ratio	8.2		dB
SONET eye pattern mask	Compliant with Telcordia GR-253 and ITU-T G.957		
Jitter generation	Compliant with Telcordia GR-253 and ITU-T G.958		
Side node suppression ratio (SSR)	n/a	n/a	
(Sheet 2 of 2)			

Table 77
1-port OC-48/STM-16 POS SM SR FP receive characteristics

Receive characteristics	Minimum	Maximum	Unit
Sensitivity		-18	dBm
Overload	-3.0		dBm
Optical path power penalty		1	dB
Received reflectance		-27	dB
Jitter tolerance and transfer	Compliant with Telcordia GR-253 and ITU-T G.958		

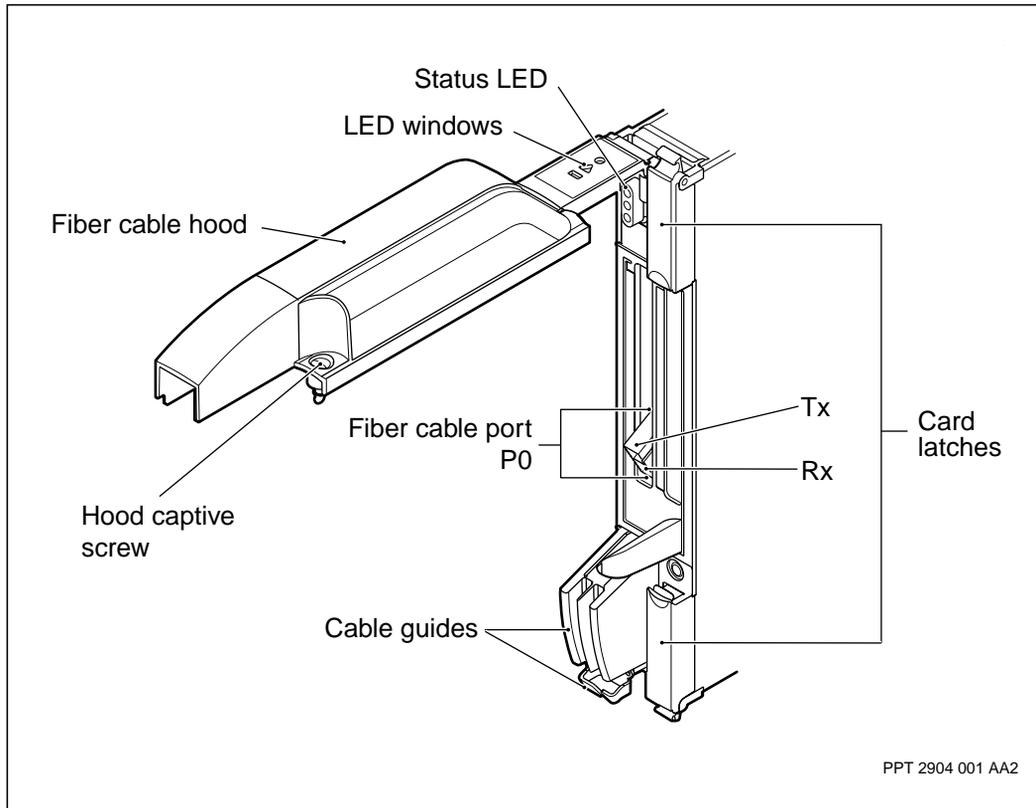
1-port STM-1Ch FP

For the interface information about the 1-port STM-1 FP, see:

- “Faceplate of a 1-port STM-1 FP with PEC NTHR83” (page 266)
- “1-port STM-1 FP cable assembly” (page 267)
- “1-port STM-1 FP optical interface characteristics” (page 267)

The software name (card type) of the NTHR83 is 1pSTM1ChSmIr.

Figure 72
Faceplate of a 1-port STM-1 FP with PEC NTHR83



1-port STM-1 FP cable assembly

Use only single-mode (SM) fiber cable with the 1-port STM-1 FP. You must provide the cable with attached connectors.

The single-mode fiber cable must have a core diameter of 9 microns and a cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The sum of cable losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for single-mode cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 15 to 20 km for single-mode cable, depending on the losses due to splices and connectors.

1-port STM-1 FP optical interface characteristics

The optical interface characteristics for the 1-port STM-1 single-mode (SM) intermediate reach (IR) FP are shown in these tables

- “1-port STM-1 FP general interface characteristics” (page 267)
- “1-port STM-1 SM IR FP transmit characteristics” (page 268)
- “1-port STM-1 SM IR FP receive characteristics” (page 268)

Table 78

1-port STM-1 FP general interface characteristics

General optical interface characteristics	
Faceplate connector	simplex single-mode SC transceiver
Bit rate	155.520 Mbit/s
Line encoding	Binary non-return-to-zero (NRZ)

Table 79
1-port STM-1 SM IR FP transmit characteristics

Transmit characteristic	Value
Emission wavelength	1261 to 1360 nm
Attenuation	0 to 12 dB
Maximum dispersion	96 ps/nm
Maximum RMS spectral width	7.7 nm
Mean transmission power	-15 to -8 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	not applicable

Table 80
1-port STM-1 SM IR FP receive characteristics

Receive characteristic	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-28 dBm
Optical path power penalty	1 dB
Maximum received reflectance	not applicable

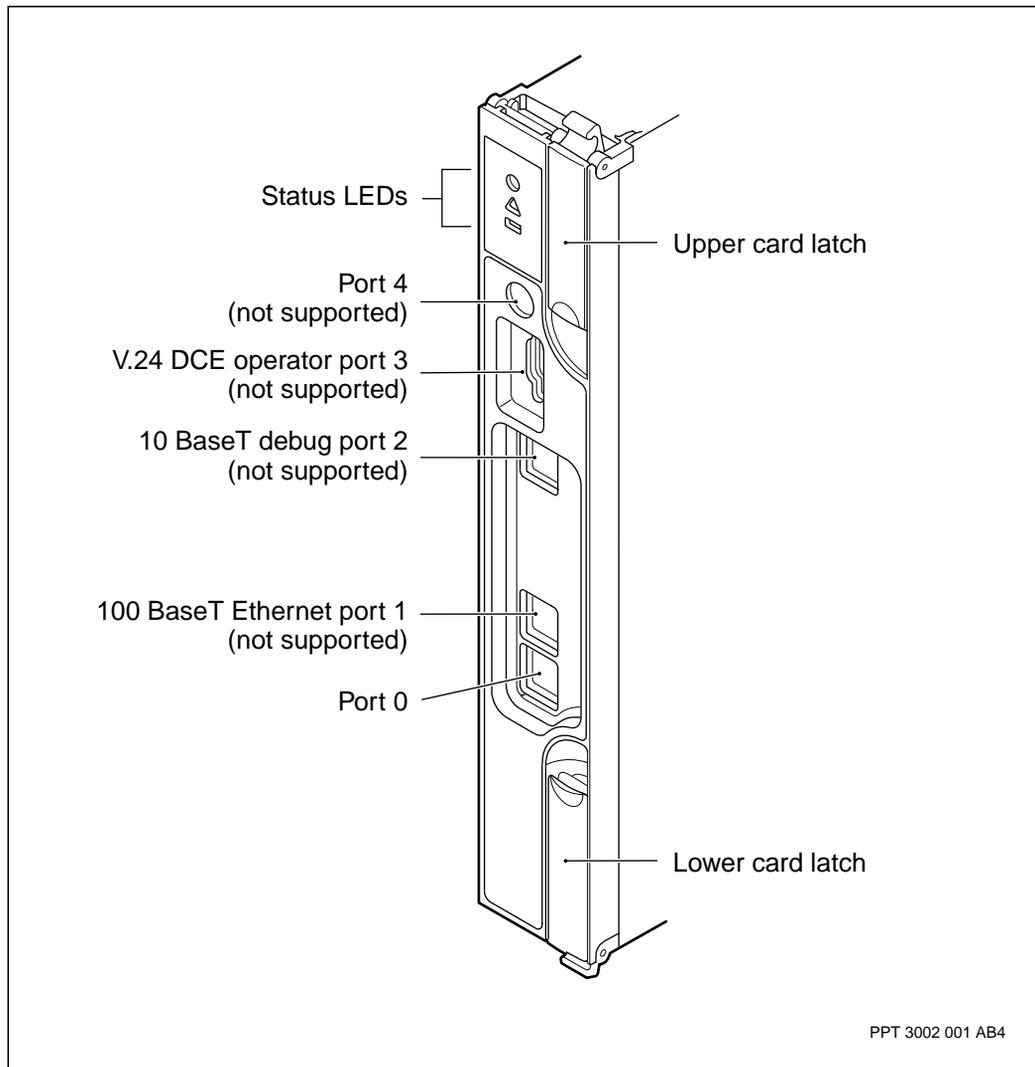
VPN extender card

The VPN extender card (VpnXc) is a processor card for IP services. IP services use the VpnXc to provide enhanced IP-VPN scalability without impacting the multi-service performance of Passport 15000 or 20000. The VPN extender card is used to host all the virtual routers (VRs) that support IP-VPN services. The VPN extender card allows IP-VPN services to scale well beyond the capabilities of a CP only scenario.

The product engineering code (PEC) of the VPN extender card for Passport 15000 or 20000 is NTHW30.

See the figure “Faceplate of a VPN extender card with PEC NTHW30” (page 270).

Figure 73
Faceplate of a VPN extender card with PEC NTHW30



See these sections for more information on the VPN extender card

- “VpnXc components” (page 271)
- “VpnXc configuration” (page 271)
- “VpnXc sparing” (page 271)
- “VpnXc compliance with standards” (page 272)

VpnXc components

The VPN extender card consists of a motherboard, a memory daughter card, and a power supply daughter card, with a hard disk mounted on the motherboard.

Note: The hard drive on the VpnXc is for future use and is not supported.

The VpnXc connects to the shelf backplane, providing an interface to both fabric cards.

The VpnXc interface supports these functions

- 16 Mbyte FLASH memory
- 512 Mbyte DRAM memory

Note: The VPN extender card has a 10Base-T Ethernet debug port and two 100Base-T Ethernet ports that are for future use and are not supported.

VpnXc configuration

The VPN extender card has no external connections or ports that require configuration. The card type value <cardtype> is *VpnExtender* or *VpnXc* for the VPN extender card. For more information on configuring Passport 15000 or 20000 FPs, see 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*.

VpnXc sparing

The VPN extender card supports cold one-for-one sparing. The standby FP is idle but ready to provide service should the active FP fail. This FP requires no cabling, therefore, you must provision sparing. The redundant pair of VPN extender cards do not need to be installed in adjacent slots.

For more information, see 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*.

VpnXc compliance with standards

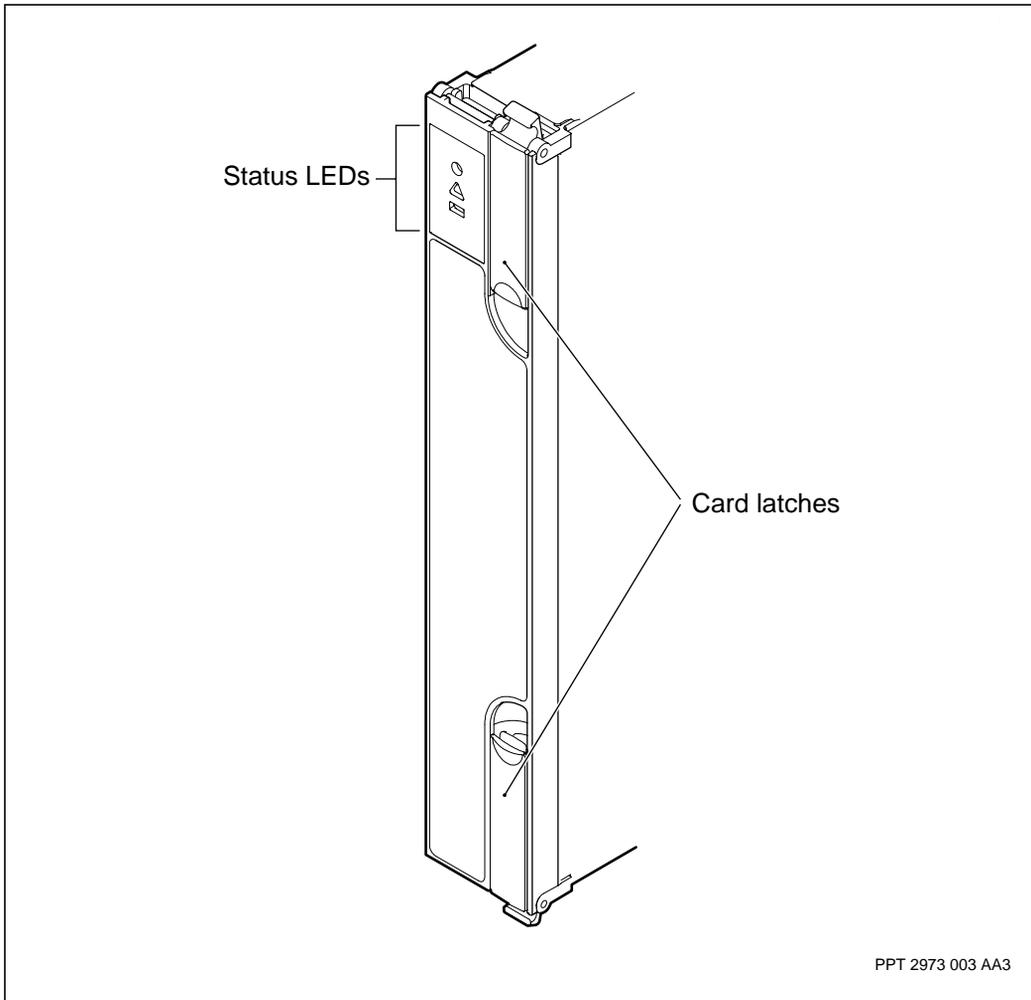
The VPN extender card is compliant with ISO 8601 and Nortel Networks Corporate Standard 1805.00.

Voice services processor 2 (VSP2) FP

For the interface information about the VSP 2, see “Faceplate of a VSP2 FP with PEC NTHW87” (page 273). No cables connect to a VSP2.

The software name (card type) of the NTHW87 is VSP2.

Figure 74
Faceplate of a VSP2 FP with PEC NTHW87



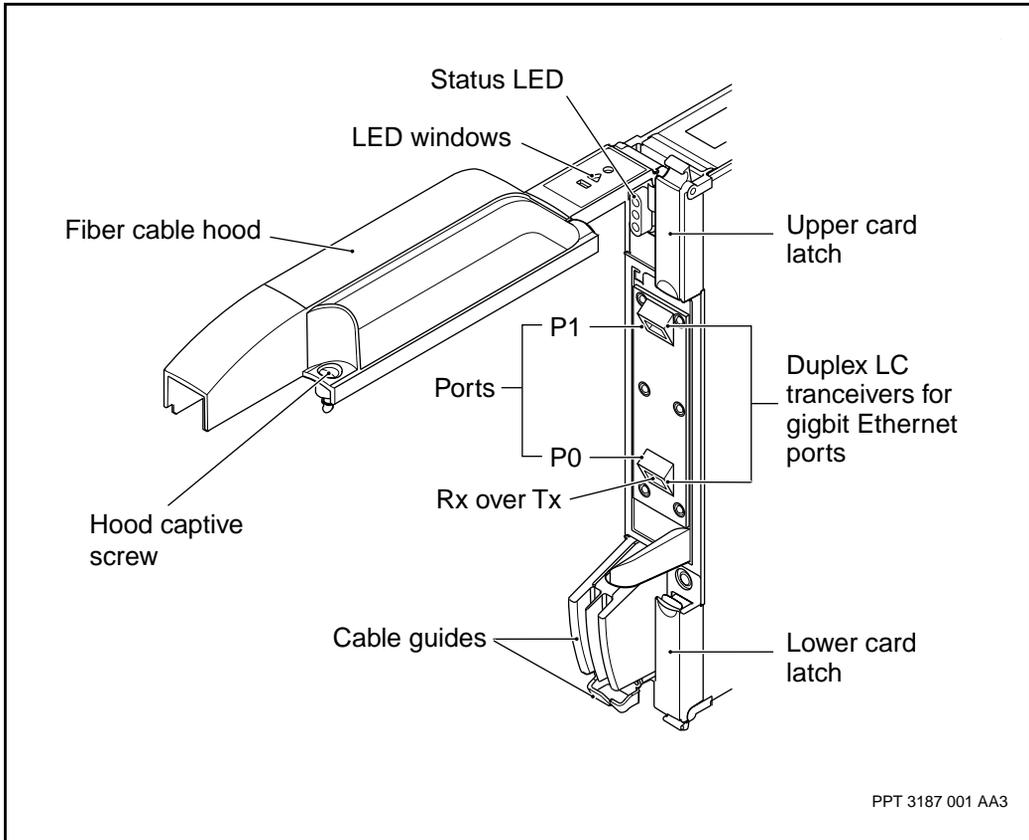
Voice services processor 3 (VSP3) FP

For the interface information about the VSP3, see:

- “Faceplate of a VSP3 FP with PEC NTHW84” (page 275)
- “VSP3 line connections” (page 275)
- “VSP3 cable assemblies” (page 276)
- “VSP3 sparing” (page 278)
- “Equipment to interface VSP3 Ethernet ports” (page 278)

The software name (card type) of the NTHW84 is 2pGeMmSrVsp3.

Figure 75
Faceplate of a VSP3 FP with PEC NTHW84



VSP3 line connections

The VSP3 card has virtual ports that communicate over the backplane of the Passport, and has two gigabit Ethernet (gigE) ports. You can use either the virtual ports or the gigE ports to communicate with an Internet Protocol (IP) local area network (LAN). Using the gigE ports enables having a direct Ethernet port connection to an IP network without needing an Ethernet card as an interface.

The VSP3 can receive signals over the backplane from an ATM interfacing card in the same shelf, or directly through the gigE ports. Signals can arrive on the TDM port on the TDM card in the same shelf as the VSP3, and leave through the gigE ports. The VSP3 always needs a TDM card and a packet port (such as the gigE ports) in the same shelf.

The gigE ports are used with the PVG base voice-over-IP features (for example, *vgsIpGigE* and *vgsIpG729GigE*). When both VSP3 gigabit ports are cabled, all IP packets pass through the ports, including voice, call server protocol, primary rate interface (PRI) using Q.921, and V5.2 backhaul signaling.

VSP3 cable assemblies

With the NTHW84 card, use duplex multimode (MM) fiber cable with duplex LC small-form connectors at the FP end and any other fiber connector at the other end.

The VSP3 card has two gigabit Ethernet ports on the faceplate. One port is the standby of the other. For an example, see the figure “An example duplex LC-to-LC cable assembly” (page 277). You must custom make each cable assembly according to the specifications in “Cable specifications for custom-making an LC cable assembly” (page 276).

The sum of cable losses and connector losses from the FP to the far end termination must not exceed 7.5 dB for MM cable. The losses in a transmission path determine the distance the FP can send a signal. The signal distance with the gigabit Ethernet ports is described in “Cable specifications for custom-making an LC cable assembly” (page 276).

Cable specifications for custom-making an LC cable assembly

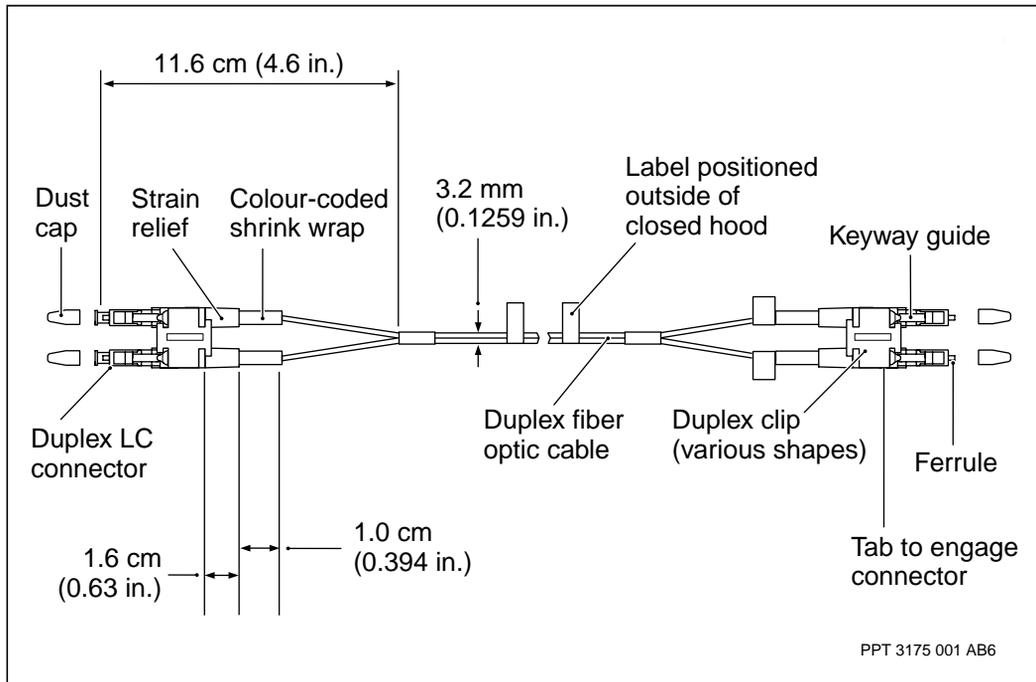
Make an LC cable assembly for an NTHW84 card using the following specifications

- multimode (MM) fiber
- duplex fiber cables (recommended to facilitate lesser cable densities) with colour-coded halves
- a core diameter of 50 microns or 62.5 microns
- a cladding diameter of 125 microns (the same for either core diameter)

- a maximum cable length for 50 microns at 550 m (1,804 ft.) and for 62.5 microns is 275 m (902.27 ft.)
- duplex small-form LC connectors at the FP end, and any other fiber connector you choose at the far end from the FP
- the signal strength reaching the port must be between -3 dbm and -17 dbm.
- attenuation between end-points is not required

Strip back the outside cable sheath to accommodate the curve under the hood of the FP faceplate, and to accommodate attaching the connector according to the manufacturer's instructions for the connector.

Figure 76
An example duplex LC-to-LC cable assembly



VSP3 sparing

The sparing of a VSP3 can be configured from the end that the virtual ports or gigabit Ethernet ports connect to. The sparing for VSP3 cards is different than the usual Passport method of equipment protection because

- it depends on the hardware and software configuration of the far-end equipment that the card connects to
- the gigabit Ethernet port sparing is hot protection whereby the standby port takes over without dropping active calls when a link failure occurs on the active gigabit Ethernet port

The following hardware sparing configurations are supported

- one-for-one (formerly 1:1) or one-for-n (formerly 1:n) inter-card port sparing, where n is up to 7
- one-for-one intra-card port sparing, that is, one gigabit Ethernet port spares the other on the same card, and by default the port that comes into service first is automatically the active port
- no port sparing for the two gigabit Ethernet ports such that each is operating independently (the default)

For details about the hardware sparing setup, see the section about VSP3 far-end interfacing equipment in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Equipment to interface VSP3 Ethernet ports

When using the virtual ports of the a voice services processor 3 (VSP3) function processor (FP) card, no cabling from the FP faceplate is required. The virtual ports communicate through the backplane of the Passport 15000 or 20000.

When using the gigabit Ethernet ports to access an Internet Protocol (IP) network, the FP must be cabled to various kinds of far-end equipment. The interfacing equipment depends on what you want the VSP3 to do. For a further description of what the card does, refer to 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*.

The interfacing equipment also determines the method of sparing VSP3 cards. This section provides

- “VSP3 far-end interfacing equipment” (page 279)
- “Sparing a VSP3 at the far-end” (page 280)

VSP3 far-end interfacing equipment

When using the gigabit Ethernet ports, the ports must be cabled from the FP faceplate to the far-end equipment. The equipment that can interface the gigabit Ethernet ports of a VSP3 must have the following specifications for one-for-one or one-for-n sparing.

- a router that
 - transmits 1000Base-SX short wavelength laser (at 770 to 860 nm) over multimode (MM) cable
 - bridges connections
 - connects other IP subnets
 - has VRRP (or an equivalent protocol) for router sparing
 - for example, provides both bridging and VRRP routing capabilities within the same chassis by bridging through configured port-based VLANs, as with a Passport 8600
- each port connected to a Layer 2 bridge to form part of an Ethernet local area network (LAN)
- Ethernet ports of the VSP3 cards are within the same LAN (although not necessarily to the same physical bridge)

When the VSP3 is unspared, a direct point-to-point connection to a router which does not support bridging is possible

- each directly-connected VSP3 is placed in a separate IP subnet
- the far-end must support auto-negotiation

For an example configuration, refer to the figure “Example of spared VSP3 cards in a LAN hardware configuration” (page 282).

Sparing a VSP3 at the far-end

The sparing of a VSP3 can be configured through the far-end equipment that its gigabit Ethernet ports connect to. The intra-card sparing capability protects the gigabit Ethernet ports from loss of traffic provided both ports are configured for sparing and the far-end setup criteria are met. The inter-card sparing capability protects the VSP cards through configured 1-for-one (1:1) or one-for-n (1:n) sparing. However, during a switchover between cards, traffic is lost. Combining the sparing of the cards and the gigabit ports provides fast switchover for link failures and cold switchover for VSP3 cards.

