NTRN10AM

Nortel Networks

OPTera Metro 3500 Multiservice Platform

Release 12.0 Planning and Ordering Guide—Part 2 of 2

Standard Issue 1 November 2003

What's inside...

See Part 1 for the following...

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About this document

ATTENTION

This document is presented in two parts: Part 1 and Part 2. Each part has its own table of contents. The table of contents in Part 1 contain topics found in Part 1 only. The table of contents in Part 2 contain topics found in Part 2 only. Part 2 continues sequential chapter numbering from Part 1.

You are reading Part 2 of Nortel Networks *OPTera Metro 3500 Multiservice Platform Release 12.0 Planning and Ordering Guide*, NTRN10AM.

Part 1 of *OPTera Metro 3500 Multiservice Platform Release 12.0 Planning and Ordering Guide*, NTRN10AM covers a network element overview and new features in Release 12.0, operation, administration, and maintenance (OAM) features, and hardware description features.

Part 2 of *OPTera Metro 3500 Multiservice Platform Release 12.0 Planning and Ordering Guide*, NTRN10AM covers technical specifications, engineering rules, cable and connector details, shelf mounting guidelines, ordering information, terms and conditions, and a glossary.

Standards

The Telecommunications Industry Association (TIA) and the Electronics Industries Alliance (EIA) accepted RS-232 as a standard in 1997 and renumbered this standard as TIA/EIA-232. In this document, RS-232 is used to reflect current labels on the hardware and in the software for the OPTera Metro 3500 Multiservice Platform.

Supported software

This document supports the software release for OPTera Metro 3500 Release 12.0.

Supported hardware

This document supports the OPTera Metro 3500 shelves (NTN476AA, NTN476DA) and the Universal OPTera Metro 3500 shelf (NTN476AH).

> ***Note:*** The OPTera Metro 3500 shelf NTN476AA must be upgraded using the power module and cooling upgrade kit (NTN458MW) to support OC-192 optical interfaces.

Hardware naming conventions

The following naming conventions are used throughout this document to identify the OPTera Metro 3500 hardware:

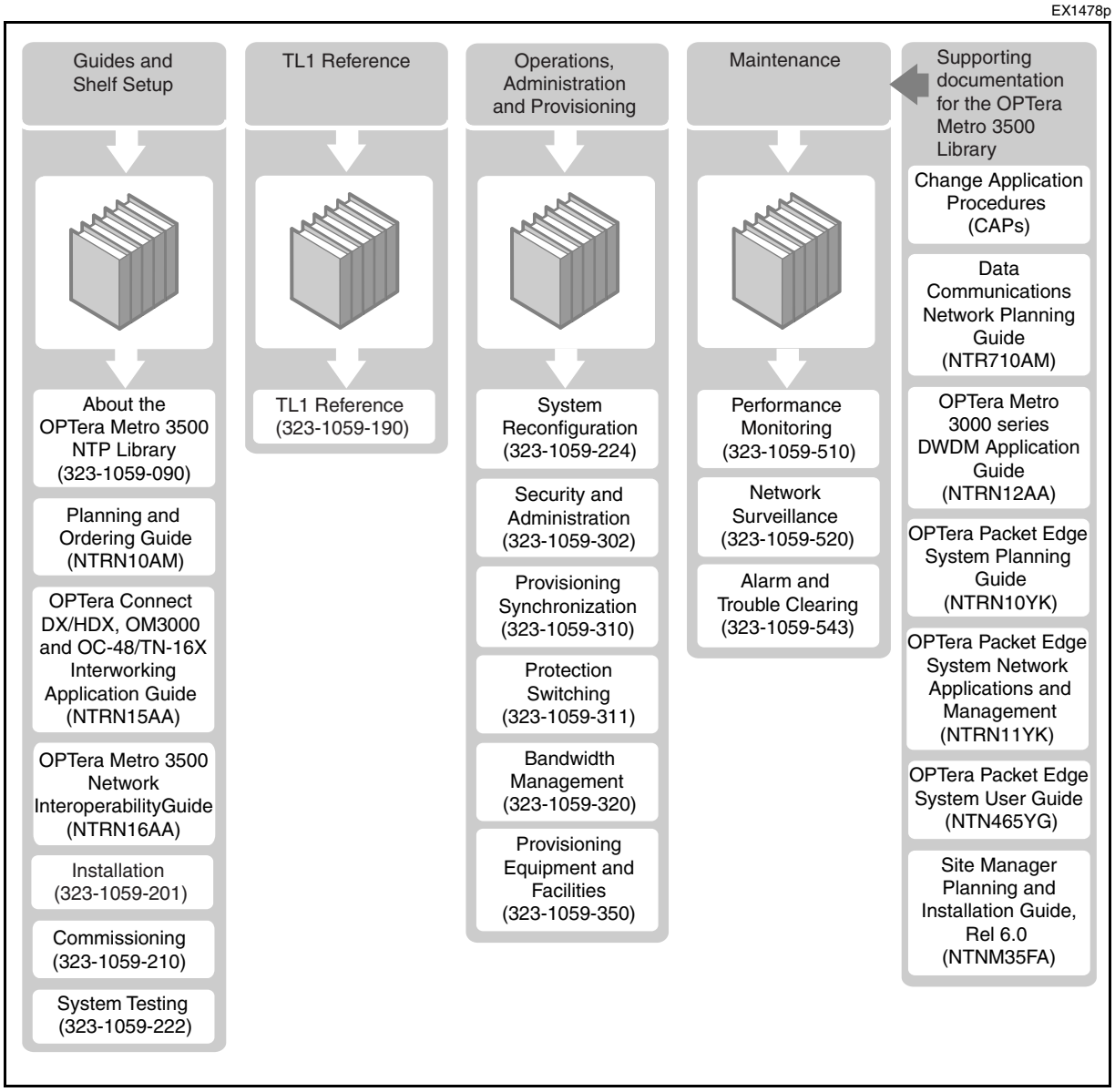
- The extended shelf processor (SPx) is referred to as the shelf processor.
- The extended network processor (NPx) is referred to as the network processor.