The setup sparing for VSP3 cards involves the following.

- It depends on the hardware and software configuration of the far-end equipment that the card connects to.
- The gigabit Ethernet port sparing is hot protection whereby the standby port takes over without dropping active calls when a link failure occurs on the active gigabit Ethernet port.

The criteria for the hardware sparing configurations are as follows:

- for one-for-one (1:1) or one-for-n (1:n) inter-card port sparing:
 - the active and the standby cards reside in the same Passport shelf
 - the cards are cabled to the same LAN (or VLAN), as are all devices within an IP subnet
 - the cards belong to the same protection group as designated by software configuration
 - the active and standby ports belong to the same IP subnet
 - one card is configured as the Spare and each other card is configured as a Main
 - up to nn cards in the same Passport 15000 or 20000 shelf are configured for sparing, where nn is 14 FP slots minus however many TDM cards share the shelf, and the far-end supports sparing that many VSP3s
- for one-for-one (1:1) intra-card port sparing:
 - the VSP3 software has been configured to enable the sparing and both are configured under the same logical processor (LP)

- both gigabit Ethernet ports are connected to the same LAN or subnet
- for no card sparing between VSP3s, connect the VSP3

Note: Configure both Ethernet ports for sparing at the same time. If you configure only one of the two Ethernet ports on a VSP3 card, and you wish to add the second one later, then configure the second port for sparing and physically connect it. The newly added port becomes the standby. The only method to trigger a manual switchover between two spared gigabit Ethernet ports is to delete the configuration of the active port, thereby forcing a switchover to the standby. Traffic is lost during the switchover. To provide a standby for the newly active port, then configure the formerly active port again. It automatically becomes the standby.

A switchover from the active to the standby VSP3 card occurs provided:

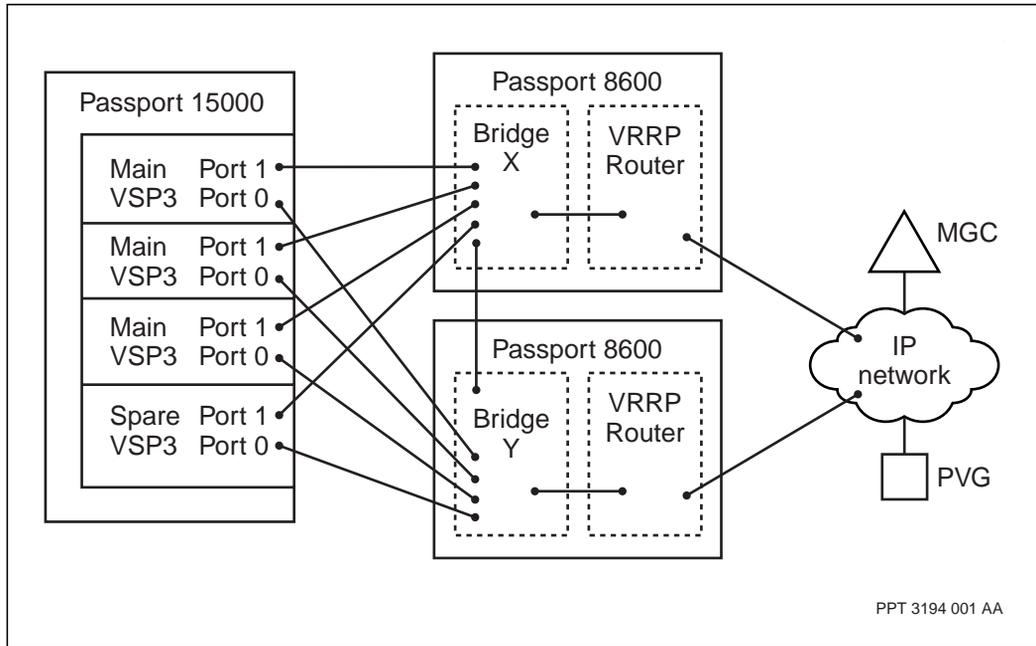
- the attribute *switchoverOnFailure* under the component *IpInterface* is enabled (for the description of components, refer to 241-5701-060 *Passport 7400, 15000, 20000 Components*)
- the PVG application is without an active port for the continuous period specified by the attribute *switchoverHoldoffTime* under the component *IpInterface*
- at least one of the gigabit Ethernet ports has been active since the VSP3 card started up after a reboot or a switchover (which also stops the VSP3 from constantly resetting or switching over when the ports are disconnected or have failed)
- the standby card is in service at the time a switchover is attempted

Cable the sparing connections between each VSP3 and the far-end according to the capabilities of the far-end equipment. For an example of cable connections, refer to the figure “Example of spared VSP3 cards in a LAN hardware configuration” (page 282).

After powering up both ends of the VSP3 connection, the Ethernet port that comes up first automatically becomes the active port, and the second one (if configured for sparing) becomes the standby.

Once both ports are in service, the switchover occurs automatically when the far-end detects a loss of signal from the active Ethernet port.

Figure 77
Example of spared VSP3 cards in a LAN hardware configuration



Voice services processor 3 with optical TDM interface (VSP3-o) FP

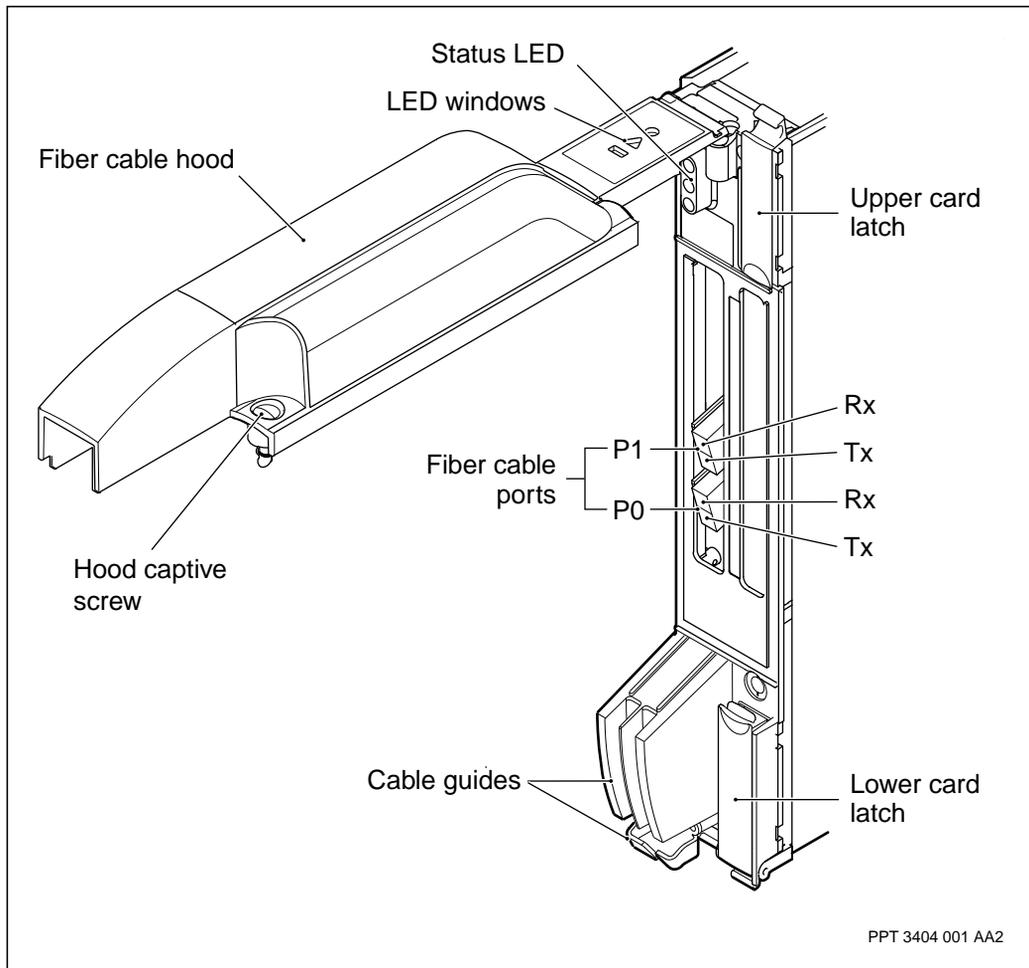
The voice services processor 3 with optical TDM interface (VSP3-o) FP card is supported in Packet Voice Gateway (PVG) shelves of a Passport 15000 or 20000.

For the interface information about the VSP3-o FP card, see:

- “Faceplate of a VSP3-o FP card with PEC NTHW77” (page 284)
- “VSP3-o FP line connections” (page 284)
- “VSP3-o FP cable assembly” (page 285)
- “VSP3-o FP optical interface characteristics” (page 285)
- “VSP3-o FP sparing” (page 287)

The software name (card type) of the NTHW77 is 2pOC3ChSmIrVsp3.

Figure 78
Faceplate of a VSP3-o FP card with PEC NTHW77



VSP3-o FP line connections

The VSP3-o FP card has two OC-3/STM-1 optical TDM ports. Only one of the two OC-3/STM-1 optical TDM ports (ports 0 and 1) is an active port that communicates with the TDM network. The VSP3-o FP card only supports internal TDM traffic through the active port 0 of the two OC-3/STM-1 optical TDM ports on the same VSP3-o FP card. Other TDM FP cards are not supported by the VSP3-o FP card.

The VSP3-o FP card can receive IP-routed traffic over the backplane from a 4-port gigabit Ethernet FP card or an ATM IP FP card in the same Passport shelf, and send the traffic to the TDM network through the active port 0 of the two OC-3/STM-1 optical TDM ports on the VSP3-o FP card. TDM signals can arrive on the active port 0 of the two OC-3/STM-1 optical TDM ports on the VSP3-o FP card, and leave through the 4-port gigabit Ethernet FP card to the IP network.

VSP3-o FP cable assembly

Use only single-mode (SM) fiber cable with the VSP3-o FP card. You must provide the cable with attached connectors.

Single-mode fiber cable must have a core diameter of 9 microns and a cladding diameter of 125 microns. The attenuation is less than 0.5 dB/km at 1300 nm.

The VSP3-o FP card uses standard duplex LC connectors.

The sum of cable losses and connector losses from the FP to customer premises equipment (CPE) must not exceed 12 dB for single-mode cable. The losses in a transmission path determine the distance the FP can send a signal. The maximum distance from the FP to CPE is 15 to 20 km for single-mode cable, depending on the losses due to splices and connectors.

VSP3-o FP optical interface characteristics

The optical interface characteristics for the VSP3-o FP card are shown in these tables

- “VSP3-o FP general interface characteristics” (page 286)
- “VSP3-o FP transmit characteristics” (page 286)
- “VSP3-o FP receive characteristics” (page 286)

Table 81
VSP3-o FP general interface characteristics

General optical interface characteristics	
Faceplate connector	dual LC transceiver for simplex cable connectors
Bit rate	155.520 Mbit/s
Line encoding	binary non-return-to-zero (NRZ)

Table 82
VSP3-o FP transmit characteristics

Transmit characteristic	Value
Emission wavelength	1260 nm to 1360 nm
Attenuation	0 to 12 dB
Maximum dispersion	96 ps/nm
Maximum RMS spectral width	7.7 nm
Mean transmission power	-15 to -8 dBm
Minimum extinction ratio	8.2 dB
Eye pattern mask	Compliant with ITU G.957 Fig 2, ANSI T1E1.2/94-002R1-Fig 10, TA-253 Issue 8 Fig 4-2
Side node suppression ratio (SSR)	not applicable

Table 83
VSP3-o FP receive characteristics

Receive characteristic	Value
Maximum receive power (average)	-8 dBm
Minimum receive power (average)	-31 dBm
Optical path power penalty	not applicable
Maximum received reflectance	not applicable

VSP3-o FP sparing

The sparing of a VSP3-o FP card can be configured from the end that the virtual ports connect to. The sparing for VSP3-o FP cards is different than the usual Passport method of equipment protection because

- it depends on the hardware and software configuration of the far-end equipment that the card connects to

The following hardware sparing configurations are supported

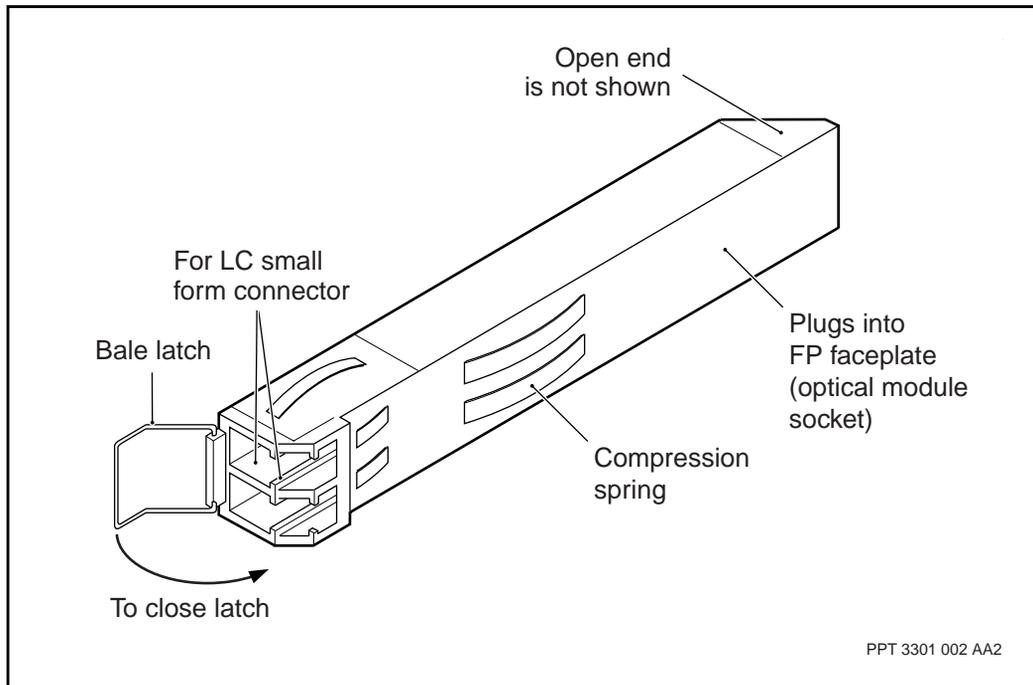
- one-for-one (formerly 1:1)

For details about the hardware sparing setup, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

SFP optical module

A small-form pluggable (SFP) optical transceiver module is a device that transmits and receives an optical signal to and from an optical fiber. Each device handles either single-mode (SM) or multimode (MM) fiber cable with small-form LC connectors plugged into it. The other end of the SFP plugs into the optical module socket (known as a port in software terms) on the faceplate of various FPs, for example, the 4-port Gigabit Ethernet (NTHW49) or the 16-port OC-3/STM-1 POS and ATM (NTHW44). See the figure “A typical SFP optical module” (page 288). When the SFPs are cabled, the hood of the faceplate closes over them as with any other non-SFP optical FP.

Figure 79
A typical SFP optical module



Using SFPs means having SM or MM or a combination of both fibers interfacing the ports of the same FP. By replacing an SFP with a different version, you can change the type of fiber connection without having to change the FP. The FPs with optical module sockets can handle signals from either SM or MM fibers.

The bale latch on the SFP optical module ensures that the SFP optical module cannot be removed from the FP until unplugging the fiber.

Each version of optical module uses a specific wavelength laser to transmit and receive data over a fiber optic cable. The wavelengths are matched to the type of fiber cable it accommodates and to the strength of the laser, namely short reach (SR), intermediate reach (IR), or long reach (LR).

When an in-service SFP fails or the inserted SFP does not match what the socket is configured for in software, alarm 7011 5480 is generated.

An SFP module can be safely removed or inserted without powering off the FP.

Note: The SFP optical modules are separately ordered units and should be tracked as separate products in all respects, including repair and return. If an SFP optical module fails, only the failed SFP optical module should be returned and not the FP. If the FP fails, its SFP optical modules must be removed from the FP before returning the FP.

For more information on fiber cabling, see “SFP optical module cable assemblies” (page 290).

To install or replace an SFP optical module, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

To configure an Ethernet port with an optical module, see 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*.

For information about the SFPs that are available for the FPs that can accommodate them, see the description of the FP in this chapter.

SFP optical module cable assemblies

With an SFP optical transceiver module, use duplex single-mode (SM) or multimode (MM) fiber optic cables with duplex LC connectors at the FP end and any other fiber connector at the other end. Only an SM optical fiber cable (two 9/125 micron SMF) should be used with an SM SFP optical module. Only an MM optical fiber cable (two 62.5/125 MMF or two 50/125 MMF) should be used with an MM SFP optical module.

Additional information about LC cables is provided in the description of each type of FP that uses them.

Optical module compliances

The SFP optical transceiver modules comply with the following:

- ANSI TI.646, SONET specification
- IEEE802.3-2002
- ITU-T G.957, Optical Interfaces for Equipment and Systems Relating to SDH
- LASER Safety FDA Class 1 as per FDA 21, Chapter 1, Sub-chapter J, Part 1040.10 dated 4-1-03
- LASER Safety IEC Class 1 as per IEC 60825-1 Edition 1.2 dated 2001-08
- Telcordia GR-253-CORE, SONET Transport Systems

Chapter 5

Termination panels for FPs

The termination panels that are available to a Passport 15000 or 20000 include fanout panels and sparing panels. These termination panels interconnect equipment to the function processors (FPs) of a Passport 15000 or 20000 switch.

With a NEBS 2000 frame or equivalent mounting apparatus that houses a single switch, termination panels can be attached to the empty portion of the mounting apparatus. In frames containing two Passport switches, a separate mounting apparatus is required. The 19-inch wide sparing panels that are used with Passport 15000 or 20000 FPs can be mounted onto a NEBS 2000 frame using the adapter brackets from kit NTHW14.

The type of cable and connector that is available as prefabricated cable assemblies and the cable specifications that are required to custom make your own are provided in the description of each FP that uses the panel. FP descriptions are in “Control and function processors” (page 141).

The installation of each termination panel and its cables is in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

The replacement of each termination panel or one of its cables is in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

The description and capabilities of the Passport 15000 or 20000 termination panels are in

- “Basic functionality and operation of a sparing panel” (page 292)

- “Basic functionality and operation of a fanout panel” (page 296)
- “12-port DS3 or E3 fanout panel NTHW52” (page 297)
- “12-port DS3 or E3 sparing panel NTQS31” (page 300)
- “4-port DS3 sparing panel NTHR79” (page 304)
- “3-port DS3, E3, or E1 sparing panel NTFP99AA” (page 306)
- “Multiport aggregate device for a 32-port E1 TDM” (page 308)
- “Dimensions of the termination panels” (page 313)

Basic functionality and operation of a sparing panel

The basic functionality of a sparing panel for a Passport 15000 or 20000 is to enable equipment protection of one or more FPs of the same type that are connected to the far end of an FP connection. The FPs connected to the same sparing panel must be compatible vintages for equipment protection to occur. A sparing panel is a patch panel with a mechanical relay. Software tells the relay when to switch the path of traffic from one FP to another. Some sparing panels can operate as a patch panel (or fanout panel) without sparing.

Of all the FPs connected to a sparing panel, one must be designated in software as the Spare FP and all other FPs connected to the same panel must be designated as Main FPs. The Spare FP is the standby FP for one or more FPs. When a sparing panel supports only one Main FP, it provides one-for-one equipment protection. When a sparing panel supports more than one Main FP, it provides one-for-n equipment protection, where n is the quantity of Main FPs backed up by the one Spare.

The control processor (CP) software controls which FP or FPs actively use the sparing panel and which one does not or is on standby. When a Main FP fails, the active CP identifies which Main FP has failed, and instructs the sparing panel to switch the relay contacts from the failed FP to the standby FP. The Spare FP becomes an active FP carrying traffic.

A subsequent switchover cannot occur until the failed FP is replaced and returned to service. With any Passport FP in a one-for-one or one-for-n configuration, the replacement FP automatically becomes the standby card and remains standby even if it was previously the active card. If you decide to restore active traffic to the replaced FP, you must switch it back manually

using the appropriate software commands. The switchback behavior for a 1-for-n configuration depends on the software attribute for revertive equipment protection.

It is expected that you will test a replaced FP while it is on standby, then verify the operation of the sparing panel.

Some traffic loss occurs between the start of the switchover and the instant traffic runs through the mate. The amount of loss depends on

- the amount of traffic passing through the FP at the time of the switchover
- whether the FP supports hot, warm, or cold equipment protection (sparing)
- what services the FP supports, for example a DS3 with IMA can take / longer than other cards
- how much configuration (provisioning) is on the FP, for example, with one-for-n sparing, the card that fails cannot be predicted so the configuration cannot be loaded onto the spare card until the failed FP is identified, and traffic or services cannot run on the card until it is loaded
- how fast the mechanical relay is for the specific type of sparing panel (all the values are in milliseconds)

To determine how much time a switchover can take, monitor the duration for your particular configuration of services and the amount of traffic passing through.

When disconnecting cables from the standby FP that uses a sparing panel, traffic is unaffected provided the active mate remains in service. If you accidentally disconnect an active cable, traffic is lost through that connection until the cable is re-connected.

For information on configuring the software to facilitate DS3 or E3 sparing, see 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide*. For the procedures to install, replace or redeploy a sparing panel, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*. For the description and running of card tests, see 241-5701-520 *Passport 7400, 15000, 20000 Troubleshooting and Testing*.

Common characteristics of a sparing panel

All Passport sparing panels share the following common characteristics. Each characteristic applies to each sparing panel in this chapter unless otherwise specified.

A status LED lights to indicate whether the Main or the Spare FP is actively carrying traffic. Whether the switchover is triggered manually or automatically by the system, a status LED on the sparing panel indicates the active FP. When a switchover occurs due to a failed FP or an FP upgrade, putting the replacement FP in service does not automatically cause a switchback of activity.

There is a transmit (Tx) and receive (Rx) pair of connectors per port. The connections between the sparing panel, the electrical FPs, and all equipment up to the far-end connection are intended to be Tx-to-Tx and Rx-to-Rx with Passport equipment. When the Tx-to-Rx combinations get crisscrossed between an FP, a termination panel, and the far-end termination, the effect of one error nullifying another can establish a workable connection. It is important that you label the connection information of each Tx and Rx connection onto the end of the cable at each break in the cable path.

The row of ports labelled Pn beside Main on the sparing panel are to be connected to the same Pn ports on the Main FP. Similarly, the row of Spare Pn ports are to be connected to the same Pn ports on the Spare FP.

The line ports are to be connected from the other-end equipment to the FP, such as

- another FP of the same type in a compatible vintage
- an EdgeLink 100 multiplexor
- a multi-port aggregate device
- other customer premises equipment (CPE) that is compatible with DS3 technology

The monitor ports are used for connecting test equipment to the sparing panel to monitor traffic through the ports of the Main or Spare FP, or the line equipment. Using these ports is your option. Connecting these ports or not has no effect on the operation of the sparing panel.

The 19-inch wide sparing panels that are to be mounted on the 21-inch wide NEBS 2000 frame require the optional adapter brackets from kit NTHW14.

The location of the sparing panel relative to the FPs and the next leg or far-end equipment determines the length of cables required. The density of cables may obstruct air flow that is required to keep the system at a nominal operating temperature.

Power source of a sparing panel

A sparing panel requires power to light the status LEDs and to enable software to switch its on-board mechanical relay (or relays) from one FP to another. A sparing panel gets power through at least one control port cable, but connecting all control port cables eliminates intermediate or transitory LED statuses. When power reaches the sparing panel for a power up, whether or not traffic is passing through the sparing panel, the Main LED lights. If the standby FP was active at the time power was cut off, the Main connection on the sparing panel will automatically switch the traffic over to its Spare connection. The Spare LED lights to confirm it is active.

When both LEDs are not lit, power is not being provided to the sparing panel. When power is cut off to a sparing panel, neither LED is lit and the switchover relay either stays at or automatically gets switched to the Main FP as the default position. If the Main FP was active, that is, already controlling the traffic, then no traffic is lost, traffic continues to and from the sparing panel, and without power a switchover of the traffic to the standby (Spare) FP can no longer occur. If the Main was active, loss of power makes the sparing panel operate as a one-for-one fanout panel. If the standby FP was active, traffic is lost until the sparing panel is powered again.

Loss of power to the sparing panel can be caused by unplugging one end of all control port cables, unseating all FPs, or disrupting any leg of power input to both FPs. Without power

- both sparing panel status LEDs are not lit
- traffic can continue through the main connections (behaving as a patch panel or a one-for-one fanout panel)
- traffic cannot continue through the spare connections
- a switchover to the spare FP cannot occur

When both FPs are in-service and power to the sparing panel resumes

- the LED of the active FP connection lights
- with Passport 15000 or 20000 FPs, the status of active traffic through the sparing panel always aligns with the status of traffic through the FP pair
- an automatic or manual switchover to the mate can occur provided it is in service

Basic functionality and operation of a fanout panel

Fanout panels act as a cable distribution system that provides any of the following functions, depending on the functional processor (FP) they support. Fanout panels can

- provide a break-out (or fanout) for customer equipment connections so that each port of an FP has its own termination point and access
- provide media conversion
- act as a concentrator, reducing the number of cables that are attached to the front of a Passport 15000 or 20000
- provide a common grounding point for cables
- determine the type of connection (DCE or DTE) depending on which connector is used

The connections between the fanout panel, the FPs, and all equipment up to the far-end connection are intended to be Tx-to-Tx and Rx-to-Rx with Passport equipment. When the Tx-to-Rx combinations get crisscrossed between an FP, a termination panel, and the far-end termination, the effect of one error nullifying another can establish a workable connection. It is important that you label the connection information of each Tx and Rx connection onto the end of the cable at each break in the cable path.

Fanout panels do not operate by software or require power. A fanout panel is effectively a fan-in or fan-out patch panel. Some Passport sparing panels automatically become a one-for-one fanout panel when power is cut off.

12-port DS3 or E3 fanout panel NTHW52

The 12-port DS3 or E3 fanout panel NTHW52 is intended as a termination point between customer premises equipment such as a network interface and these DS3 or E3 function processors (FPs)

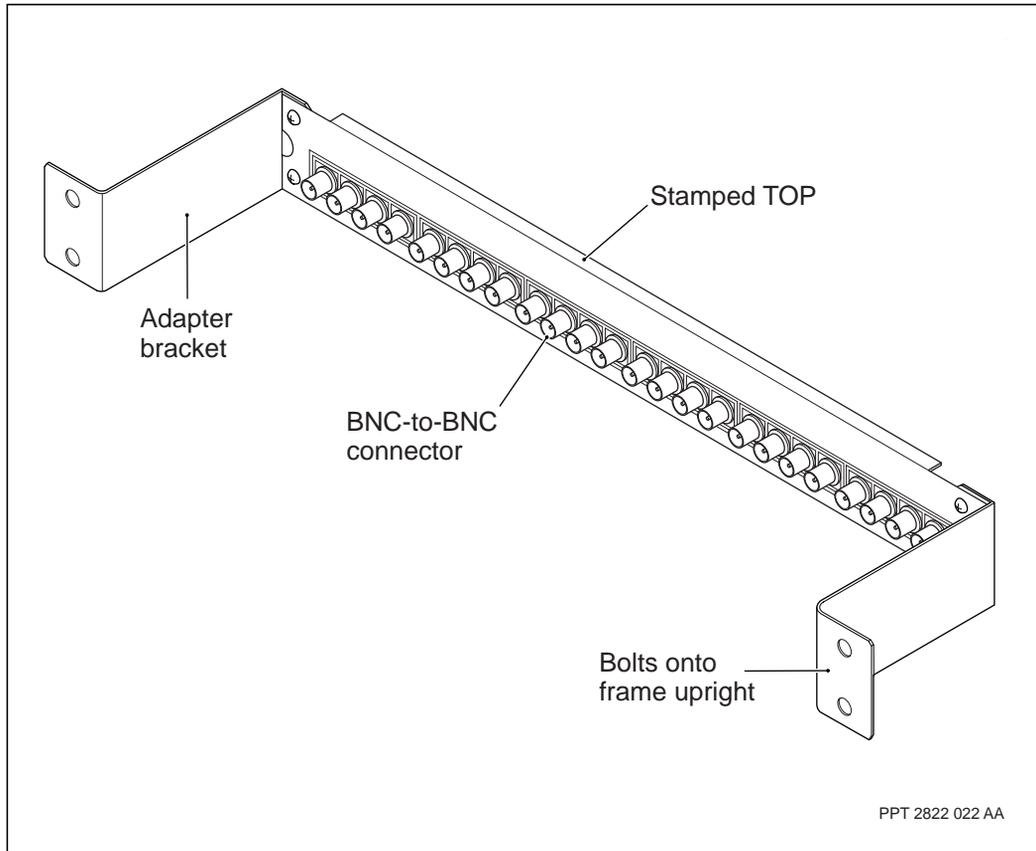
- NTHR23, the “12-port DS3 FP” (page 185)
- NTHR25, the “12-port E3 ATM FP” (page 195)
- NTHR31, the “4-port DS3Ch ATM FP with IMA” (page 175)
- NTHR88 or NTHR89, the “4-port DS3Ch FR FP” (page 166)
- NTHR91, the “4-port DS3Ch FP with AAL1 CES” (page 180)
- NTHW91, the “2-port DS3Ch TDM FP” (page 160)
- NTHW92, the “32-port E1 TDM FP” (page 209)

The NTHW52 has standard coax BNC-to-BNC connections, and allows a transition from BNC connections to high-density 8W8 mini-coax connections on the FPs. See the figure “A 12-port DS3 or E3 fanout panel NTHW52” (page 298).

The NTHW52 requires no software or power to operate.

For the size of the panel, see the table “Dimensions of fanout and sparing panels” (page 313).

Figure 80
A 12-port DS3 or E3 fanout panel NTHW52



Assigning the fanout panel cable connections

Fanout panel connection assignments are specific to the FP and the fanout panel being used. Determine your fanout panel connections from “Assigning 12-port DS3 or E3 fanout panel connections” (page 299).

The sparing panel NTFP99 or NTHR79 can also be deployed as a one-for-one fanout panel (or patch panel) provided the connections are to the Main Tx and Rx ports. Refer to the figures in

- “Assigning sparing panel connections for 2-port DS3C TDM FPs” (page 164)

- “Assigning sparing panel connections for 32-port E1 TDM FPs” (page 213)

Assigning 12-port DS3 or E3 fanout panel connections

Logically assign a connection from a specific slot on an FP to a specific connection on the fanout panel, and align it with a connection to each connection of all equipment between the fanout panel and the far-end final termination of the FP connection.

The 12-port fanout panel has 24 connectors, a transmit (Tx) and receive (Rx) pair for each port. When cabling Passport FPs and sparing panels, do Tx-to-Tx and Rx-to-Rx for all equipment from the FP up to the far-end termination of the FP connection.

The 12-port fanout panel can support three 4-port DS3 or E3 cards from any shelves.

The sparing panel NTFP99 or NTHR79 can also be deployed as a one-for-one fanout panel (or patch panel) provided the connections are to the Main Tx and Rx ports.

12-port DS3 or E3 sparing panel NTQS31

The 12-port DS3 or E3 sparing panel NTQS31 is a patch panel that can fan out connections to and from the network and also provide one-for-six sparing (back up). That is, when up to seven FPs from the same shelf are interconnected through a one-for-six sparing panel, one of the FPs can spare the other six.

The FPs that can use the NTQS31 as a fanout or a sparing panel include

- NTHR23, the “12-port DS3 FP” (page 185)
- NTHR25, the “12-port E3 ATM FP” (page 195)
- NTHR31, the “4-port DS3Ch ATM FP with IMA” (page 175)
- NTHR88 or NTHR89, the “4-port DS3Ch FR FP” (page 166)
- NTHR91, the “4-port DS3Ch FP with AAL1 CES” (page 180)
- NTHW91, the “2-port DS3Ch TDM FP” (page 160)
- NTHW92, the “32-port E1 TDM FP” (page 209)

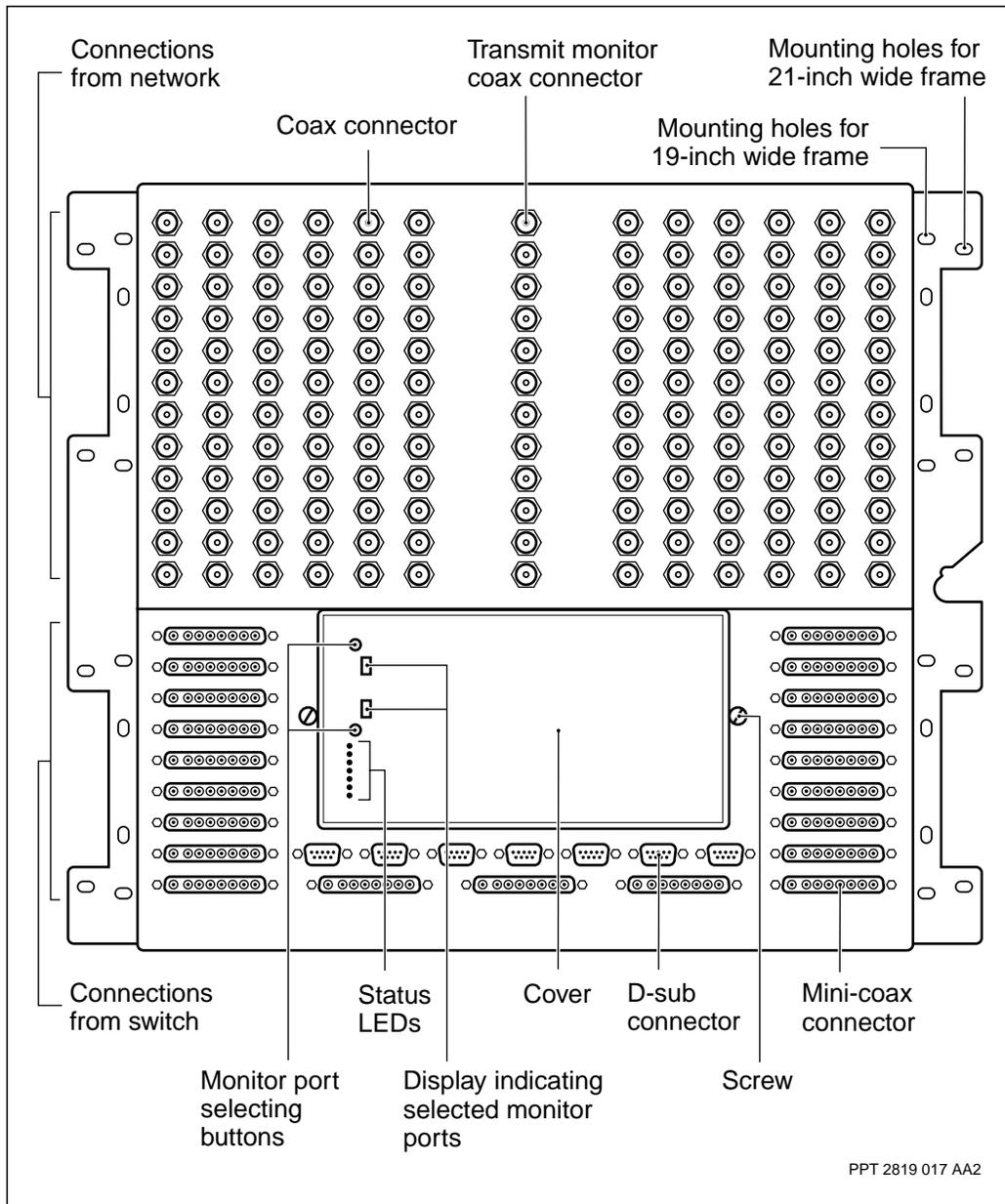
In addition to the sparing panel information provided in “Basic functionality and operation of a sparing panel” (page 292), the NTQS31 has the following distinguishing characteristics.

When the 12-port DS3 or E3 sparing panel is used with 4-port FPs, you must logically assign the same Pn ports on the panel to the Pn ports on the FP. For example, if P0 on the first FP is connected to sparing panel P1, then P0 of all other FPs in the same sparing group must be connected to the other sparing panel P1s. This is made clear in the FP cabling procedures of 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

The faceplate has standard female BNC connectors for the signaling ports, standard female DB9 connectors for the control ports, and proprietary female 8W8 D-sub mini-coax connectors from the FPs. See the figure “A 12-port DS3 or E3 one-for-six fanout sparing panel NTQS31” (page 302).

The size of the panel is in the table “Dimensions of fanout and sparing panels” (page 313). Although the NTQS31 is designed for a 21-inch wide mounting apparatus, it has a second set of mounting holes to enable fastening it to the rails of a Passport 7400 19-inch wide cabinet.

Figure 81
A 12-port DS3 or E3 one-for-six fanout sparing panel NTQS31



Testing a transmit port on the NTQS31

The one-for-six sparing panel also has the hardware capability for monitoring any transmit port on a specific FP. (No software is involved in monitoring.)

The transmit monitor provides access to the transmit (Tx) signal of a port for monitoring by customer premises test equipment, for example, to verify the initial setup of confidence checking. If the external test equipment indicates a problem, then the DS3 or E3 FP and the cable to the port must be tested.

The monitoring signal is 25 dB lower than the transmit signal so that the transmission is insignificantly affected.

Selection of the FP and transmit port must be done at the panel by two push buttons located above the sparing status LEDs on the control module. FP numbers are 1 to 6. Port numbers are indicated in hexadecimal from 0 (zero) to b. The FP and port numbers each have their own LED display beside the selection buttons.

4-port DS3 sparing panel NTHR79

The 4-port DS3 sparing panel NTHR79 provides one-for-one sparing for these FPs

- NTHR31, the “4-port DS3Ch ATM FP with IMA” (page 175)
- NTHR91, the “4-port DS3Ch FP with AAL1 CES” (page 180)

In addition to the sparing panel information provided in “Basic functionality and operation of a sparing panel” (page 292), the NTHR79 has the following distinguishing characteristics.

The NTHR79 is a Class B device for electromagnetic interference (EMI).

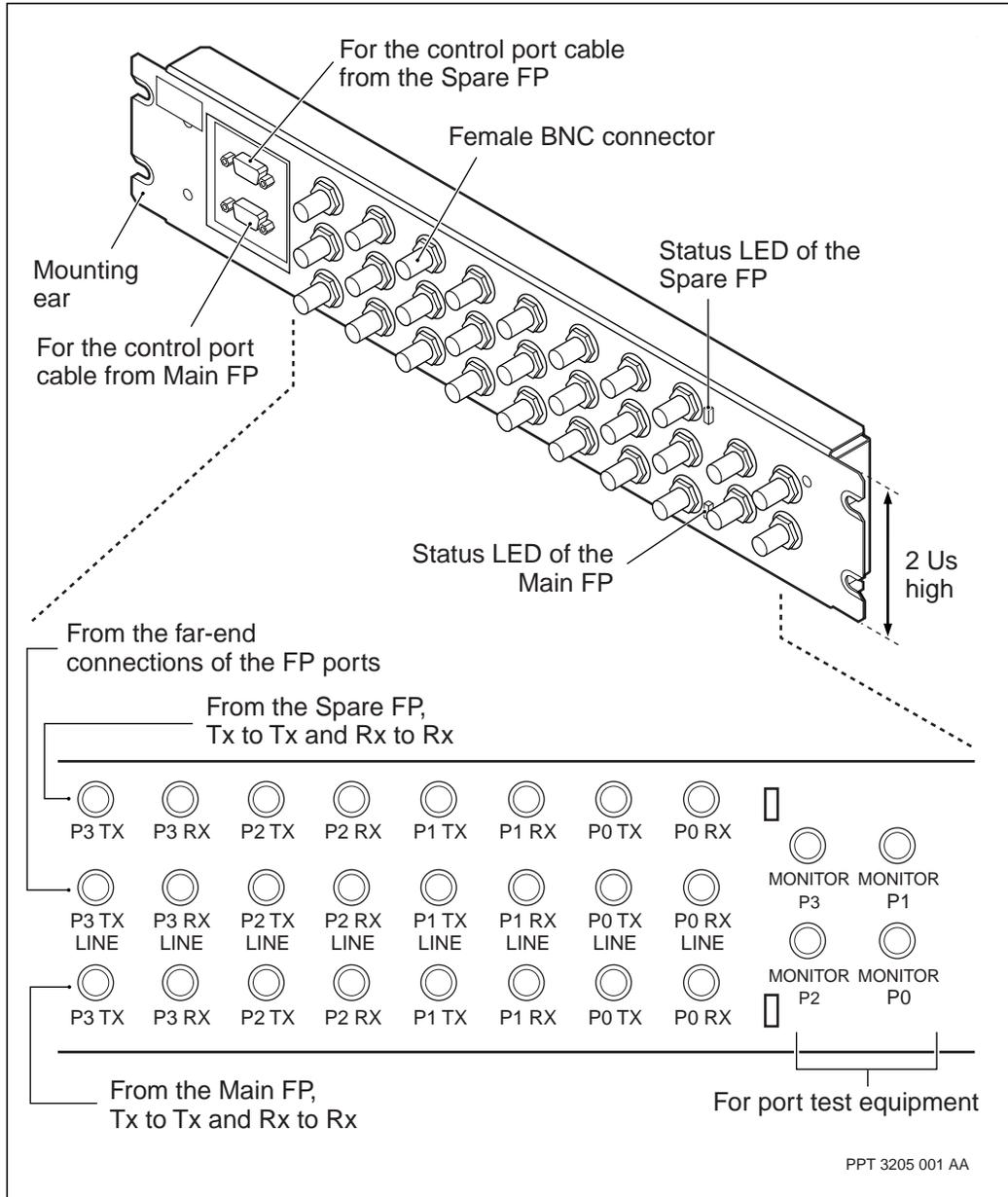
The NTHR79 can be used as a patch panel without sparing (like a one-for-one fanout panel) for one DS3 card provided the signaling and control port cables are connected to the respective Main ports on the sparing panel.

The faceplate has standard female BNC connectors for the signaling ports and female DB9 connectors for the control ports. The monitor ports are also 75-ohm BNC connectors. See the figure “A 4-port DS3 one-for-one 19-inch sparing panel NTHR79” (page 305).

To facilitate more effective cable management, the faceplate includes spaces for writing port connection information.

The size of the panel is in the table “Dimensions of fanout and sparing panels” (page 313).

Figure 82
A 4-port DS3 one-for-one 19-inch sparing panel NTHR79



3-port DS3, E3, or E1 sparing panel NTFP99AA

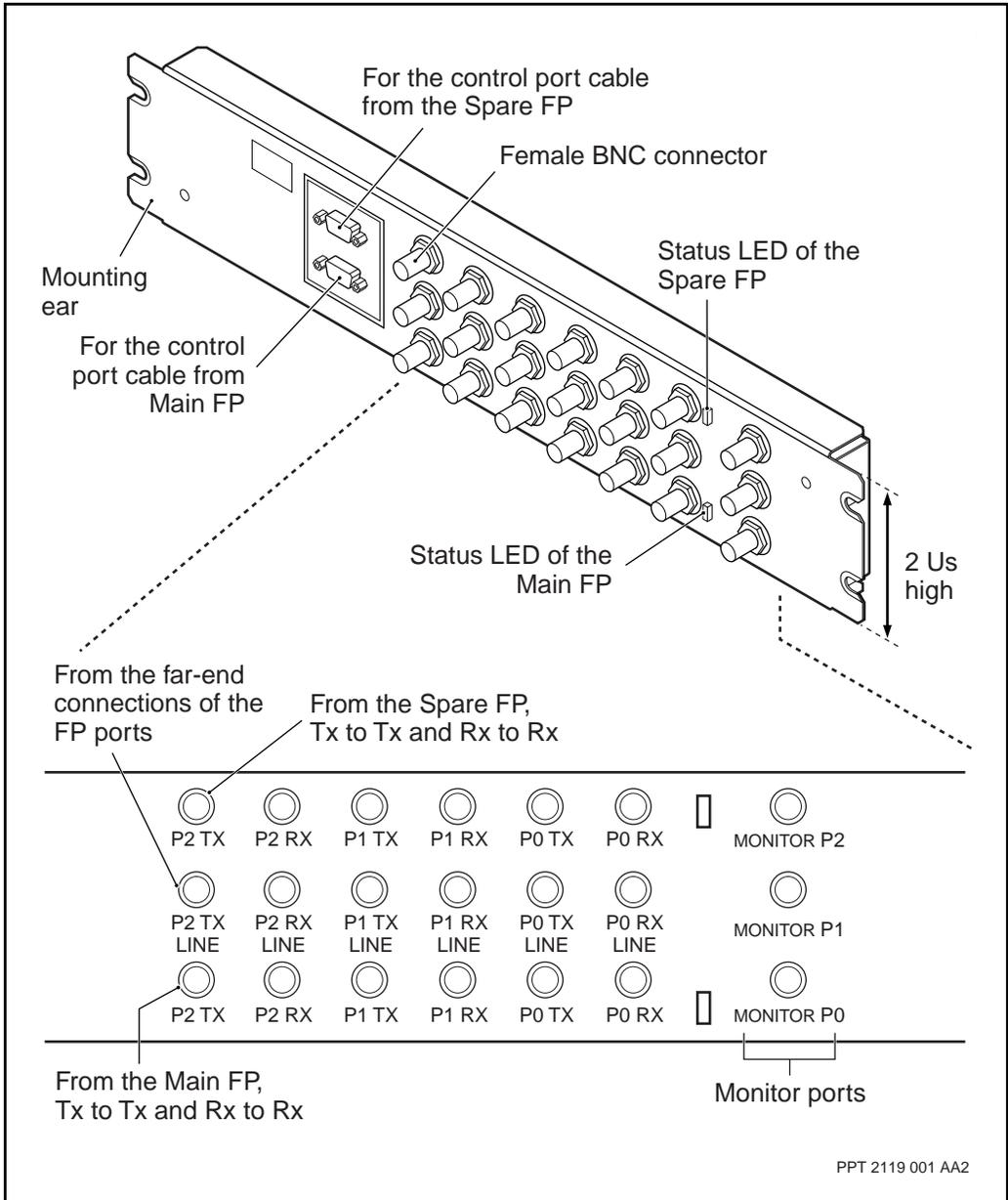
A 3-port DS3, E3, or E1 sparing panel NTFP99AA provides one-for-one sparing to the

- NTHW91, the “2-port DS3Ch TDM FP” (page 160)
- NTHW92, the “32-port E1 TDM FP” (page 209)

In addition to the sparing panel information provided in “Basic functionality and operation of a sparing panel” (page 292), the NTFP99AA has the following distinguishing characteristics.

The NTFP99AA has standard coax BNC-to-BNC connections. See the figure “A 3-port DS3, E3, or E1 one-for-one 19-inch sparing panel NTFP99AA” (page 307).

Figure 83
A 3-port DS3, E3, or E1 one-for-one 19-inch sparing panel NTFP99AA



For the size of the panel, see the table “Dimensions of fanout and sparing panels” (page 313).

The NTFP99AA can be used as a patch panel without sparing (like a one-for-one fanout panel) for one DS3 card provided the signaling and control port cables are connected to the respective Main ports on the sparing panel.

Multiport aggregate device for a 32-port E1 TDM

The 32-port E1 TDM FP uses a multiport aggregate device to break out the ports of the FP. Each multiport aggregate device provides individual access for 16 E1 ports. To break out all of the ports of a 32-port E1 TDM FP, you need two multiport aggregate devices.

The PECs of the multi-port aggregate devices are

- NT0486 for the balanced
- NT0421 for the unbalanced

The multiport aggregate device mounts in a Passport or seismic cabinet, or a standard 19 inch rack. See the figure “Balanced multiport aggregate device” (page 309) or “Unbalanced multiport aggregate device” (page 310).

To add a multiport aggregate device to a NEBS 2000 frame, you also need adapter bracket kit NTHW14.