Audience

The following members of your company are the intended audience of this Nortel Networks technical publication (NTP):

- planners
- provisioners
- network administrators
- transmission standards engineers

OPTera Metro 3500 NTP library



Technical support and information

For technical support and information from Nortel Networks, refer to the following table.

Technical Assistance Service	
For service-affecting problems: For 24-hour emergency recovery or software upgrade support, that is, for: • restoration of service for equipment that has been carrying traffic and is out of service • issues that prevent traffic protection switching • issues that prevent completion of software upgrades	**North America:** 1-800-4NORTEL (1-800-466-7835) **International:** 001-919-992-8300
For non-service-affecting problems: For 24-hour support on issues requiring immediate support or for 14-hour support (8 a.m. to 10 p.m. EST) on upgrade notification and non-urgent issues.	**North America:** 1-800-4NORTEL (1-800-466-7835) ***Note:*** You require an express routing code (ERC). To determine the ERC, see our corporate Web site at www.nortelnetworks.com. Click on the Express Routing Codes link. **International:** Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortelnetworks.com. Click on the Contact Us link.
Global software upgrade support:	**North America:** 1-800-4NORTEL (1-800-466-7835) **International:** Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortelnetworks.com. Click on the Contact Us link.

Technical specifications

Table 4-1
General specifications

Parameter	Specification
Transmission capacity	OC-192 line rate for optical channels is supported in slots 11 and 12, provided you use the STX-192 circuit pack OC-48 line rate for optical channels is supported in slots 11 and 12 OC-12 line rate for optical channels is supported in slots 11 and 12, provided you use the VTX-48e circuit pack
Protection ratio	1+1 nonrevertive for OC-192, OC-48, OC12x4, OC-12, OC-3x4, OC-3, DS3VTx12, DS3x12e, DS3x12, DS3x3, EC-1x12, EC-1x3, and DSM DS1x84 termination module 1:n revertive for DS1
High-speed interface	
Optical interface	
Line bit rate	622.08 Mbit/s (OC-12), 2488.32 Mbit/s (OC-48) or 9953.28 Mbit/s (OC-192) 10.709 Gbit/s for OC-192 Long Reach (LR) G.709 FEC and OC-192 DWDM G.709 FEC optical interfaces
Modulation method	PCM
Line code	Scrambled NRZ

Table 4-1 (continued)
General specifications

Parameter	Specification
Middle-speed interface	
DS3 (see note)	
Line bit rate	44.736 Mb/s
Signal format	B3ZS or HDB3
Impedance	75 Ω, unbalanced
Pulse amplitude	0.36V to 0.85V
Power level	-4.7dBm to +3.6dBm
734A cabling	450 ft (137.16m) max, 225 ft (68.58m) LBO break-point
735A cabling	230 ft (70.10m) max, 115 ft (35.05m) LBO break-point
728A cabling	450 ft (137.16m) max, 225 ft (68.58m) LBO break-point
RG-59B/U cabling	275 ft (83.82m) max, 137.5 ft (41.91m) LBO break-point
Low-speed interface	
DS1	
Bit rate	1.544 Mbit/s ± 130 PPM
Line code	AMI or B8ZS
Impedance	100 Ω +5%
Cable	655 ft to DSX-1, LBO for shorter span
Optical extension	
Bit rate	155.52 Mb/s, 622.08 Mb/s, or 2488.32 Mb/s
Modulation method	PCM
Line code	Scrambled NRZ
Switching performance	
Trouble condition	Signal failure, signal degraded, unit failure
Detection time	Less than 10 ms
Switching time	Less than 50 ms for path failure on a single optical interface Less than 200 ms for path failures on multiple optical interfaces