For more information about the multiport aggregate device, see

- “Multiport aggregate device connections and cabling” (page 310)
- “Multiport aggregate device power and grounding requirements” (page 311)
- “Multiport aggregate device LEDs” (page 311)
- “Multiport aggregate device alarms” (page 312)

Figure 84
Balanced multipoint aggregate device

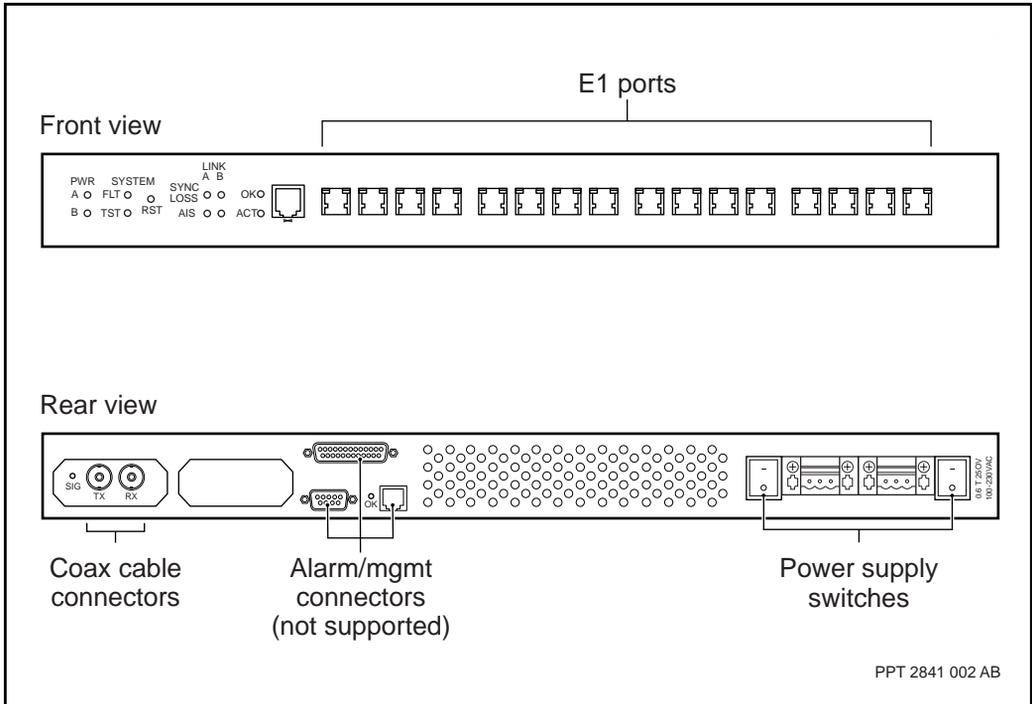
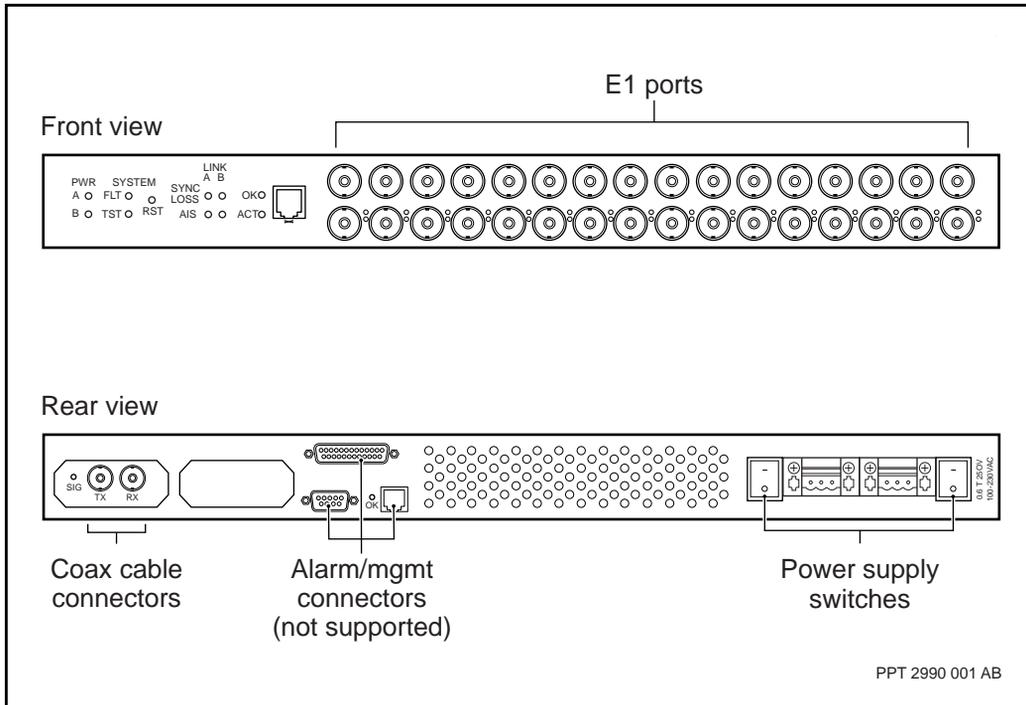


Figure 85
Unbalanced multiport aggregate device



Multiport aggregate device connections and cabling

The multiport aggregate device provides coaxial (unbalanced) connections between the device and the FP or termination panel and RJ45 (120 ohm) connections or coaxial connections for each of the E1 ports. See the table “E1 RJ45 connector pinouts” (page 311).

The maximum cable length for E1 lines to customer equipment is 183 m (600 ft). The E1 balanced and unbalanced interface connections comply with ITU-T Recommendation G.703.

Table 84
E1 RJ45 connector pinouts

Pin number	Signal name
1	Receive (tip)
2	Receive (ring)
3	Frame ground
4	Transmit (ring)
5	Transmit (tip)
6	Frame ground
7	not connected
8	not connected

Multiport aggregate device power and grounding requirements

The multiport aggregate device contains two dc power supplies. When both power supplies are operational, they share power consumption for the device. If one of the power supplies fails, the remaining power supply provides power for the device.

The dc power source must be within the range of -36 to -72 V dc. Maximum power consumption is 20 Watts. The dc power feeds into the system must be protected with an external circuit breaker or fuse, with appropriate voltage ratings and regulatory approvals. The disconnect device must be external to the cabinet or rack and reside in the same room.

You must supply your own power cables. Power cables must be properly grounded.

Multiport aggregate device LEDs

The SYNC LOSS LED for link A indicates a loss of frame (LOF) or loss of signal (LOS) condition on the link between the device and the FP. The SIG LED on the rear of the device is lit when the device is receiving a signal from the FP. You can use the SIG LED for link A in conjunction with the SYNC

LOSS LED to distinguish between LOS and LOF. The AIS LED for link A indicates that alarm indication signal is being received from the Passport switch.

A pair of LEDs for each E1 port indicate loss of signal (LOS) and alarm indication signal (AIS) conditions.

Multiport aggregate device alarms

If a power supply for the multiport aggregate device fails, it reports the condition to Passport and Passport raises an alarm. E1 alarms from customer equipment are reported to the Passport switch through the E1 signal. E1 alarm conditions include AIS, LOF, and remote alarm indication (RAI) conditions.

In the event of an E1 LOS condition, the Passport switch sets LOF, RAI, and AIS alarm conditions on the affected ports. There is no distinction between LOS and LOF.

If the link between the FP and the multiport aggregate device fails, Passport raises alarms on the affected 16 E1 ports.

Dimensions of the termination panels

The table “Dimensions of fanout and sparing panels” (page 313) includes the specifications for all available fanout and sparing panels, sorted by product engineering code (PEC). When a panel that is less than 21 inches wide (W) is to be installed in the NEBS 2000 frame, each panel requires adapter brackets from the kit NTHW14. The installation procedure of each termination panel addresses how to install the brackets in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Table 85
Dimensions of fanout and sparing panels

PEC of panel	Description of termination panel	Outside dimensions (height x width x depth)
NT0421 or NT0486	multiport aggregate device	4.4 H x 43.2 W x 26.8 D cm 1.7 H x 17.0 W x 10.5 D inches (1 unit high)
NTFP99AA	3-port DS3, E3, or E1 one-for-one sparing panel	8.8 H x 48.26 W x 3.0 D cm 3.5 H x 19.0 W x 1.18 D inches
NTHR79	4-port DS3 one-for-one sparing panel	8.89 H x 48.26 W x 1.9 D cm 3.5 H x 19.0 W x 0.75 D inches (2 units high)
NTHW52	a 12-port DS3 or E3 fanout panel	4.44 H x 53.34 W x 1.9 D cm 1.75 H x 21.0 W x 0.75 D inches
NTQS31	a 12-port DS3 or E3 one-for-six fanout sparing panel (comprised of NTHR37, NTHR39, NTHR42, and NTHR43)	44.45 H x 53.34 W x 10.92 cm 17.5 H x 21.0 W x 4.3 D inches Note: there are also holes for mounting it in a Passport 7400 19-inch cabinet.

Chapter 6

Cables and cable management

The types of cables used on a Passport 15000 or 20000 system are divided in this document into

- power cables for operating the system
- telecom signaling cables for connecting the node to other telecom equipment

Although the power cables and telecom cables can share cable management hardware and methods of use, the planning, installation, and replacement of either type of cable is handled separately.

Managing power cables

The hardware and method involved in managing power cables is included with the planning information for preparing a site to accommodate the switch hardware. For power cable specifications, requirements, and limitations, refer to 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide*.

For power cable installation, management, and replacement, refer to 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Managing telecom cables

Managing telecom cables usually means installing the hardware and then connecting cables to it. With a Passport 15000 or 20000, there is optional hardware that facilitates easier, quicker, safer, more efficient, and more

organized methods of cabling. For example, before marking the footprint of the frame onto the floor in preparation for anchoring it, you must consider where optional equipment is located for cabling the system.

The hardware and method involved in managing telecom cables includes:

- “Basic cable management brackets for low-density cabling” (page 316)
- “Cable management brackets for high-density cabling” (page 319)
- “Hardware to manage fiber cable slack near the switch” (page 326)
- “Cabling a card with or without a termination panel” (page 330)

Basic cable management brackets for low-density cabling

When a Passport 15000 or 20000 switch is mounted in a NEBS 2000 frame, the basic cable management brackets are already installed on the frame. If a shelf-based switch is shipped for installation into a mounting apparatus other than the NEBS 2000 frame, basic cable management brackets are shipped without being installed.

A basic cable management bracket is a plastic one with three segregated sections. All switch hardware packages have 28 plastic cable management brackets and two metal brackets at the upper rear of each NEBS 2000 frame. The metal brackets (P0879577) have two fingers each and are intended for the heavier and thicker electrical cables being routed up to a cable trough. (When power cables are routed down through the floor, they are to be fastened to the zig-zag bars of the frame, not the basic or optional cable management brackets.) See the figures

- “Metal and plastic cable management brackets on a NEBS 2000 frame” (page 317)
- “A plastic cable management bracket P0937935” (page 318)

With any switch hardware package, enough cable management brackets are provided to ensure tight and neat cable dressing for low-density cabling of fiber and mini-coax cables. For switch configurations that have higher density cabling, optional hardware is available. See “High-density cable management brackets” (page 320).

Figure 86
Metal and plastic cable management brackets on a NEBS 2000 frame

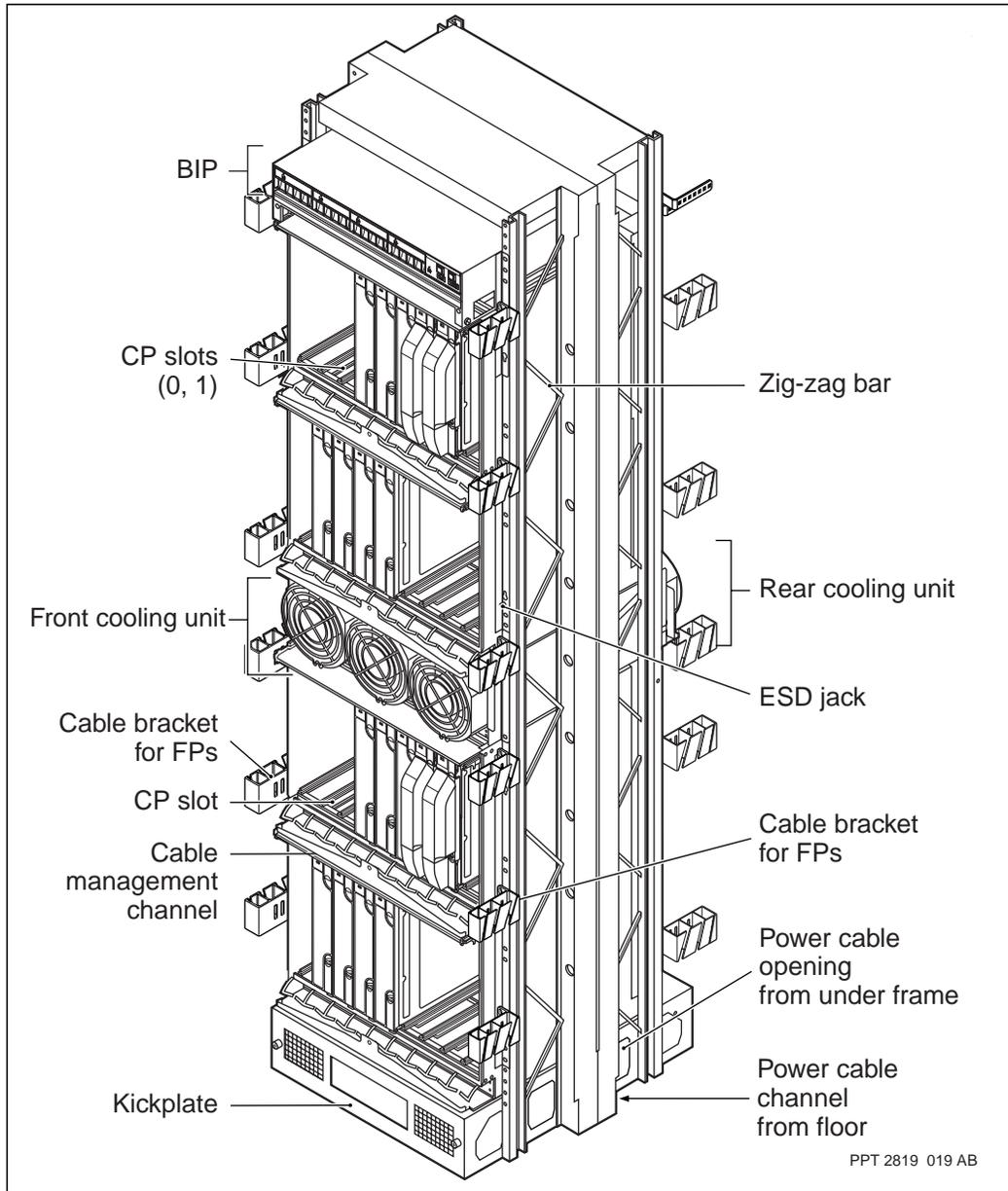
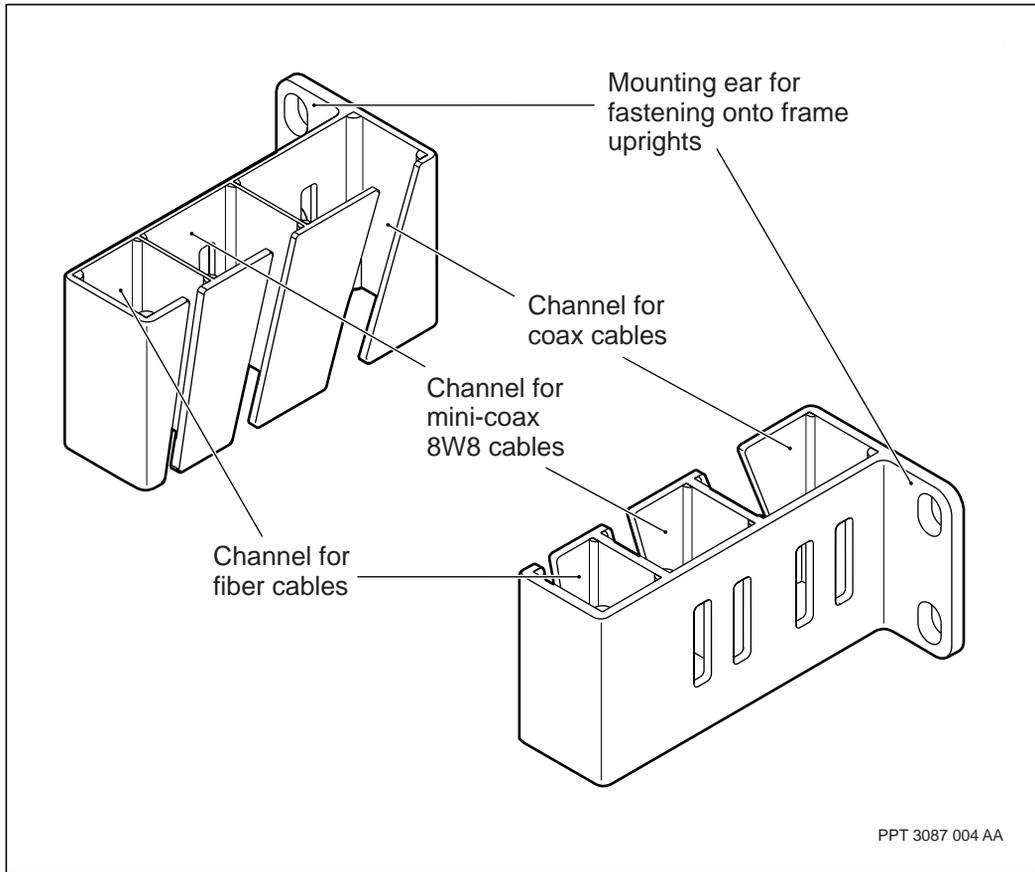


Figure 87
A plastic cable management bracket P0937935



Cable management brackets for high-density cabling

High-density cable management must be done on a NEBS 2000 frame when the number of cables exceeds the capacity of the basic cable management brackets. See the 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* to determine whether you need a low, high, or very high density cable management.

The optional cable management hardware that accommodates higher-density cable management for one or two switches in a frame includes

- paired plastic brackets as described in “High-density cable management brackets” (page 320)
- the extended cable management brackets as described in “Very high-density cable management brackets” (page 321)

You can use sets of the optional cable management brackets for one or two switches in a NEBS 2000 frame as follows:

- a set of high-density brackets on one or both sides of the frame
- a set of extended cable management brackets on one or both sides of the frame to accommodate very high-density mini-coax or standard coax cabling
- a set of high-density brackets and a set of extended cable management on the same side of the frame

See 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* to choose which optional hardware is needed to accommodate your cable density.

Since the location and quantities of FP types in one or two switches determine whether the FP cables must be routed to the left or right side of the frame, and up or down the side of the frame, see 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*, the section on choosing card slots. Use this information to identify where optional cable management brackets ought to be installed on the frame.

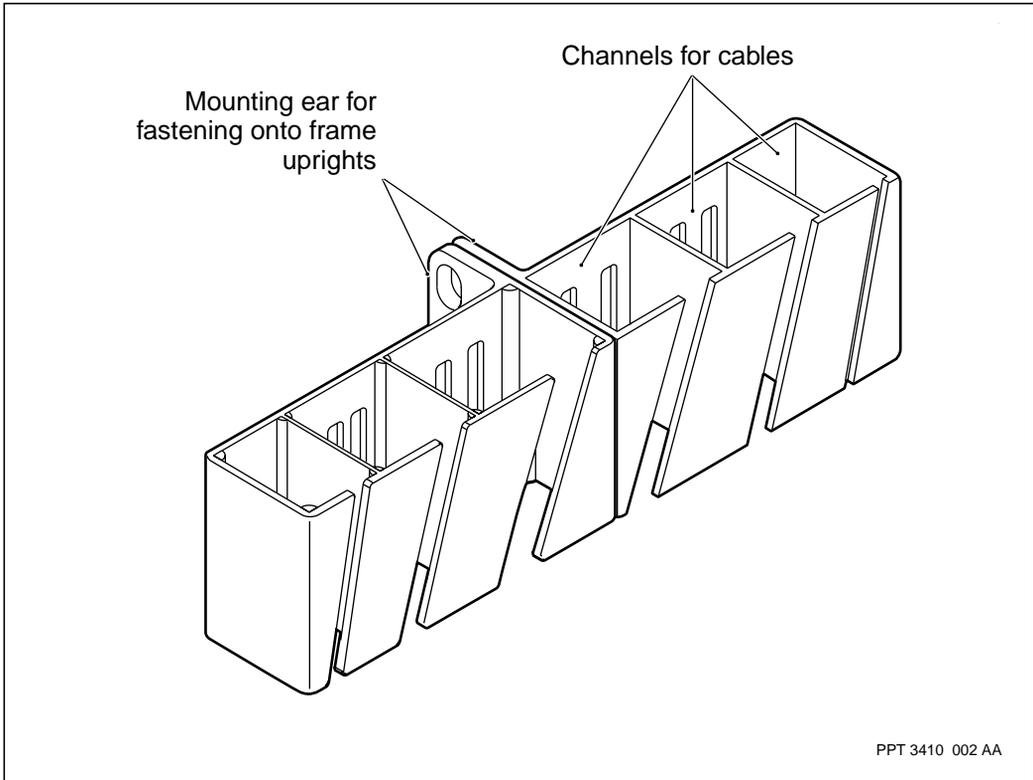
High-density cable management brackets

The high-density cable brackets double the capacity of the basic brackets by pairing them back-to-back as shown in the figure “High-density cable management bracket pair” (page 321). The second plastic brackets can be added onto the frame at any time and use the original bracket mounting holes. These brackets replace the single basic plastic brackets as shown in the figure “A plastic cable management bracket P0937935” (page 318) or replace all but two of the older two-finger metal brackets as shown in the figure “Metal and plastic cable management brackets on a NEBS 2000 frame” (page 317).

Each high-density cable management bracket (part number P0937935) accommodates fiber or mini-coax cables, or both. The 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* indicates how many cables of each kind fit through each bracket, and how to calculate how many your switch or switches in a NEBS 2000 frame will need.

When cable densities exceed the capacity of the high-density cable management brackets, you may need to use the optional coax brackets described in “Very high-density cable management brackets” (page 321).

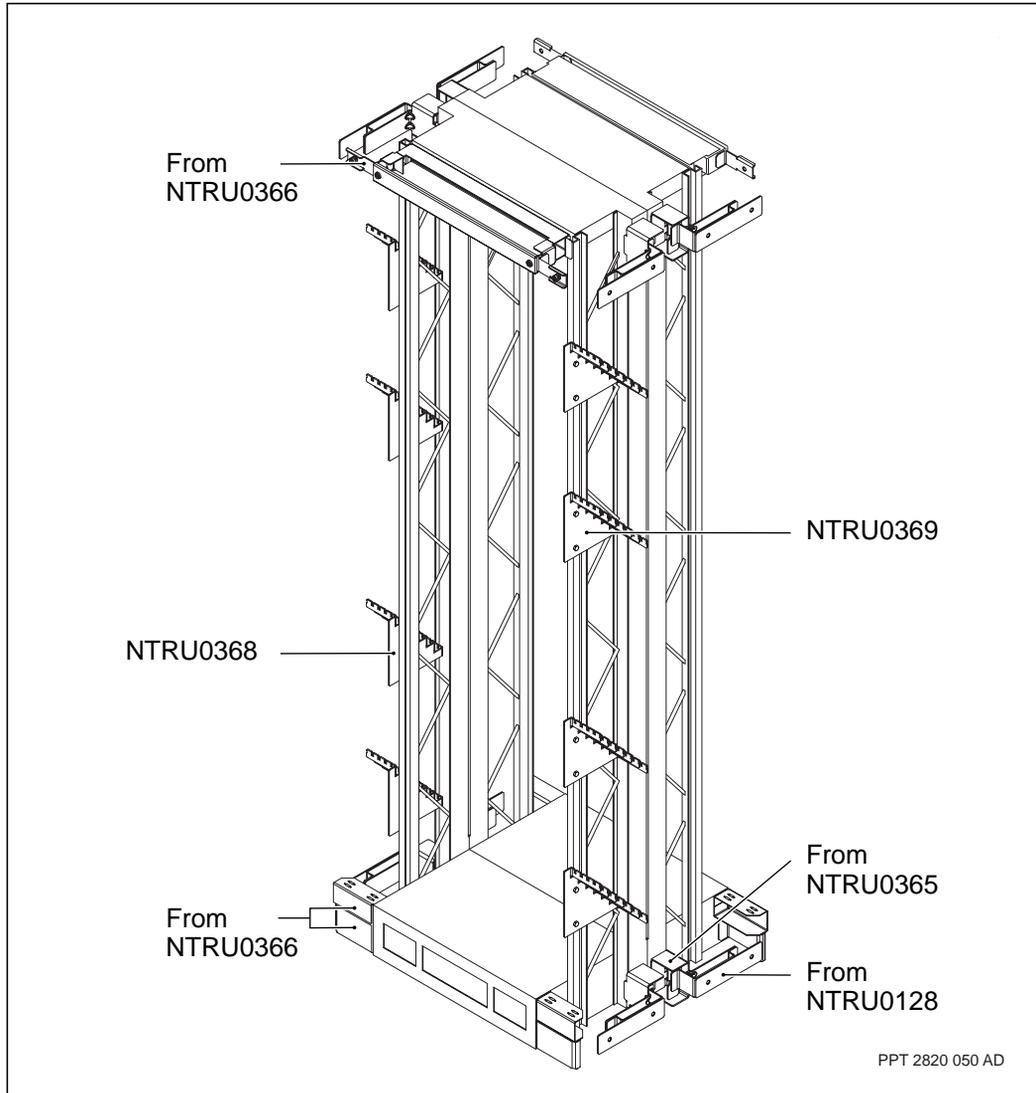
Figure 88
High-density cable management bracket pair



Very high-density cable management brackets

The very high-density cable management brackets are the optional extended cable management brackets that can be mounted to one or both sides of a frame as shown in the figure “A NEBS 2000 frame with extended cable management brackets and side panel brackets” (page 322). Up to four brackets fit on each side of a frame. The bracket installation procedure identifies where the brackets are fastened to the frame. The brackets must be mounted onto the frame before it is anchored to the floor unless enough unobstructed space is kept available to add the brackets later. See 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* to plan the frame footprint to include space for the brackets.

Figure 89
A NEBS 2000 frame with extended cable management brackets and side panel brackets

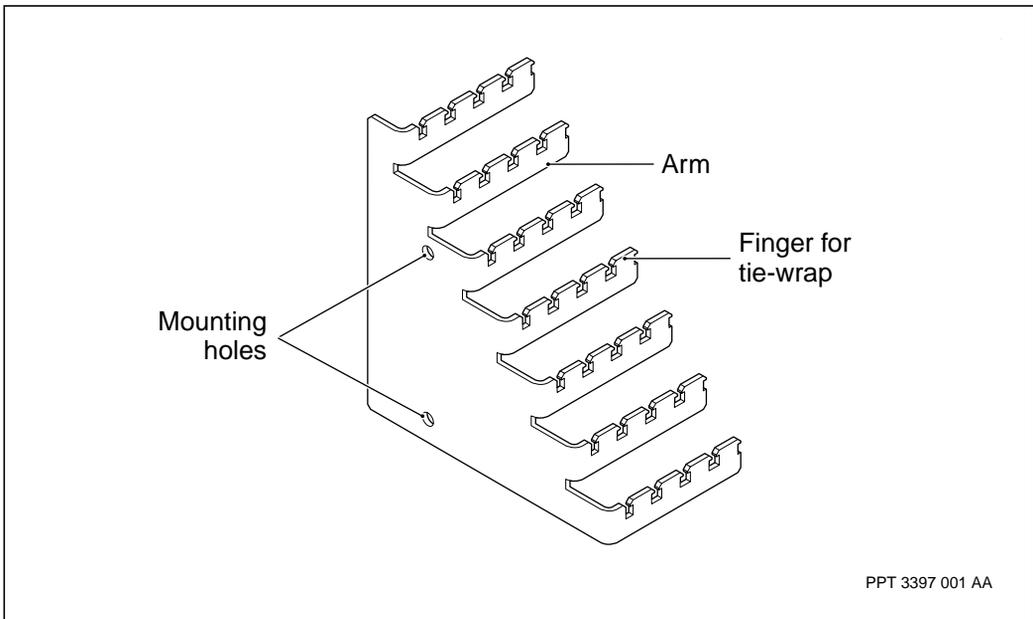


The extended cable management brackets accommodate only standard coax or the proprietary 8W8 mini-coax cables of Nortel Networks. A bracket for the left side of the frame (while facing the front of the switch) has part number

NTRU0368 while the right side has NTRU0369 as shown in the figure “An extended cable management bracket for the right side of a NEBS 2000 frame” (page 323).

The 241-1501-205 *Passport 15000, 20000 Site Requirements and Preparation Guide* indicates how many cables of fit onto each bracket. The 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade* has the task flows to indicate when the installation procedure is to be done, and how to efficiently bundle the cables onto the brackets. The effect of this bundling is described in “Location of specific FP cables in a bundle” (page 328).

Figure 90
An extended cable management bracket for the right side of a NEBS 2000 frame



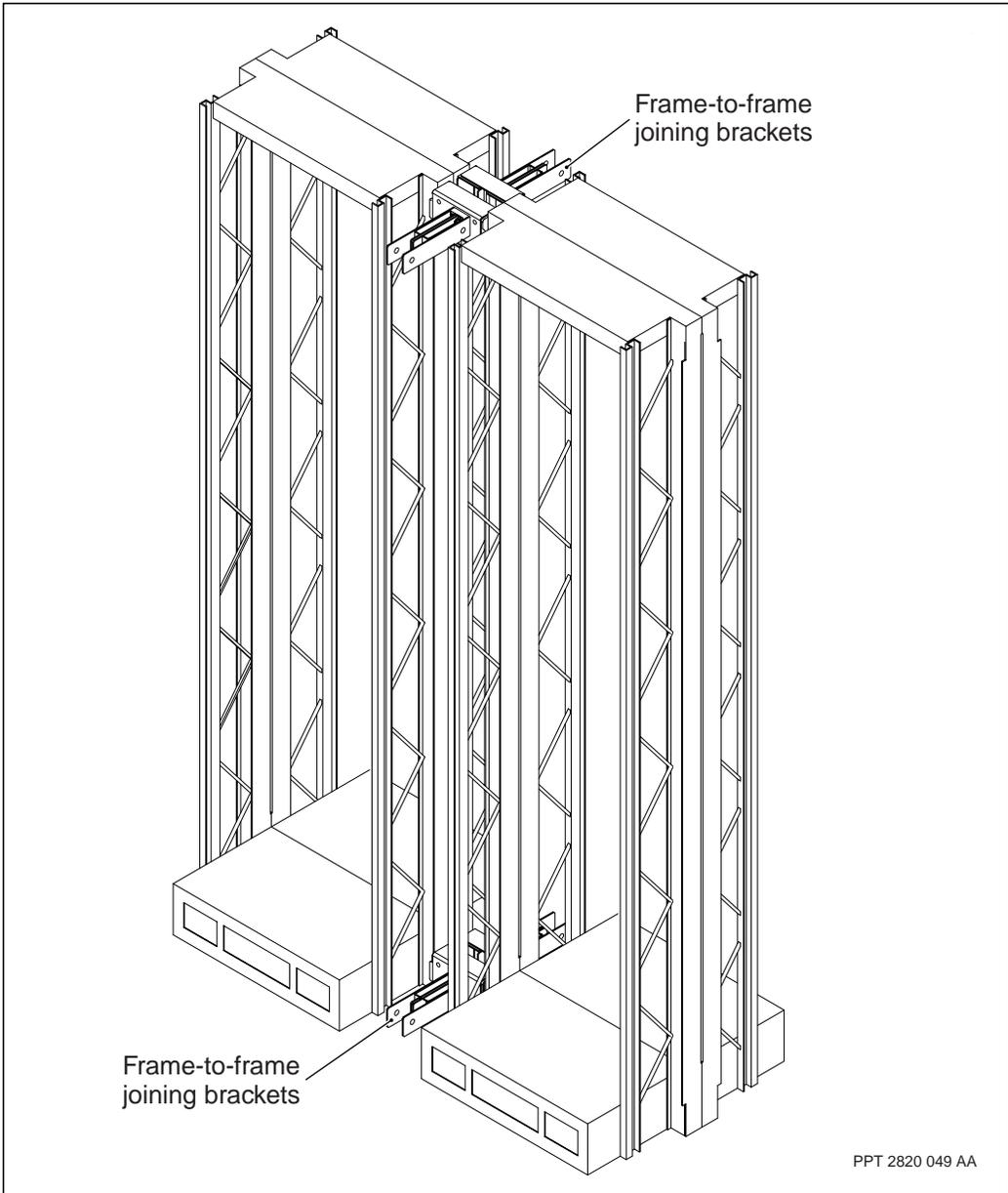
The hardware kits that appropriately space parallel sets of extended cable management brackets between two joined frames have these product engineering codes (PECs):

- NTRU0128 for side panel mounting brackets

- NTRU0365 for frame spacer brackets
- NTRU0366 for cable covers (front or rear panels)

To ensure that cable extension brackets fit between two Nortel Networks frames and allow space for the addition or removal of FP cables, the minimum distance between the frames is determined by adding optional joining brackets. See the figure “Frame-to-frame joining brackets” (page 325).

Figure 91
Frame-to-frame joining brackets

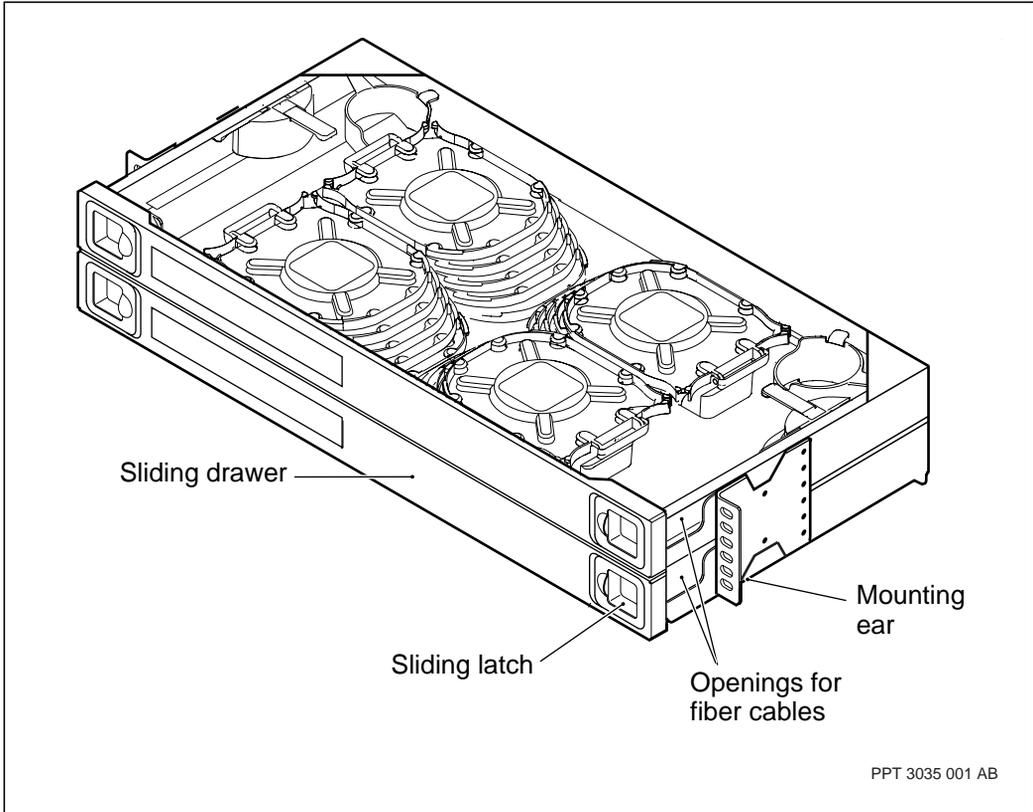


Hardware to manage fiber cable slack near the switch

Fiber cable slack can be managed near the Passport 15000 or 20000 switch by installing one or more optional dual-drawer fiber management units in a NEBS 2000 frame or equivalent near the switch.

The fiber management unit is manufactured by ADC. The unit includes two latched drawers with 20 fiber trays each. See the figure “A dual-drawer fiber management unit NTHW50” (page 327). Each tray accommodates up to 2 m (6.5 ft.) of one single-mode or multi-mode fiber cable with the appropriate bend radius. The fiber unit has mounting ears to fit a 21-inch (53.34-cm) wide frame or rack. Blank labels are included on each tray so that the origination and destination can be recorded. Each drawer is labeled Fiber manager. Fiber cables are routed in and out of the unit through the sides.

Figure 92
A dual-drawer fiber management unit NTHW50



Location of specific FP cables in a bundle

During initial installation or when a control processor (CP) or function processor (FP) is added to a Passport 15000 or 20000, the cable connections are labeled as well as the bundle into which all cables of an FP are tie-wrapped. Tracing a single cable for replacement is difficult unless you know which bundle the cable is in. Have the network operator identify which FP has the signaling problem so that you can trace the cable from end-port to end-port.

When the extended cable management brackets are used on both sides of a NEBS 2000 frame, up to 700 cables can be routed from two Passport 15000 or 20000 switches fully provisioned with 12-port FPs. When replacing a CP or an FP cable, use the tables “Position of each FP cable bundle on right-side extended cable brackets” (page 328) and “Position of each FP cable bundle on left-side extended cable brackets” (page 329) to locate the labeled cable bundle that holds the cable to be replaced.

Note: Slot 8 is omitted from the tables because it was intended to house an OC card.

Table 86
Position of each FP cable bundle on right-side extended cable brackets

Lower shelf slot numbers	Lower shelf slot numbers	Upper shelf slot numbers	Upper shelf slot numbers
15	7	15	7
14	6	14	6
13	5	13	5
12	4	12	4
11	3	11	3
10	2	10	2
9	1	9	1
Note: slot 1 of the shelf may contain a CP instead of an FP.			

Table 87
Position of each FP cable bundle on left-side extended cable brackets

Upper shelf slot numbers	Upper shelf slot numbers	Lower shelf slot numbers	Lower shelf slot numbers
15	7	15	7
14	6	14	6
13	5	13	5
12	4	12	4
11	3	11	3
10	2	10	2
9	1	9	1
Note: slot 1 of the shelf may contain a CP instead of an FP.			

Cabling a card with or without a termination panel

The information about custom-made or prefabricated cable assemblies for a plug-in card or a termination panels is provided with the description of each control processor (CP) or function processor (FP) card. Each description lists the optional prefabricated cable assemblies and includes the specifications for type of cable and connector, and includes the port pinouts of the faceplate connections.

In general, cabling a Passport card port to a termination panel port means doing Tx-to-Tx and Rx-to-Rx connections for the entire end-to-end connection path. You can also determine the appropriate Tx-to-Rx combinations depending whether the signal is exiting one unit and entering the other provided the pattern of combinations is the same for the entire end-to-end connection path. When the Tx-to-Rx combinations get criss-crossed between an FP, a termination panel, and the far-end termination, the effect of one error nullifying another can establish a workable connection. It is important that you label the connection information of each Tx and Rx connection onto the end of the cable at each break in the cable path.

Specific cabling information for the plug-in CPs and FPs is included in “Control and function processors” (page 141).

Specific cabling information for the fanout and sparing panels of the DS3 cards is included in “Termination panels for FPs” (page 291).

Preparing OC or STM fiber distribution cables

The fiber distribution cables connect the ports on the function processors (FPs) to a termination port. The customer must supply the fiber distribution cables for the Passport 15000 or 20000.

The fiber cable connectors for Passport 15000 or 20000 FPs are the LC, MT-RJ, or SC type. Choosing the type of cable and connectors for a fiber optic FP depends on the terminations at both ends. You must provide the cables and connectors that link the FPs to the far end. The 16-port OC-3/STM-1 cards have either LC or MT-RJ connectors. See the figures “A duplex cable assembly with LC-to-LC connectors” (page 333) and “Cable assembly with an MT-RJ fiber connector and a duplex SC connector” (page 334).

Handling any system cable is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Single-mode FPs at both ends can operate with either multimode or single-mode fiber cables. The difference in performance depends on the length of fiber cable. Multimode FPs at both ends can operate with only multimode cables.

The length of a fiber cable is determined from the exact path of fiber from its port on an FP to its termination port. The path depends on

- where the FP is located in the NEBS 2000 frame (the node, the shelf, and the slot)
- which way along the cable management channel on the Passport 15000 or 20000 that the cables continue their path; fiber cables can go in either direction
- whether the cabling is routed along the side of the frame (or equivalent mounting apparatus) under the floor or through an overhead trough
- whether there is an optional fiber management unit NTHW50 for slack control
- whether you use a fiber patch panel between the termination ends
- what the angle of connection is at each termination port
- where the far-end termination port is located

Determine the length of a fiber cable from an FP by measuring the exact path from each port on the faceplate to its termination port.

Note: If using a metal tape measure, avoid contacting live power cables or connections.

Remove any cable slack resulting from cautious cable cutting before fastening the second connector to the cable. Otherwise, install and cable a fiber management unit NTHW50 as described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

To prepare FP distribution cables, do the procedure “Preparing OC or STM fiber distribution cables” (page 331).

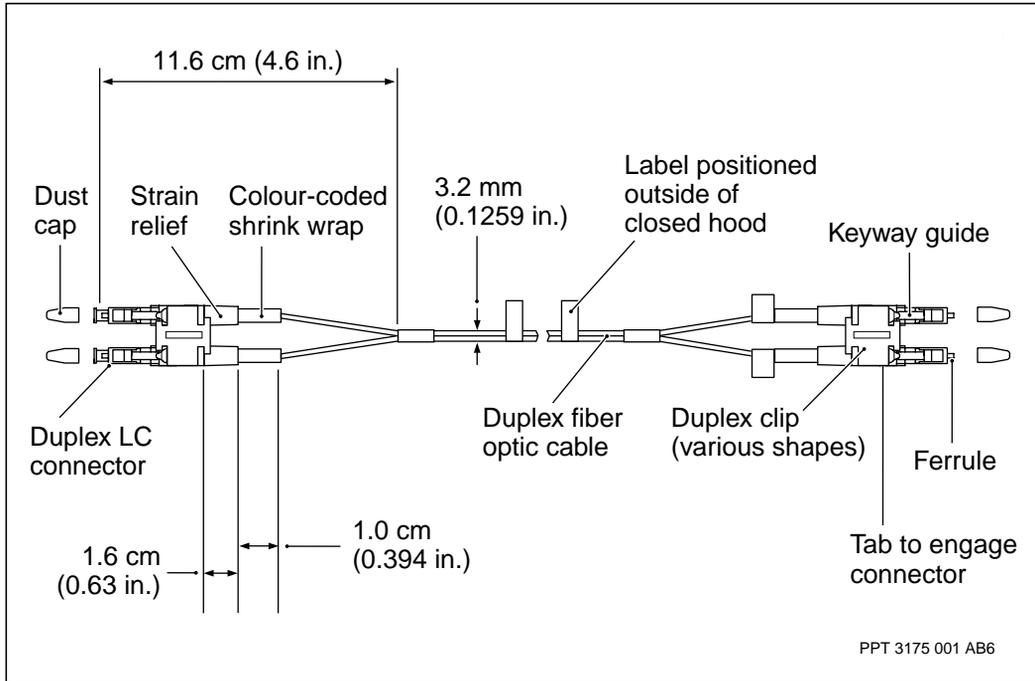
LC fiber cables and connectors

The small form LC transceiver on the faceplate of a 16-port OC-3/STM-1 FP accommodates simplex or duplex single-mode fiber connectors. For an example of a cable assembly, see the figure “A duplex cable assembly with LC-to-LC connectors” (page 333).

Handling fiber cables is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Some FPs have small form pluggable (SFP) optical modules that plug into the FP faceplate, and interface the LC cable connectors. For information about SFPs, see SFP optical module.

Figure 93
A duplex cable assembly with LC-to-LC connectors

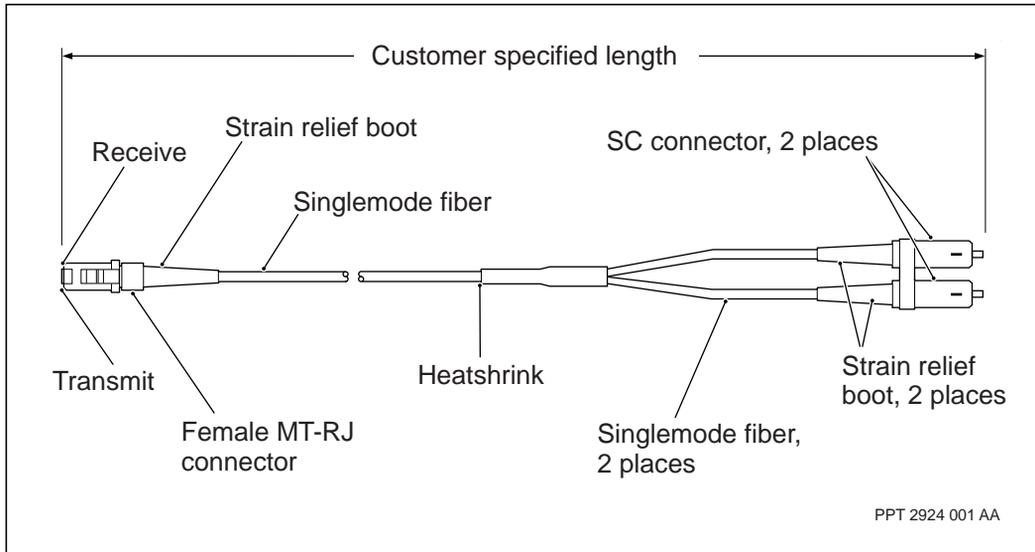


MT-RJ fiber cables and connectors

The MT-RJ connector accommodates two fibers. One fiber carries the transmit signal and the other fiber carries the receive signal. The cable is a 3-mm (1/8-inch) jacketed fiber-optic cable with two strands of single-mode fiber in it. See the figure “Cable assembly with an MT-RJ fiber connector and a duplex SC connector” (page 334). Ensure that the manufacturer of the cable identifies which SC connector is to transmit and which is to receive.

Handling fiber cables is described in 241-1501-240 *Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade*.

Figure 94
Cable assembly with an MT-RJ fiber connector and a duplex SC connector



Preparing coax distribution cables

Cards requiring coax connections at the faceplate of FPs or a termination panel can be provided by Nortel Networks in prefabricated cable assemblies or must be provided by you. To custom make your own cables for a specific type of FP, refer to the cable assembly specifications in “Control and function processors” (page 141). Use the specifications to make your cables. If the FP description does not list cable assembly parts, you must use the appropriate prefabricated cable assemblies.

The specialized mini-coax distribution cables for the 4-port DS3 and 12-port DS3 or E3 cards are available from Nortel Networks in prefabricated assemblies. These cables have special 8W8 connectors at the FP end to accommodate dense cabling at the faceplate of the cards. The other end of the FP cable can be standard coax or mini-coax 8W8.

The PEC of all available FP distribution cables is in the tables

- “Prefabricated FP control port cables for connecting to a sparing panel” (page 335)
- “Prefabricated 75-ohm cables for connecting FPs to a sparing panel” (page 336)
- “Prefabricated DS3 or E3 cables connecting FPs to an NTHW52” (page 336)

Note: There is no control cable between an FP and an NTHW52.

Table 88
Prefabricated FP control port cables for connecting to a sparing panel

PEC	Description	Length
NTHR69	DB9 sparing control port	2.5 m (8.2 ft)
NTHR70	DB9 sparing control port	5.0 m (16.4 ft)
NTHR71	DB9 sparing control port	15 m (49.2 ft)

Table 89
Prefabricated 75-ohm cables for connecting FPs to a sparing panel

PEC	Description	Length
NTFP19AD	male straight BNC to male straight BNC	3.0 m (9.8 ft)
NTFP19AE	straight male BNC to straight male BNC	15 m (49 ft)
NTHR58	male 8W8 mini-coax to male BNC	2.5 m (8.2 ft)
NTHR59	male 8W8 mini-coax to male BNC	5.0 m (16.4 ft)
NTHR60	male 8W8 mini-coax to male BNC	15 m (49.2 ft)
NTHR69	DS3 or E3 male D-sub to male D-sub	2.5 m (8.2 ft)
NTHR70	DS3 or E3 male D-sub to male D-sub	5.0 m (16.4 ft)
NTHR71	DS3 or E3 male D-sub to male D-sub	15 m (49.2 ft)
NTHR72	male 8W8-to-8W8 mini-coax	2.5 m (8.2 ft)
NTHR73	male 8W8-to-8W8 mini-coax	5.0 m (16.4 ft)
NTHR74	male 8W8-to-8W8 mini-coax	15 m (49.2 ft)
<p>For the mapping of 8W8 connector pins to the BNC connectors for software port numbering, see “Assigning sparing panel connections for a 12-port DS3 or E3 FP” (page 192).</p>		

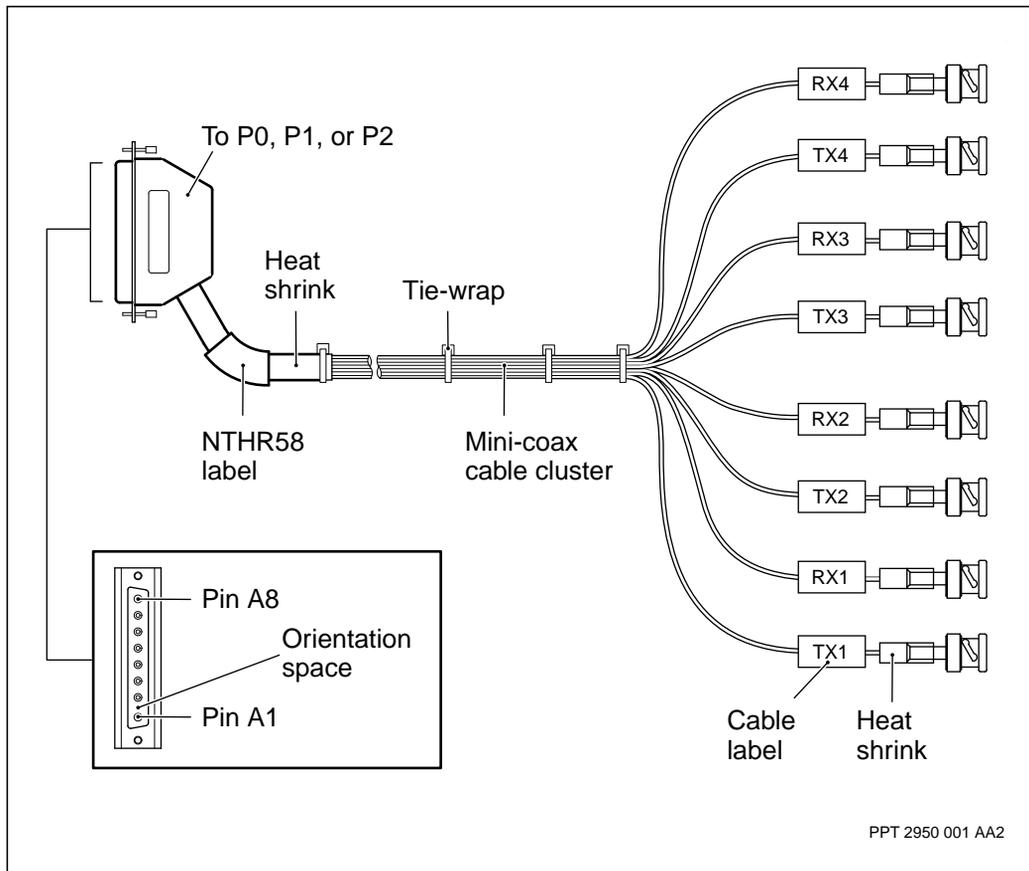
Table 90
Prefabricated DS3 or E3 cables connecting FPs to an NTHW52

PEC	Description	Length
NTFP19AD	straight male BNC to straight male BNC	2.5 m (8.2 ft)
NTFP19AE	straight male BNC to straight male BNC	15 m (49.2 ft)
NTHR58	male 8W8 mini-coax to male BNC	2.5 m (8.2 ft)
NTHR59	male 8W8 mini-coax to male BNC	5.0 m (16.4 ft)
NTHR60	male 8W8 mini-coax to male BNC	15 m (49.2 ft)
<p>For the mapping of 8W8 connector pins to the BNC connectors for software port numbering, see “Assigning the fanout panel cable connections” (page 298).</p>		

Note: When the FPs have more than four ports each or the total number of FP connections per shelf is 64 or more, the optional extended cable management brackets must be installed.