Table 4-1 (continued)
General specifications

Parameter	Specification
OPTera Metro 3500 shelf characteristics	
Shelf dimensions	Height 17.5 in. (445 mm) Depth 11.8 in. (299.72 mm) Width 17.1 in. (435 mm) with cover 20.3 in. (515 mm)
Weight	44 lb (19.96 kg) when empty 68 lb (30.84 kg) when fully equipped
Features	Universal mounting brackets for 19 in. and 23 in. frames Front and rear cable access Front cover lockable, removable, or 180° open Built-in upper air deflector and fiber management tray
Office alarm / environmental output alarm relay contacts	
Maximum current (NO/NC contact)	0.5 A (at 60 V dc), or 1 A (at 30 V dc)

Table 4-1 (continued)
General specifications

Parameter	Specification
Connectors	
OC-192	LC
OC-48	FC, ST, SC
OC-48 STS	LC
OC-12	FC, ST, SC
OC-12x4 STS	LC
OC-3	FC, ST, SC
OC-3x4	SC, LC (see Note 3)
DS1	64-pin AMP CHAMP
DSM DS1x84TM	64-pin AMP CHAMP (DS1 I/O), (SC, ST, FC, or LC optical link to host) (see Note 4)
DS3x3	BNC
DS3x12	BNC
DS3x12e	BNC
DS3VTx12	BNC
EC-1x3	BNC
EC-1x12	BNC
2x100BT-P2P	RJ-45
OPTera Packet Edge	
4x100BT	RJ-45
4x100FX	MT-RJ
2x1000SX	SC
2x1000LX	SC
2xGigE/FC-P2P	LC
TBOS	9-pin D sub
RS-232	9-pin D sub
X.25	25-pin D sub
LAN	RJ-45

Table 4-1 (continued)
General specifications

Parameter	Specification
Power requirement	
Input voltage to shelf	-40 V dc to -60 V dc
Maximum possible power dissipation in Release 12 (See Note 1)	613 W
Maximum CSA/UL-approved power rating for backplane	640W
Power dissipated by Cooling unit assembly (NTN458QA)	65 W
Power dissipated by Universal cooling unit assembly (NTN458QH)	45 W
Operating environment	
Temperature	0°C to +50°C (32°F to +122°F) in a central office
Humidity	5% to 95% (non-condensing)
Earthquake	GR-63-CORE (NEBS) Zone IV (See Note 5)
RF immunity	Meets the immunity specifications (GR-CORE, DS-8465) for narrowband conducted and radiated electric field with cover on.
Extended temperature operating environment	Extended temperature circuit packs are designed to operate in outside plant enclosures meeting the requirements of GR-487-CORE.
Temperature	-40°C to +65°C (-40°F to +149°F)
Humidity	5% to 95% (non-condensing)
Earthquake	GR-63-CORE (NEBS) Zone IV (See Note 5)
RF immunity	Meets the immunity specifications (GR-1089-CORE, DS-8465) for narrowband conducted and radiated electric field with cover on.
Regulatory	FCC part 15, subpart J, Class A on file UL listed 94N9 CSA/UL listed LR63680 FDA - lasers on file CE listed

Table 4-1 (continued)
General specifications

Parameter	Specification	
Safety standards	• EN 60950:2000-Safety of Information Technology Equipment • CAN CSA-C22.2 No. 950-95/UL 1950 Safety of Information Technology Equipment, Third Edition • IEC 60825-1:1998, Edition 1.1, Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide • IEC 60825-2:2000-05, Safety of Laser Products - Part 2: Safety of Optical Fibre Communication Systems, Second Edition • EN 60825-1:1994, Amendment A11, Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide • EN 60825-2:2000, Safety of Laser Products - Part 2: Safety of Optical Fibre Communication Systems • FDA 21 CFR 1040.10-Performance Standards for Light-Emitting Products, 4-1-00 edition	
Shelf security	padlock	
OMX shelf characteristics	**NT0H32xE**	**NT0H32xF**
Connector type	SC	SC
Minimum adjacent channel isolation (demultiplexer)	22 dB	30 dB
Minimum non-adjacent channel isolation (demultiplexer)	35 dB	50 dB
Minimum channel isolation (multiplexer)	10 dB	12 dB
Minimum directivity	55 dB	45 dB
Insertion loss (port to port) Add path	4.5 dB (maximum) 3.2 dB (typical)	2.8 dB (maximum) 2.1 dB (typical)