The cable assembly NTHR58 has the same connector pattern and labels when connected to any of the three ports on a 12-port DS3 or E3 faceplate. The position of the cable at P0, P1, or P2 determines the port mapping between the 8W8 connections at the faceplate and the BNC connectors at a sparing panel or fanout panel at the other end. Use the figure “Labels of mini-coax and BNC cable connections on an NTHR58 cable assembly” (page 338) to label the cables at the FP end and at the BNC end.

Figure 95
Labels of mini-coax and BNC cable connections on an NTHR58 cable assembly



Preparing control port cables

For the hardware configurations involving sparing panels, the control port cables are available from Nortel Networks in prefabricated assemblies. Refer to the table "Prefabricated FP control port cables for connecting to a sparing panel" (page 335).

You can custom make your own control port cable using the specifications described in the section on cable assemblies for each type of FP in “Control and function processors” (page 141). The control port pinout is the same for all DS3 or E3 cards.

Handling alarm cables

A Passport 15000 or 20000 switch has internal alarm cables installed at the time of shipping, and can have had external alarms added for the site. Internal alarm cables connect the breaker interface panel (BIP) in a NEBS 2000 frame to the switch, while external alarm cables connect the BIP to site alarms such as a LED or end-of-aisle lamp. The internal alarm cables for a second switch are typically included even if it was not installed.

Cables are mounted in exclusive bundles on different paths against the frame of the Passport 15000 or 20000. The current from power cables can interfere with the transmission of signals over coax, therefore the power and alarm cables follow different paths.

There is no bend radius for electrical cable, however, observe a 4-cm (1.5-inch) bend radius for 1/0 AWG cable. Any cable connected to the BIP must be flexible enough to do right-angle bends with cracking its sheath.

When routing the alarm cables, keep them away from the battery return (positive) and battery (negative) cable pairs. Otherwise, the cables can behave like antennas that transmit electromagnetic interference (EMI).

Prefabricated DS3 or E3 cable assemblies

The mini-coax cables for the 4-port DS3, 12-port DS3, or 12-port E3 have special 8W8 connectors at the FP end to accommodate dense cabling at the faceplate of the cards. The other end of the FP cable can be standard coax or mini-coax 8W8. The cables that connect FPs to various termination panels are available from Nortel Networks.

The PEC of each cable is in the tables

- “Prefabricated FP cable assemblies to a fanout panel NTHW52” (page 341)
- “Prefabricated FP cable assemblies to a one-for-six sparing panel NTHR37” (page 341)
- “Prefabricated FP cable assemblies to the control ports on an NTHR37” (page 341)

Table 91
Prefabricated FP cable assemblies to a fanout panel NTHW52

PEC	Description	Length
NTHR58	DS3 or E3 mini-coax 8W8 to BNC cable	2.5 m (8.2 feet)
NTHR59	DS3 or E3 mini-coax 8W8 to BNC cable	5.0 m (16.4 feet)
NTHR60	DS3 or E3 mini-coax 8W8 to BNC cable	15 m (49.2 feet)

Table 92
Prefabricated FP cable assemblies to a one-for-six sparing panel NTHR37

PEC	Description	Length
NTHR72	DS3 or E3 mini-coax 8W8 to 8W8 cable	2.5 m (8.2 feet)
NTHR73	DS3 or E3 mini-coax 8W8 to 8W8 cable	5.0 m (16.4 feet)
NTHR74	DS3 or E3 mini-coax 8W8 to 8W8 cable	15 m (49.2 feet)

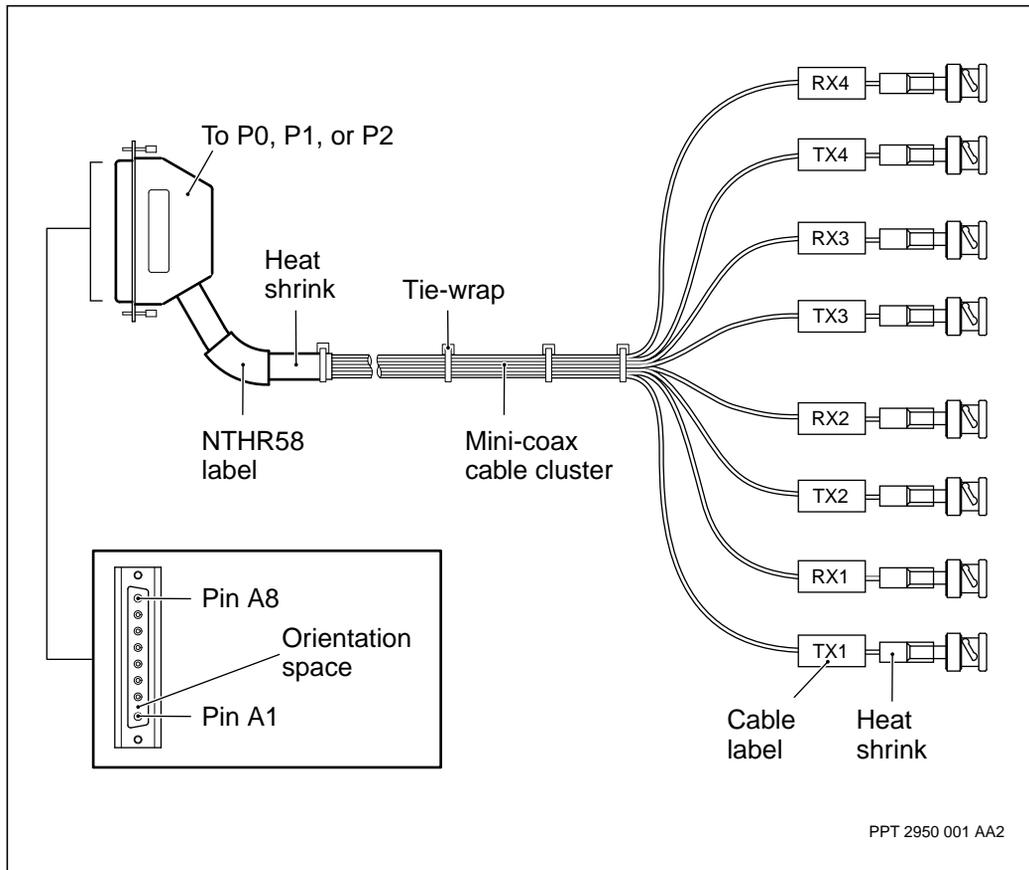
Table 93
Prefabricated FP cable assemblies to the control ports on an NTHR37

PEC	Description	Length
NTHR69	DS3 or E3 D-sub to D-sub cable	2.5 m (8.2 feet)
NTHR70	DS3 or E3 D-sub to D-sub cable	5.0 m (16.4 feet)
NTHR71	DS3 or E3 D-sub to D-sub cable	15 m (49.2 feet)

Check your site records to identify which BNC connectors map to CPE at the fanout or sparing panel. The cable assemblies that are identified by PECs NTHR58, NTHR59, and NTHR60 have numbered labels distinguishing each BNC connector from 1 to 8. The ports of the mini-coax connectors at the other end of each cable assembly are not visibly numbered, however, the pattern of pin numbering is the same for all mini-coax connectors. The mini-coax pin at the end of the D-sub nearest the exiting cluster of mini-coax cables is

numbered 1, while the pin furthest from the cluster is numbered 8. See the figure “Pinouts of mini-coax and BNC cable connections of an NTHR58” (page 342).

Figure 96
Pinouts of mini-coax and BNC cable connections of an NTHR58



Chapter 7

Using status indicator LEDs and sounds

The status of hardware equipment on a Passport 15000 or 20000 switch is indicated by a system of colored and shaped LEDs. A lit LED indicates one status in one color. On the same type of part or assembly, the LED is always in the same position relative to its mates. While the equipment is powered, there is always one LED that is lit.

The status of most of the hardware equipment on a Passport 15000 or Passport 20000 can also be checked in software. The 241-5701-520 *Passport 7400, 15000, 20000 Troubleshooting and Testing* describes the procedures for verifying hardware status.

The number of LEDs for hardware status varies between parts. For the descriptions and locations of the LEDs, see the appropriate section:

- “Follow-me LEDs” (page 344)
- “Status LEDs of a BIP alarm module” (page 346)
- “Status LEDs of a BIM” (page 349)
- “Status LEDs of a PIM” (page 350)
- “Status LEDs of a fabric” (page 352)
- “Status LEDs of a CP or an FP card” (page 356)
- “Status LEDs of a cooling unit fan” (page 362)
- “Status LEDs of a sparing panel” (page 365)
- “Turning off the audible alarm” (page 366)

Follow-me LEDs

For the status of any equipment to be indicated, the equipment must be powered. No lit LED means no power. Once the equipment is powered, one LED is always lit. The likelihood of both LEDs failing at the same time due to natural aging (as opposed to an impact) is greater than 99.999%.

The status colors of lit LEDs are:

- green rectangle, indicating normal operation
- amber triangle, indicating a major or minor problem
- red circle, indicating the part is out of service but powered, or an intermediate startup stage from being installed due to an initial installation, a maintenance replacement, or an upgrade

To determine what to do when a lit LED is other than green, see:

- “What to do when a lit red LED is detected” (page 344)
- “What to do when a lit amber LED is detected” (page 345)
- “Hierarchy of LEDs and sounds” (page 345)

The procedures in the 241-5701-520 *Passport 7400, 15000, 20000 Troubleshooting and Testing* can help with determining why a LED may not be green.

What to do when a lit red LED is detected

When a lit red LED is detected on a card, the card is powered but out of service. For a card that was previously operating normally, determine if it is the only available one in the Passport 15000 or 20000 or if it has an available spare to maintain operation.

- If it is the only card (no spare), service is down. Replace it immediately.
- If it is spared, the active card has no backup. Replace it soon.

See the appropriate replacement procedure for the type of card.

What to do when a lit amber LED is detected

When a lit amber LED is detected on a card, there is no traffic running on it. After powering up a card, amber indicates a startup mode. Wait for the LED on the card to change from amber to green or red. For a card that was previously operating normally (the LED was solid green), amber indicates the card has received new software. Either the software is invalid for that card, or the card is must be replaced with a compatible type or version of card.

See the appropriate replacement procedure for the type of card.

Hierarchy of LEDs and sounds

A lit red LED or an audible alarm always indicates a critical problem. A part with a lit red LED must always be addressed before a part with a lit amber LED. When more than one critical problem occurs, some parts must be addressed before others so that the impact of out-of-service parts is minimized and further problems are prevented. The sequence of fixing depends on:

- how the ambient temperature of the room affects the capability of the remaining fans to keep the switch nominally cool
- whether the switch has an in-service redundant spare to back up the failed part (for example, a fabric, a CP, an FP, a PIM, a BIM)
- whether the replacement part is readily available for the switch

For example, in a hypothetical scenario with a Passport 15000 or 20000 that is redundantly configured when there is a relatively simultaneous failure of a load-sharing fabric, the active CP, an unspared FP, and a fan fail in a room at 35 degrees Celsius (95 Fahrenheit), the sequence of repair is:

- 1 the fan, because determining whether the failure is the fan or its controller and replace it is the longest maintenance task; meanwhile the ambient temperature inside the switch will rise towards the point when another part can fail or have service degradation
- 2 the fabric, because although its failure triggered an automatic takeover of its load by the mate fabric thereby maintaining service, losing a fabric while there is no backup effectively causes the entire switch to be out of service

- 3 the CP, because although its failure triggered an automatic switchover of the spare CP to become active and all other FP traffic continues to be processed on that cage, losing a CP while there is no backup causes serious service degradation but the switch continues to handle existing traffic
- 4 the FP, because reduced capacity is less important than maintaining the backups that impact greater portions of the switch or its service performance

Status LEDs of a BIP alarm module

The BIP alarm module has LEDs on its faceplate to indicate the status of the one or both Passport 15000 or 20000 switches, which includes:

- a red and a green for itself
- pairs of minor, major, and critical LEDs, one set above the other (under the LED Test button), indicating the severity of the problem for either the upper or the lower switch
- ten LEDs (under the ACO button) acting as one large follow-me indicator

See the figure “Location of the alarm module status LEDs” (page 348). To clearly observe which LEDs are lit and their color, you must stand directly in front of the faceplate. Unlike the other parts of a switch that have one LED per color, each LED of the alarm module cluster shows one of the three status colors. The colors are green, amber, and red.

In a startup mode after installation and powering up, the LEDs cycle from solid red to solid green.

When the BIP is powered from an MFA150 system of ac rectifiers and at least one of the rectifiers fails or is switched off, the test LEDs indicate amber if at least one CP is connected.

After normal operation when a lit LED is not green, do “What to do when a lit red LED is detected” (page 344) or “What to do when a lit amber LED is detected” (page 345).

Testing the LEDs

Testing the operation of LEDs of a Passport 15000 or 20000 has no effect on switch performance. During the test, the LEDs remain lit amber together for about 10 seconds. If none of the LEDs is lit, no CPs are installed.

If a LED does not light, then one or more of the following conditions is occurring:

- the green LED is burned out and software can verify if the part is actually operational
- there is a problem in a cable assembly or a connection between the BIP and the PIMs
- there is a problem with one of the power feeds to the BIP, but this means a series of hardware LEDs would not be lit
- there is a problem in the backplane of the shelf

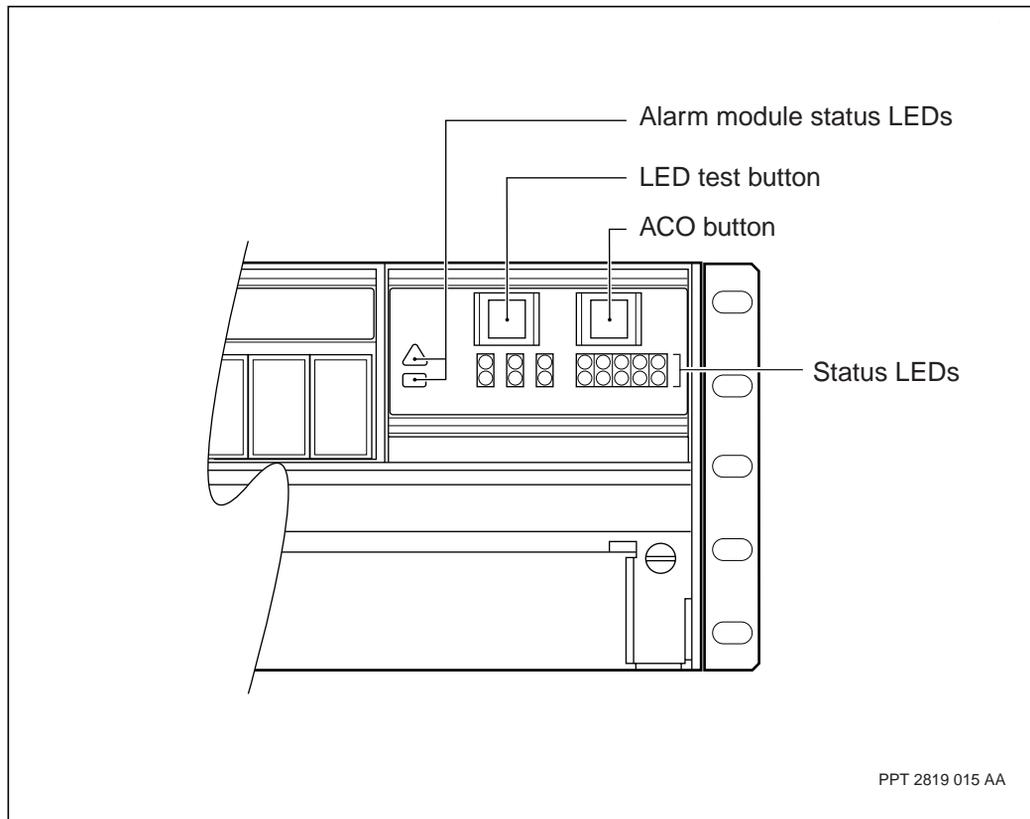
When the BIP is the power distribution unit for a Passport 15000, pressing the LED test button verifies the operation of the LEDs on the alarm module.

When the BIP is the power distribution unit for a Passport 20000, pressing the LED test button verifies the operation of the LEDs of other hardware parts by lighting all of them on:

- the BIMs and alarm module of the BIP
- the cooling unit or units
- the fabrics in one or both switches

The PIM LEDs are indicators of power on or off and are not included in the LED tests.

Figure 97
Location of the alarm module status LEDs



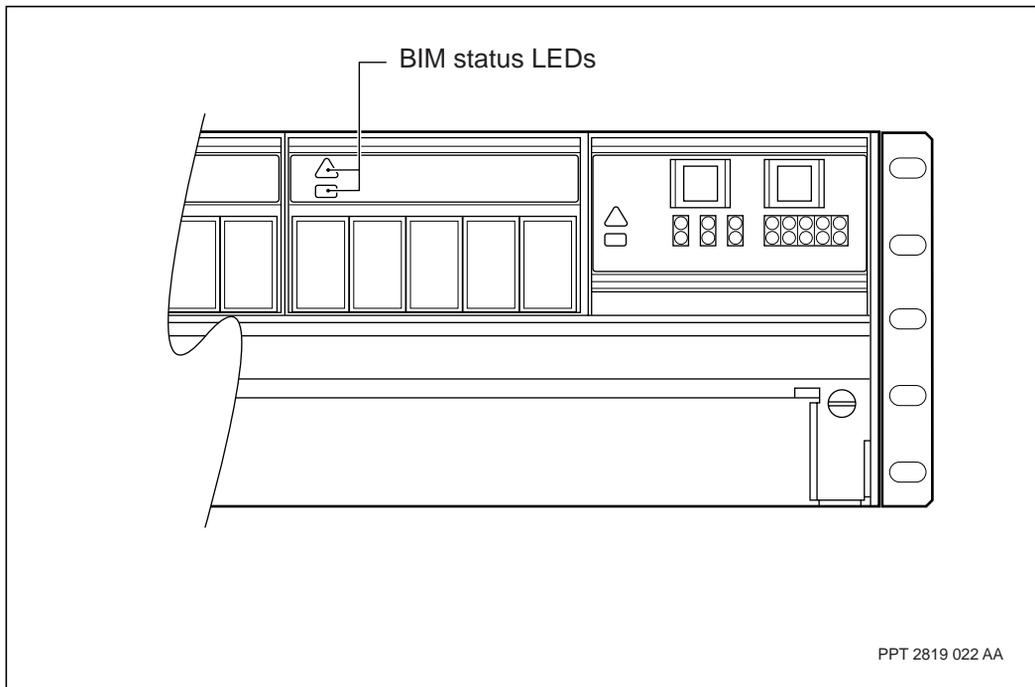
Status LEDs of a BIM

Each breaker interface module (BIM) has two LEDs on its faceplate to indicate the status of power going to a Passport 15000 or 20000. See the figure “Location of BIM status LEDs” (page 349). The colors of BIM status are green (rectangle) or red (triangle).

In a startup mode after installation and powering up, the LEDs cycle from solid red to solid green.

After normal operation when a lit LED is not green, do “What to do when a lit red LED is detected” (page 344).

Figure 98
Location of BIM status LEDs



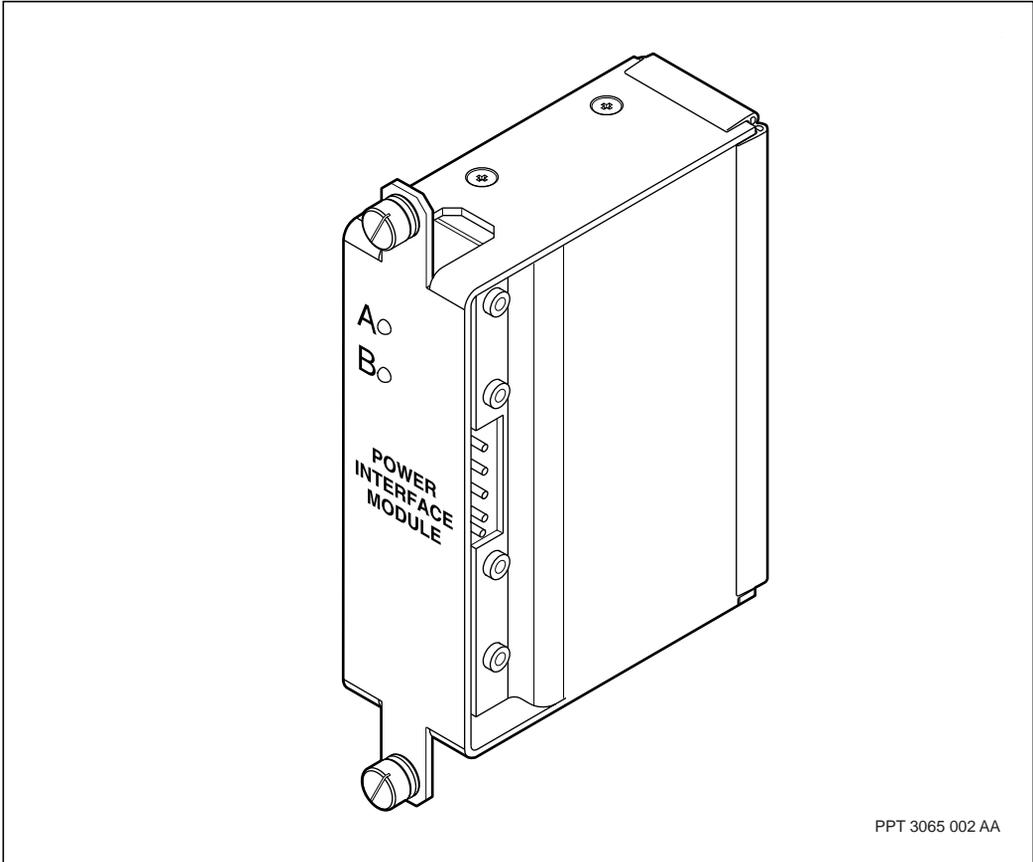
Status LEDs of a PIM

Each power interface module (PIM) of a Passport 20000 has two LEDs on its faceplate to indicate the status of power going to it from the BIP. See the figure “Location of PIM status LEDs for feeds A and B” (page 351). Each PIM receives power from either an A or B feed, depending where it is plugged into the shelf assembly. The LED labelled A indicates the incoming power from power feed A through the BIP, while B indicates it for power feed B. See the table “Power LED status indicators for each PIM” (page 350).

Table 94
Power LED status indicators for each PIM

LED color	Mode	Meaning
green	solid	power is on for the slots powered by the PIM
off		power is off because of one or more of the following: <ul style="list-style-type: none"> • the breaker on the BIM that distributes power to it is off (O is pressed in) • the cable from the BIP to the PIM is disconnected at one or both ends • the power input to the BIP is off or missing for the indicated A or B feed • the BIM is missing or defective • the LED is burned out

Figure 99
Location of PIM status LEDs for feeds A and B



Status LEDs of a fabric

Each fabric card at the rear of a switch has LEDs to indicate the status of operation. There are two LEDs on each fabric, a red and a green. Only one LED is lit to indicate the status of the fabric when the switch hardware is powered up.

Fabric LEDs are described in:

- “Status LEDs of a fabric in a Passport 15000” (page 352)
- “Status LEDs of a fabric in a Passport 20000” (page 354)

Status LEDs of a fabric in a Passport 15000

For normal operation, the circular LED is solid green. See the figure “Location of fabric status LEDs in a Passport 15000” (page 353).

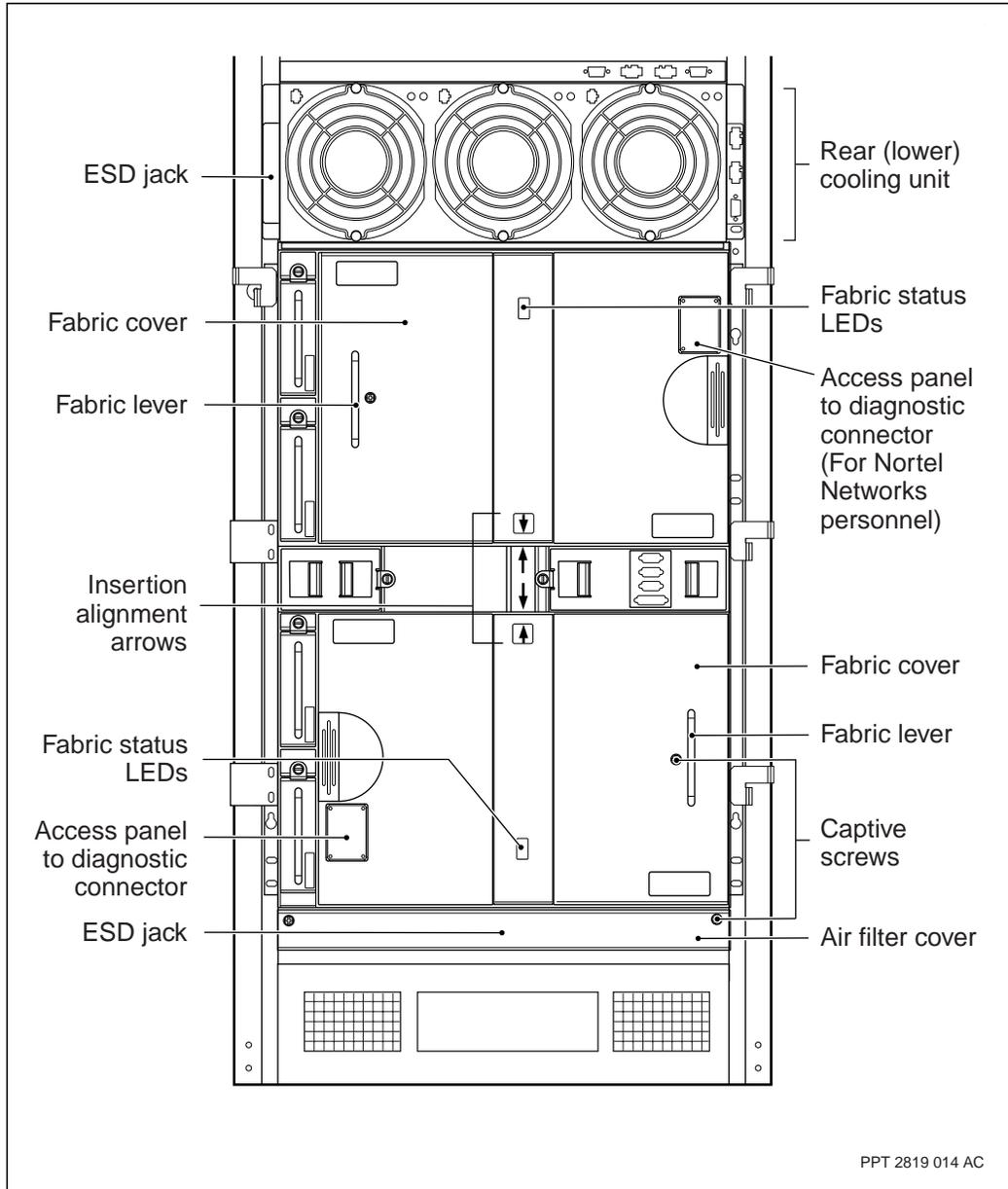
In a startup mode after installation and powering up, the LEDs cycle from solid red to solid green. (There is no amber status.) Both LEDs must be solid green for normal operation to occur.

When a fabric is disabled by the system because of faults, the LED turns red. A red LED can be caused by more than disabling, which means a fabric with a red LED can still be transmitting data. Similarly, a fabric with a green LED might be prevented from transmitting data.

When a fabric is locked by force in software, it shows solid green (unlike a CP or an FP).

After normal operation when the LED is not green, do “What to do when a lit red LED is detected” (page 344).

Figure 100
Location of fabric status LEDs in a Passport 15000



Status LEDs of a fabric in a Passport 20000

For normal operation, the rectangular LED is solid green. See the figure “Location of fabric status LEDs in a Passport 20000” (page 355).

In a startup mode after installation and powering up, the LEDs cycle from solid red to solid green even if the firmware has not yet been loaded.

When the LED is red, the fabric status is one of the following:

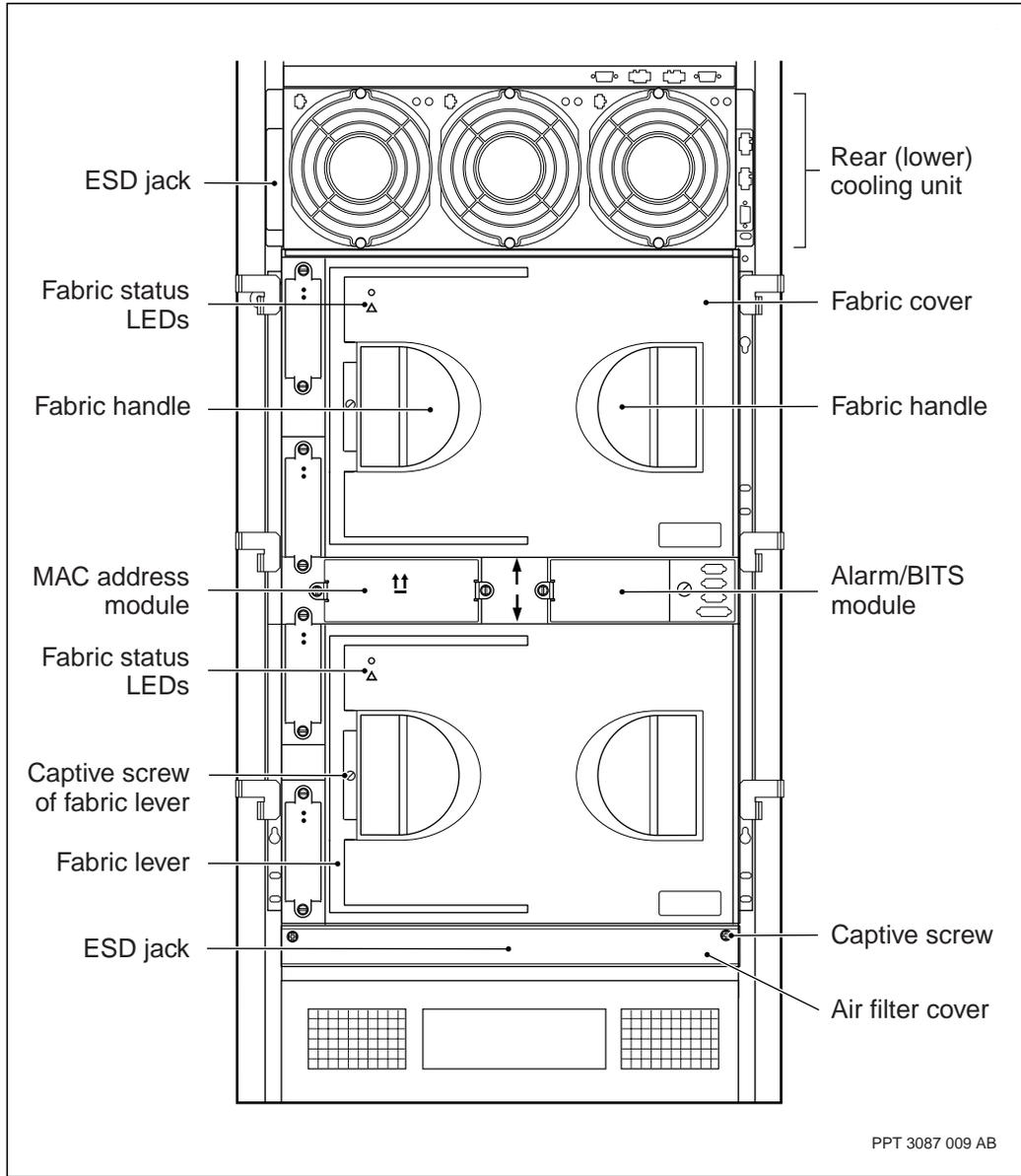
- on the fabric the captive screw of the lever has not been fastened, which depresses a switch to reset the fabric
- has failed and has automatically been disabled by the system
- has partially failed (may be green instead)
- is unseated
- is being reset
- is being initialized

When the LED is green, the fabric status is one of the following:

- is locked by force in software (unlike a CP or an FP)
- has failed partially and cannot transmit data

After normal operation when the LED is not green, do “What to do when a lit red LED is detected” (page 344) or “What to do when a lit amber LED is detected” (page 345).

Figure 101
Location of fabric status LEDs in a Passport 20000



Status LEDs of a CP or an FP card

The control processors (CPs) and function processors (FPs) at the front of the Passport 15000 or 20000 have a column of three LEDs each. The sequence from top to bottom is red (circle), amber (triangle), and green (rectangle). See the figure “Location of the common CP or FP card status LEDs” (page 357).

The CPs and some FPs also have other status LEDs for card-specific functionality.

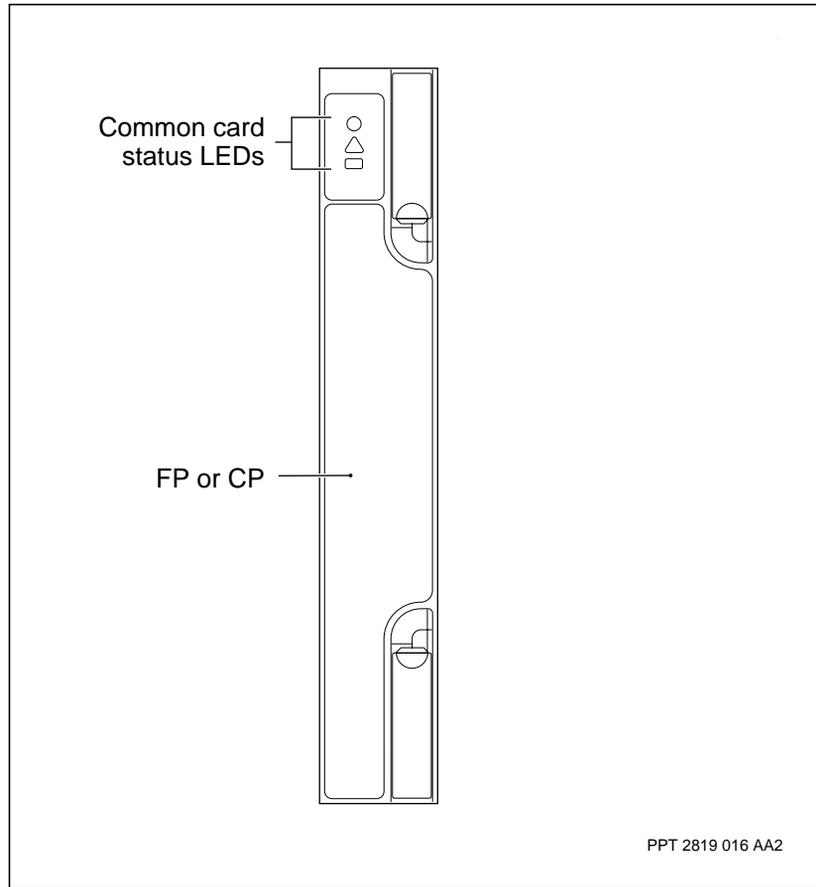
When a CP or an FP is locked by force in software, the LED shows solid red.

After normal operation of a CP or an FP when a lit LED is not green, do “What to do when a lit red LED is detected” (page 344) or “What to do when a lit amber LED is detected” (page 345).

More card-specific information is provided in:

- “Status LEDs of a CP” (page 357)
- “Status LEDs of an FP” (page 358)
- “Status LEDs of the Ethernet ports on an NTHW49” (page 359)

Figure 102
Location of the common CP or FP card status LEDs



Status LEDs of a CP

For a CP in a startup mode after installation, the common LEDs light in sequence from:

- 1 solid red, indicating powering up or after power-up, or is being reset or restarted; during solid red, the hardware and fabric backplane is tested and initialized; if there is a problem, the CP reboots and remains solid red
- 2 flashing red, indicating that initializing and testing the fabric backplane has passed and the CP software is loading

- 3 fast flashing red, indicating software is downloading
- 4 solid amber, indicating the software is not yet loaded or configured for that CP
- 5 slow flashing green, indicating the software has been loaded and the applications are being initialized
- 6 fast flashing green, indicating the hardware and software is on standby as the redundant (back-up or inactive) CP, or the module is ready to be put into service by the software
- 7 solid green, indicating power is on, software is loaded, the CP is in service operating normally, and is the active CP

Note: While both CPs are amber, then the FPs cannot reach solid green.

A spare CP in startup mode after being configured in software and after the main CP has already been installed shows a flashing green indication.

A CP3 card has two LEDs on each 100Base-T port. The LEDs are integrated into the RJ-45 jack. Behaviour of these LEDs is as follows:

- solid green link LED: link is present
- flashing green link LED: either Tx or Rx activity is detected
- 'off' yellow Collision LED: no collision has been detected
- flashing yellow Collision LED: a collision has been detected

Status LEDs of an FP

For an FP in a startup mode after installation, powering up, and software configuration, and after at least one CP is installed, the common LEDs progress in relative sequence. The sequence is not fixed because the status of an individual card or the rate of self-test differs between card types. The relative sequence of LEDs is from:

- 1 solid green, confirming initial power up
- 2 solid red, indicating a reset or restart to test hardware; if there is a problem, the FP reboots; if the FP stays solid red after 30 seconds, it is faulty

- 3 slow flashing red, indicating the software is initializing for a reset or is loading firmware which causes a reset to run the self-test again (solid red)
- 4 fast flashing red, indicating software is downloading
- 5 solid amber, indicating the card is not faulty but cannot operate because the slot is configured for a card type other than the type of the inserted card
- 6 slow flashing green, indicating the software has been loaded, and the FP is being initialized
- 7 fast flashing green, indicating the hardware and software is on standby (an inactive spare) or the FP is ready to be put into service by the software
- 8 solid green, indicating power is on, software is loaded, and the card is active, in service, and operating normally; some FPs show a solid green LED while software loading is still completing (for example, a VSP3) but the overlap is very brief

Note: If the FP has not yet been configured in the software, the LED cycle is solid green to solid red, then alternating between flashing red and flashing green.

While operational, an electrical FP indicates it is active by showing a solid green LED. Its standby mate shows a fast flashing green LED.

While operational, an optical FP indicates it is active by showing a solid green LED. An optical FP does not have a true standby mate. When dual-FPs are configured for AnnexB, LAPS, or Y-protection, both cards show solid green LEDs regardless if all active ports that are providing service (as opposed to being on hot standby) are on only one card.

When an FP is undergoing software migration, that is, a change of software, the LED shows fast-flashing green.

Status LEDs of the Ethernet ports on an NTHW49

The 4-port Gigabit Ethernet function processor (FP), also known as the 4pGe or NTHW49, has transmit (Tx) and receive (Rx) LEDs to the left of each of its four optical module sockets (“ports” in software). See the figure “The Ethernet port status LEDs of an NTHW49” (page 361).

Provided the card slot has been configured (provisioned) correctly for the NTHW49, and the card is installed with the correct small form-factor pluggable (SFP) optical transceiver modules, the typical behavior of the port status LEDs is as follows.

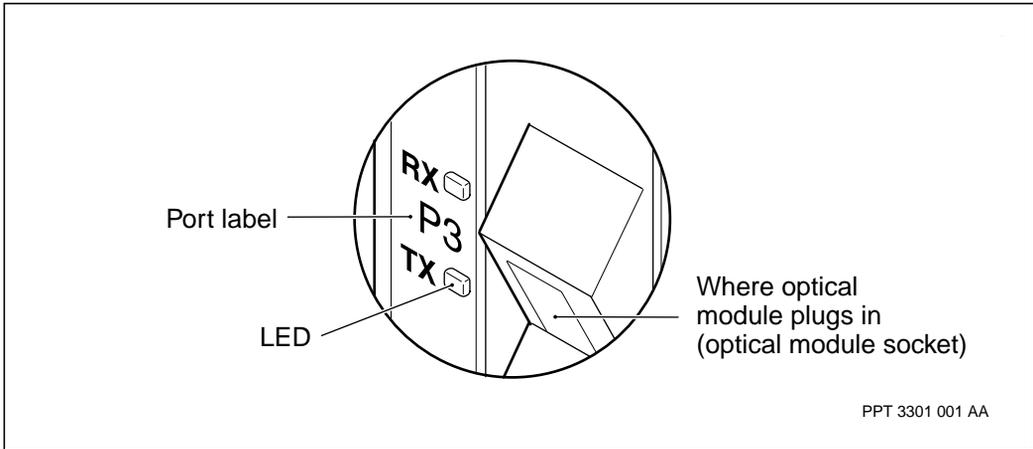
- Both LEDs are unlit when the card is initially powered up.
- Both LEDs light solid green when the port software is initialized and all alarms related to the port and its SFP modules have cleared.
- When traffic passes through the transmit portion of the port, its LED flashes green. When traffic passes through the receive portion of the port, its LED flashes green. The Tx LASER is on and the Rx fiber is lit.
- Both LEDs are lit during an Ethernet port test, and are unlit after the test until the port is unlocked. When the port test includes Tx or Rx traffic, the respective LEDs flash.
- When one LED is lit and the other is not, the LED itself has failed. Traffic will continue to flow through that portion of the port.

When the card is powered, both LEDs are unlit when:

- the port is locked
- an alarm has been generated against the port, for example, SFP alarm 7011 5480, loss of signal (LOS), a hardware failure, or an auto-negotiation alarm
- the card or port is not correctly configured in software

To determine the operational status of the Ethernet port, especially if a LED is unlit, use the procedure 241-5701-600 *Passport 7400, 15000, 20000 Configuration Guide* to display the status of an installed SFP module.

Figure 103
The Ethernet port status LEDs of an NTHW49



Status LEDs of a cooling unit fan

The status LEDs for each fan of both the front and rear cooling units is shown at the front of the frame so that the status of the rear (lower) fans can be determined without going to the rear of the frame. The rear cooling unit's LEDs are duplicated at the front and back of the Passport 15000 or 20000. The LEDs are labeled with G and R to distinguish between green and red.

For a cooling unit in a startup mode after installation and powering up, the LEDs cycle in sequence from solid red to solid green.

After normal operation when a lit LED is not green, assess the impact of the ambient room temperature on a Passport 15000 or 20000 being cooled by two fans and do “What to do when a lit red LED is detected” (page 344).

When the LED beside a fan is off after the fan or its controller has been replaced, verify the in-line 4 A fast-acting fuse between the controller and its input power has not blown. If so, replace the controller because the fuse is soldered in.

When a fan fail occurs, major software alarm 7012 0051 is generated and both the major and minor hardware alarm lights are lit. For information on hardware alarms, see “Hardware alarm definitions” (page 66).

Upon the first fan failure:

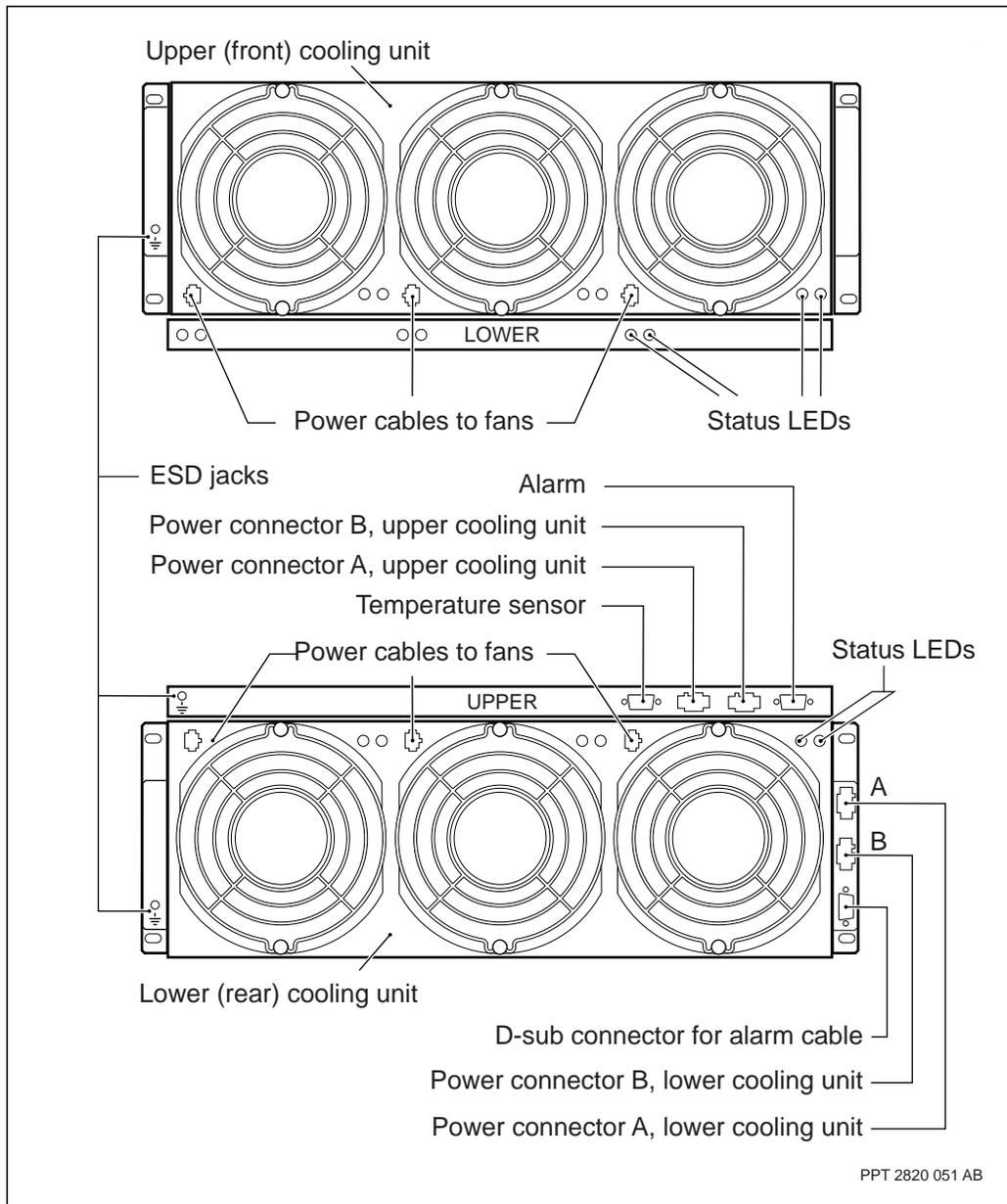
- the fan trouble indicator light goes from green to red
- the frame-level alarm indicator displays a minor and a major alarm
- a major software alarm is raised at the network management console
- single fan failures should be attended to immediately or, alternately, within 48 hours

Upon the second and third fan failures:

- the fan trouble indicator light goes from green to red
- the frame-level alarm indicator continues to display a minor and a major alarm unless something else has changed

- double or triple fan failures must be attended to immediately before one or both fabrics automatically shut down
- additional software alarms are raised if the shelf temperature rises above the shut down temperature

Figure 104
Location of fan controller status LEDs



Status LEDs of a sparing panel

Each sparing panel has a column of 7 LEDs, one for each DS3 or E3 FP card. See the figure “Location of status LEDs for sparing panel NTQS31” (page 366).

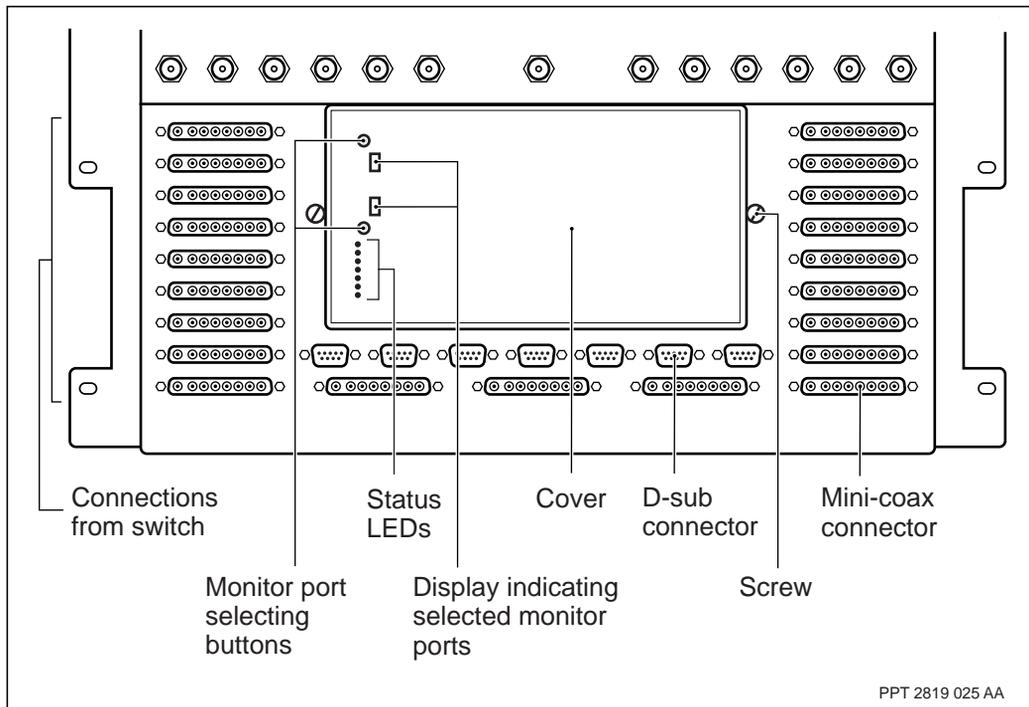
Each LED is a tri-colored LED to indicate the sparing status of the FP. See the table “LED statuses of a DS3 or E3 sparing panel” (page 365).

Table 95
LED statuses of a DS3 or E3 sparing panel

LED color	Normal FP	Spare FP
off	the associated FP is not detected	the associated FP is not detected
red	the FP is connected but communication is not established	the FP is connected but communication is not established
amber	the spare FP is carrying traffic for this FP	the spare FP is not in use or traffic from the FP is looped back (normal operation)
green	the FP is carrying traffic (normal operation)	the spare FP is carrying traffic for one of the main FPs

In a startup mode after installation and powering up, the LED for each cabled FP cycles from solid red to solid green. If the software configuration is not completed for each FP connection on the sparing panel, the LEDs remain red.

Figure 105
Location of status LEDs for spring panel NTQS31



Turning off the audible alarm

Turn off an audible alarm by pressing the ACO button on the alarm module. See the figure “Location of the alarm module status LEDs” (page 348).

Chapter 8

Field replaceable units

Passport 15000 or 20000 has hardware parts that are field replaceable units (FRUs). The FRUs are uniquely identified by either a product engineering code (PEC) or a part number. Part numbers from a non-Nortel Networks manufacturer are indicated.

Service replaceable units (SRUs) are included in the lists as FRUs.

The PECs or part numbers that are shared by Passport 15000 or 20000 or are unique to either Passport are listed together in tables under the same replacement groups. Since this chapter assumes you are replacing a part with the same kind of part, and each part has a unique identification number, parts for either a Passport 15000 or 20000 are listed together. An individual part that is unique to a Passport 15000 or 20000 is identified.

Note: Procedures throughout this document referred to part numbers of hardware that can only be ordered through a parts kit. If the part number or the name of a part is not listed in this chapter, and you need to replace it, contact your Nortel Networks sales representative to identify the kit that contains the replacement part.

Any backplane cannot be changed in the field because of the difficulty to change it or the downtime to key portions or the whole system. To replace a backplane, for example, because of bent pins, the hardware assembly they are part of must be replaced. Hardware assemblies with backplanes include the BIP, cooling unit, fabric, or shelf.

The FRUs are grouped into these sections:

- “FRUs that plug into or get screwed onto a Passport 15000 or 20000” (page 368)
- “FRUs for an MFA150 system of ac rectifiers” (page 385)

FRUs that plug into or get screwed onto a Passport 15000 or 20000

The field replaceable units (FRUs) that plug into the BIP, shelf assembly, or the cooling unit, or get screwed onto the NEBS 2000 frame are grouped in the following tables or sections:

- “FP cards, SFP modules, and termination panels” (page 370)
- “Control processor (CP) cards” (page 372)
- “CP and FP signalling cable assemblies and mounting equipment” (page 373)
- “Custom-made cable assemblies” (page 374)
- “Prefabricated cable assemblies” (page 374)
- “Spare parts kit NTQS29AA for a Passport 15000” (page 375)
- “Spare parts kit NTQS29AB for a Passport 15000” (page 376)
- “Spare parts kit NTQH29AA for a Passport 20000” (page 376)
- “Spare parts kit NTQH29AB for a Passport 20000” (page 377)
- “Spare parts kit NTQH29AC for a Passport 20000” (page 377)
- “Spare parts kit NTQH29AD for a Passport 20000” (page 378)
- “Cooling unit parts for the AA versions” (page 378)
- “Cooling unit parts for the AB versions” (page 379)
- “BIP parts for a Passport 15000” (page 380)
- “BIP parts for a Passport 20000” (page 380)
- “Frame accessories and other filler hardware” (page 381)
- “All other plug-in or screw-on parts for a Passport 15000” (page 383)
- “All other plug-in or screw-on parts for a Passport 20000” (page 383)

- “All other plug-in or screw-on parts for a Passport 15000 or 20000” (page 384)
- “Interface cables for interworking between an EdgeLink 100 and a Passport 15000 or 20000” (page 384)

FP cards, SFP modules, and termination panels

The following function processors (FPs), small-form factor pluggable (SFP) optical modules, and the FP termination panels include these FRUs:

- NT0486, balanced DC multiport aggregate device
- NT0421, unbalanced DC multiport aggregate device
- NTFP99AA, 3-port one-for-one sparing panel (from Passport 7400) for two 2-port DS3 TDM FPs or two 2-port E1 TDM FPs
- NTHR17, OC3/STM-1, 4-port, multimode
- NTHR21, OC3/STM-1, 4-port, single-mode intermediate reach
- NTHR23, DS3, 12-port
- NTHR25, E3, 12-port
- NTHR29, OC-12/STM-4, 1-port, single-mode long range
- NTHR31, DS3, 4-port, channelized IMA
- NTHR37, sparing panel module for DS3 or E3 (see NTQS31)
- NTHR39, sparing panel relay module for DS3 or E3 (see NTQS31)
- NTHR42, sparing panel control module for DS3 or E3 (see NTQS31)
- NTHR79, DS3, 4-port one-for-one sparing panel
- NTHR83, STM-1, 1-port, channelized single-mode intermediate reach
- NTHR88, DS3, 4-port, channelized frame relay
- NTHR89, DS3, 4-port, channelized frame relay
- NTHR91, DS3, 4-port, channelized ATM CES
- NTHW01, OC-48/STM-16, 1-port single-mode intermediate reach ATM with APS
- NTHW05, OC-3/STM-1, 4-port, multimode
- NTHW10, general processor with disk, 2-port
- NTHW11, OC-12/STM-4, 4-port, single-mode intermediate reach ATM
- NTHW15, OC-3/STM-1, 4-port, single-mode intermediate reach
- NTHW18, 6-module packet server service processor

- NTHW21, OC3/STM-1, 16-port, ATM single-mode (SM) intermediate reach (IR) with MT-RJ connectors
- NTHW30, VPN extender card
- NTHW31, OC3/STM-1, 16-port, ATM single-mode (SM) intermediate reach (IR) with LC connectors
- NTHW39, OC-48/STM-16, 1-port, single-mode short reach POS
- NTHW44, OC-3/STM-1 POS and ATM, 16-port
- NTHW49, Gigabit Ethernet, 4-port
- NTHW52, fanout panel for 12-port DS3 or E3
- NTHW70, OC-3/STM-1Ch, 4-port, single-mode intermediate reach TDM/CES
- NTHW84, voice services processor 3 (VSP3)
- NTHW86, OC-12/STM-4, 4-port, single-mode intermediate reach ATM
- NTHW87, voice services processor 2 (VSP2)
- NTHW91, DS3, 2-port, channelized TDM
- NTHW92, E1, 32-port, TDM
- NTQS31, sparing panel module for DS3 or E3 (includes NTHR37, NTHR39, and NTHR42)
- NTPP01AB SFP 1000BASE-SX reach in an NTHW49 with up to 550 m (1,804.6 ft or 0.34 mi) with 50/125 multimode (MM) fiber cables or up to 275 m (902.3 ft) with 62.5/125 MM fiber cables
- NTPP01CB SFP 1000BASE-LX with extended reach in an NTHW49 of up to 10 km (6.25 mi) with single-mode (SM) fiber cables
- NTPP02AD SFP in an NTHW44 with multimode (MM) short reach (SR-0) cables up to 2 km (1.25 mi)
- NTPP02CD SFP in an NTHW44 with single-mode (SM) intermediate reach (IR-1) cables up to 15 km (9.3 mi)
- NTPP02ED SFP in an NTHW44 with single-mode (SM) long reach (LR-1) cables up to 40 km (24.8 mi)

Control processor (CP) cards

The following CP cards field replaceable units (FRUs):

- NTHR06, CP2 with DS1 BITS interface (Passport 15000)
- NTHR35, CP2 with E1 BITS interface (Passport 15000)
- NTHW06, CP3 with DS1 BITS interface (Passport 15000)
- NTHW06CA, CP3 with DS1 BITS interface (Passport 20000)
- NTHW08, CP3 with E1 BITS interface (Passport 15000 or 20000)

Table 96
CP and FP signalling cable assemblies and mounting equipment

Order code	Part description
NT0479	CP Ethernet cable kit for CP2, CP2E, or CP3
NTBP25	CP cable for DCE V.24 RS232 local operator port
NTFP19AD	DS3 or E3 straight male BNC to straight male BNC cable assembly, 3.0 m (9.8 ft)
NTFP19AE	DS3 or E3 straight male BNC to straight male BNC cable assembly, 15 m (49 ft)
NTHW50	fiber management unit, dual drawer
NTHR58	fanout or sparing panel DS3 or E3 mini-coax 8W8 to BNC cable assembly, 2.5 m (8.2 feet)
NTHR59	fanout or sparing panel DS3 or E3 mini-coax 8W8 to BNC cable assembly, 5.0 m (16.4 feet)
NTHR60	fanout or sparing panel DS3 or E3 mini-coax 8W8 to BNC cable assembly, 15 m (49.2 feet)
NTHR69	sparing panel DS3 or E3 DB9 D-sub to D-sub control cable assembly, 2.5 m (8.2 feet)
NTHR70	sparing panel DS3 or E3 DB9 D-sub to D-sub control cable assembly, 5.0 m (16.4 feet)
NTHR71	sparing panel DS3 or E3 DB9 D-sub to D-sub control cable assembly, 15 m (49.2 feet)
NTHR72	sparing panel DS3 or E3 8W8 to mini-coax 8W8 cable assembly, 2.5 m (8.2 feet)
NTHR73	sparing panel DS3 or E3 8W8 to mini-coax 8W8 cable assembly, 5.0 m (16.4 feet)
NTHR74	sparing panel DS3 or E3 8W8 to mini-coax 8W8 cable assembly, 15 m (49.2 feet)
NTRU0368	cable management bracket, extended, left side
NTRU0369	cable management bracket, extended, right side
P0879577	cable management bracket, metal, left or right side, front or rear uprights
(Sheet 1 of 2)	

Table 96 (continued)
CP and FP signalling cable assemblies and mounting equipment

Order code	Part description
P0937935	cable management bracket, moulded plastic, left or right side, front or rear uprights
P0918821	adapter bracket, left (L) front (long), for a shelf-based switch
P0918822	adapter bracket, right (R) front (long), for a shelf-based switch
P0918823	adapter bracket, left (L) rear (short), for a shelf-based switch
P0918824	adapter bracket, right (R) rear (short), for a shelf-based switch
(Sheet 2 of 2)	

Table 97
Custom-made cable assemblies

Order code	Part description
not applicable	alarm/BITS cables to J3 or J4 from site source except for E1 unbalanced in the table "Prefabricated cable assemblies" (page 374)
not applicable	any fiber optic cable with SC connectors
Note: See also "Prefabricated cable assemblies" (page 374).	

Table 98
Prefabricated cable assemblies

Order code	Part description
not applicable	for CP or FP faceplate cables, see the table "CP and FP signalling cable assemblies and mounting equipment" (page 373)
A0834149	power-and-ground cable assembly, ETSI
A0834143	power-and-ground cable assembly, polyvalent
P0940531	external alarm cable assembly between BIP J2 and MFA150 controller card TB2
(Sheet 1 of 2)	

Table 98 (continued)
Prefabricated cable assemblies

Order code	Part description
NTHR75	alarm/BITS cables for E1 unbalanced to J3 or J4 from site source
NTHR55	alarm/BITS to J2 on lower shelf and Alarm on lower cooling unit and to J2 on upper shelf and Alarm on upper cooling unit
NTHR56	alarm/BITS to J1 on lower shelf and P7 on the BIP
NTHR57	cooling unit alarm cable assembly, lower or upper
NTHR66	cooling unit power cable assembly, lower or upper
NTHR54	power interface module (PIM) cable assembly to the lower shelf
NTPN81	kit to convert NTPN13 to an E1 unbalanced version, includes cable assembly and balun adapter 460
(Sheet 2 of 2)	

Table 99
Spare parts kit NTQS29AA for a Passport 15000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A0758423	fan assembly, upper or lower, any position
NTHR10AA	fan controller
NT6C60PA	breaker interface module (BIM), 20-amp, for BIP NT6C61 or NT6C62
NT6C60PB	alarm module for BIP NT6C61 or NT6C62
NTHR15	power interface module (PIM)
NPS50332-1	wrist strap with velcro and 10 feet of coiled cord

Table 100
Spare parts kit NTQS29AB for a Passport 15000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A0522179	fan assembly, upper or lower, middle position
A0522182	fan assembly, upper or lower, side (end) position
NTHR10AB	fan controller
NT6C60PA	breaker interface module (BIM), 20-amp, for BIP NT6C61 or NT6C62
NT6C60PB	alarm module for BIP NT6C61 or NT6C62
NTHR15	power interface module (PIM)
NPS50332-1	wrist strap with velcro and 10 feet of coiled cord

Table 101
Spare parts kit NTQH29AA for a Passport 20000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A07548423	fan assembly, upper or lower, side (end) position
NTHR10AA	fan controller
NT6C67PA	breaker interface module (BIM), 25-amp, for BIP AP6C67 or AP6C68
NT6C60PB	alarm module for BIP AP6C67 or AP6C68
NTPN15AA	power interface module (PIM)
WS1A2C10B1	wrist strap

Table 102
Spare parts kit NTQH29AB for a Passport 20000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A07548423	fan assembly, upper or lower, side (end) position
NTHR10AA	fan controller
NT6C67PA	breaker interface module (BIM), 25-amp, for BIP AP6C67 or AP6C68
NT6C60PB	alarm module for BIP AP6C67 or AP6C68
NTPN15AA	power interface module (PIM)
NTPN81AA	cable assembly for BITS unbalanced E1 for NTPN13
WS1A2C10B1	wrist strap

Table 103
Spare parts kit NTQH29AC for a Passport 20000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A0522182	fan assembly, upper or lower, side (end) position
A0522179	fan assembly, upper or lower, middle position
NTHR10AB	fan controller
NT6C67PA	breaker interface module (BIM), 25-amp, for BIP AP6C67 or AP6C68
NT6C60PB	alarm module for BIP AP6C67 or AP6C68
NTPN15AA	power interface module (PIM)
NTPN11AA	MAC address module
WS1A2C10B1	wrist strap

Table 104
Spare parts kit NTQH29AD for a Passport 20000

Order code	Part description
A0778937	air filter, medium arrestance @ 25 ppi
A0522182	fan assembly, upper or lower, side (end) position
A0522179	fan assembly, upper or lower, middle position
NTHR10AB	fan controller
NT6C67PA	breaker interface module (BIM), 25-amp, for BIP AP6C67 or AP6C68
NT6C60PB	alarm module for BIP AP6C67 or AP6C68
NTPN15AA	power interface module (PIM)
NTPN11AA	MAC address module
NTPN81AA	cable assembly for BITS unbalanced E1 for NTPN13
WS1A2C10B1	wrist strap

Table 105
Cooling unit parts for the AA versions

Order code	Part description
A0778937	air filter, medium arrestance
NTHR51AA	cooling unit, lower (rear)
NTHR52AA	cooling unit, upper (front)
A0758423	fan assembly for an NTHR51AA or NTHR52AA, any position
NTHR10AA	fan controller
NTCC8938 (or A0647397)	temperature sensor assembly, upper or lower cooling unit (Rotron Maltese 24 V dc)
(Sheet 1 of 2)	

Table 105 (continued)
Cooling unit parts for the AA versions

Order code	Part description
NTHR68AA	temperature sensor bracket assembly used with an NTHR52AA
Note: See also the table "Spare parts kit NTQS29AA for a Passport 15000" (page 375).	
(Sheet 2 of 2)	

Table 106
Cooling unit parts for the AB versions

Order code	Part description
A0778937	air filter, medium arrestance
NTHR51AB	cooling unit, lower (rear)
NTHR52AB	cooling unit, upper (front in a NEBS 2000 frame or 23-inch EIA rack)
A0522179	fan assembly for NTHR51AB or NTHR52AB, middle position only (Dyna Ace 24 V dc)
A0522182	fan assembly for NTHR51AB or NTHR52AB, either side (end) position (Dyna Ace 24 V dc)
NTHR10AB	fan controller
NTHR68AB	temperature sensor bracket assembly used with NTHR52AB
A0521944	temperature sensor assembly for an NTHR68AB or an NTHR51AB
A0521940	temperature sensor on an NTHR10AB in an NTHR51AB
Note: Note: See also the table "Spare parts kit NTQS29AB for a Passport 15000" (page 376).	

Table 107
BIP parts for a Passport 15000

Order code	Part description
NT6C62	breaker interface panel (BIP) with two 20-amp BIMs
NT6C61	breaker interface panel (BIP) with four 20-amp BIMs
NT6C60PB	BIP alarm module
NT6C60PA	BIP breaker interface module (BIM) with 20-amp breakers; also referred to as a breaker module
NTHR15	power interface module (PIM) in shelf assembly
Note: See also these tables:	
<ul style="list-style-type: none"> • “Spare parts kit NTQS29AA for a Passport 15000” (page 375) • “Spare parts kit NTQS29AB for a Passport 15000” (page 376) • all those in “FRUs for an MFA150 system of ac rectifiers” (page 385) 	

Table 108
BIP parts for a Passport 20000

Order code	Part description
AP6C68	breaker interface panel (BIP) with two 25-amp breaker interface modules (BIMs)
AP6C67AA	breaker interface panel (BIP) with four 25-amp breaker interface modules (BIMs)
NT6C60PB	BIP alarm module
AP6C67PA	BIP breaker interface module (BIM) with 25-amp breakers; also referred to as a breaker module
NTPN15	power interface module (PIM) in shelf assembly
Note: See also the tables in “FRUs for an MFA150 system of ac rectifiers” (page 385).	

Table 109
Frame accessories and other filler hardware

Order code	Part description
P0887704	BIM filler for a BIP
NTHR64	blank processor card for a shelf assembly to replace an FP; also referred to as a filler module, especially for ordering
NTRU0120	cable cover kit
NTRU0366	cable cover kit (front or rear panel kit used with extended cable management brackets)
NTQS37AA	door extension kit for a NEBS 2000 frame (NTPX4060) door mounting hardware kit (NTRU0192) two vented lockable doors (each NTRU0423)
NTQS37AB	door extension kit for a NEBS 2000 frame (NTPX4060) door mounting hardware kit (NTRU0192) two vented lockable doors (each NTRU0423) top cover illuminated brandline upgrade (NTPN53AA)
NTRU04	frame, NEBS 2000
NTRU0365	frame spacer brackets kit
NTRU0370	frame spacer junction kit
NTRU0128	side panel kit, regular size
NTPX4050	side panel kit, extended size
NTRU0185	top frame bracket
NTHW51	top cover (panel) kit, brandlining (has words)
NTHW53	top cover (panel) kit, brandlining with illuminating LED
NTHR76	shelf filler panel kit, front of frame, 1000 mm or 3.3 feet
NTHR77	shelf filler panel kit, rear of frame, 800 mm or 2.6 feet

Table 110
Shelf assemblies for a Passport 15000

Order code	Part description
NTHR50	shelf assembly
NTHW99	shelf assembly with these plug-ins included: NTHR11, the MAC address module NTHR12, NTHR13, or NTHR14, the alarm/BITS module NTHR15, the power interface module (PIM)

Table 111
Shelf assemblies for a Passport 20000

Order code	Part description
NTPN70	shelf assembly
NTPN77	shelf assembly with these plug-ins included: NTPN11, the MAC address module NTPN12 or NTPN13, the alarm/BITS module NTPN15, the power interface module (PIM)

Table 112
All other plug-in or screw-on parts for a Passport 15000

Order code	Part description
NTHR11	MAC address module Note: When a MAC address module must be replaced, it changes the unique hard-coded node number of the Passport 15000. Therefore the entire shelf must be re-configured in software. Ensure that you are familiar with the task flow in 241-1501-240 <i>Passport 15000, 20000 Hardware Installation, Maintenance and Upgrade</i> for MAC address module replacement.
NTHR12	alarm/BITS module for balanced DS1 (shielded twisted pair)
NTHR13	alarm/BITS module for balanced E1 (shielded twisted pair)
NTHR14	alarm/BITS module for unbalanced E1 (coax)
NTHR16	fabric card

Table 113
All other plug-in or screw-on parts for a Passport 20000

Order code	Part description
NTPN11	MAC address module
NTPN12	alarm/BITS module for balanced DS1 (shielded twisted pair)
NTPN13	alarm/BITS module for balanced E1 (shielded twisted pair) or unbalanced E1 with kit NTPN81
NTPN02	70 Gbit/s fabric card

Table 114
All other plug-in or screw-on parts for a Passport 15000 or 20000

Order code	Part description
NTHW85	adaptor bracket kit for mounting a Shasta 5000 into a NEBS 2000 frame
NTRU0325	zone 2 anchor kit for a frame
NTRU0327	zone 4 anchor kit for a frame
NTHR78	junction box kit
A0378999	wrist strap, antistatic

Table 115
Interface cables for interworking between an EdgeLink 100 and a Passport 15000 or 20000

Type	Part number	Length	Type of connector at EdgeLink	Type of connector at other end
DS1	A0718801	1.5 m (5 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1	A0718802	4.6 m (15 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1	A0718803	9.1 m (30 ft)	90-degree male 64-pin to 64-pin Amphenol/Cinch	RJ48 termination or wirewrap
DS1	A0718779	1.5 m (5 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS1	A0718780	7.6 m (25 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS1	A0718781	15.2 m (50 ft)	90-degree male 64-pin Amphenol/Cinch to wirewrap	wirewrap at RJ48 termination
DS3	NTFP19AC	1 m (3.2 ft)	male BNC	male BNC on a DS3 FP
DS3	NTFP19AA	3 m (9.8 ft)	male BNC	male BNC on a DS3 FP
DS3	NTFP19AB	15 m (48.2 ft)	male BNC	male BNC on a DS3 FP

FRUs for an MFA150 system of ac rectifiers

The following tables list the field replaceable units (FRUs) for an MFA150 system of ac rectifiers to power a Passport 15000 or 20000:

- “Relay racks for an MFA150 power system” (page 385)
- “Isolation kits for an MFA150 power system” (page 386)
- “Cables and lugs per ac circuit breaker for an MFA150 power system” (page 386)
- “Spare and repair parts for an MFA150 power system” (page 387)
- “Circuit breakers on the controller of an MFA150” (page 387)

Table 116
Relay racks for an MFA150 power system

Order code	Description
NT6C40CH	214 cm (7 ft) by 59 cm (23 in) standard (199 cm (78 in) MTG) with floor anchoring kit
NT6C40CF	122 cm (4 ft) by 59 cm (23 in), seismic zone 4 free standing (107 cm (42 in) MTG), with floor anchoring kit
NT6C40DE	214 cm (7 ft) by 59 cm (23 in) seismic zone 4 free standing/flush mount (199 cm (78 in) MTG) with floor anchoring kit
NT6C40BF	214 cm (7 ft) by 59 cm (23 in) seismic E/W bracing (199 cm (78 in) MTG) with floor anchoring kit and overhead or wall rack bracing kit
NT6C43BB	64 cm (25 in) by 59 cm (23 in) wall mounted framework (56 cm (22 in) MTG) Note: The wall mount enclosure is 54 cm (21 in) deep by 64 cm (25 in) high and provides only 54 cm (21 in) of mounting space.

Table 117
Isolation kits for an MFA150 power system

Order code	Description
P0729926	Isolation kit for relay rack NT6C40CH
P0736042	Isolation kit for relay rack NT6C40BF
P0744873	Isolation kit for seismic free-standing racks

Table 118
Cables and lugs per ac circuit breaker for an MFA150 power system

Circuit breaker	Distance between the controller and BIP	Cable size	Lug on the controller	Cable part number	Lug on the BIP
30 A	25 m (75 ft)	6 AWG dc cable	A0315080	R0118718	A0381005
60 A	11 m (35 ft)	6 AWG dc cable	A0315080	R0118718	A0381005
	17 m (55 ft)	4 AWG dc cable	A0355545	R0118733	A0686331
	27 m (90 ft)	2 AWG dc cable	A0360815	R0118734	A0698478
100 A	17 m (55 ft)	2 AWG dc cable	A0360815	R0118734	A0698478
<p>Note: Each lug on the BIP must be 2-hole, 90-degree offset, with narrow tongue to fit under the insulation boot.</p>					

Table 119
Spare and repair parts for an MFA150 power system

Order code	Description
A0614339	RC sense fuse (1-1/3A) for the ALL NT6C28 panel
P0834732	Air filter kit for the Helios rectifier 25/48
NT6C14PF	Alarm circuit pack for NT6C28CP panel
NT6C14PG	Meter circuit pack for NT6C28CP panel
P0710139	Fan assembly for Helios rectifier 25/48
P0710139	Helios rectifier 25/48
B0257258	Rectifier shelf kit
B0257267	Control and distribution panel

Table 120
Circuit breakers on the controller of an MFA150

Current rating (Amperes)	Mid-trip version
30	P0743232
60	P0878236
100	P0878240

Passport 15000, 20000 Hardware Description

Release 5.2

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Publication: 241-1501-200
Document status: Standard
Document version: 5.2S2
Document date: February 2004
Printed in Canada