Table 4-1 (continued)
General specifications

Parameter	Specification	
Insertion loss (port to port) Drop path	4.9 dB (maximum)	3.1 dB (maximum)
	3.5 dB (typical)	2.4 dB (typical)
Insertion loss (port to port) pass-through per band	1.2 dB (maximum)	1.0 dB (maximum)
	0.7 dB (typical)	0.7 dB (typical)
Note 1: For network equipment-building system (NEBS) compliance, the maximum power dissipation allowed is 181.2 watts/square ft. This translates into a maximum power dissipation 1272.02 watts for a 7.02 square ft. OPTera Metro 3500 bay. You can populate your bay with different shelf configurations in order to stay within the maximum power dissipation limit. For example, two fully-equipped shelves in a 7.02 square ft. bay equal a power dissipation of 1226.00 watts. ***Note 2:*** This meets requirements defined in GR-499-CORE Iss 2. ***Note 3:*** The OC-3x4 circuit pack pre-installed with SC connectors is NTN441AA. The OC-3x4 circuit pack pre-installed with LC connectors is NTN441AC. ***Note 4:*** The DS1x84TM circuit pack pre-installed with LC connectors is NTN313AC. The DS1x84TM circuit pack **not** pre-installed with LC connectors is NTN313AA. ***Note 5:*** The following bays when equipped with OPTera Metro 3500 shelves meet GR-63-CORE (NEBS) Zone IV requirements: NT7E70AA, NT7E70BA, NT7E70CA, NT7E70DA AND NT7E70EA.		

Table 4-2
OC-3 optical interface specifications

Parameter	OC-3 IC NTN401DA	OC-3 LR NTN401AA
Transmitter type • See Note 1 and Note 3	MLM FP	MLM FP
Transmitter wavelength range	1260-1360 nm	1260-1360 nm
Launch power (maximum)	-11.0 dBm	0 dBm
Launch power (minimum)	-17.0 dBm	-5.0 dBm
Spectral width	4.5 nm rms	2.5 nm rms
Side mode suppression	N/A	N/A
Dispersion penalty	1.0 dB	1.0dB
System optical return loss	N/A	N/A
Receiver type • See Note 2	PIN	PIN
Receiver wavelength range	1260-1360 nm	1260-1360 nm
• Receiver overload See Note 6	0 dBm	0 dBm

Table 4-2 (continued)
OC-3 optical interface specifications

Parameter	OC-3 IC NTN401DA	OC-3 LR NTN401AA
Receive sensitivity (min) • (BER = 1^{-10})	-23.0 dBm	-34.0 dBm
Receive reflectance	N/A	N/A
System gain • See Note 5	5.0 dB	28.0 dB
Target distance	1 km (0.62 miles)	80 km (49.71 miles) (@ 0.35 dB / km)
Note 1: MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by MLMs in its optical spectrum. ***Note 2:*** PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current. ***Note 3:*** For more information, refer to GR-253-CORE Iss 3. ***Note 4:*** The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 circuit packs in slots 11 and 12). ***Note 5:*** System gain values are computed using the Tx wavelength range of the circuit pack. ***Note 6:*** Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.		

Table 4-3
OC-3x4 optical interface specifications

Parameter	OC-3x4 IR NTN441AA NTN441AC
Transmitter type • See Note 2 and Note 3	MLM FP
Transmitter wavelength range	1261-1360 nm
Launch power (maximum)	-8.0 dBm
Launch power (minimum)	-15.0 dBm
Spectral width	7.7 nm rms
Dispersion penalty	1.0 dB
System optical return loss	N/A
Receiver type • See Note 1	PIN

Table 4-3 (continued)
OC-3x4 optical interface specifications

Parameter	OC-3x4 IR NTN441AA NTN441AC
Receiver wavelength range	1100-1600 nm
Receiver overload • See Note 7	-8.0 dBm
Receive sensitivity (min) • (BER = 1^{-10})	-28.0 dBm
Receive reflectance	N/A
System gain • See Note 6	12.0 dB
Target distance	21 km (13.02 miles)

Note 1: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current.

Note 2: MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by MLMs in its optical spectrum.

Note 3: For more information, refer to GR-253-CORE Iss 3.

Note 4: The OC-3x4 circuit pack pre-installed with SC connectors is NTN441AA. The OC-3x4 circuit pack pre-installed with LC connectors is NTN441AC.

Note 5: The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 circuit packs in slots 11 and 12).

Note 6: System gain values are computed using the Tx wavelength range of the circuit pack.

Note 7: Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.

Table 4-4
OC-12 optical interface specifications

Parameter	OC-12 IC NTN404DA NTN404MA	OC-12 IR NTN404BA NTN404KA	OC-12 LR NTN404AA NTN404JA	OC-12 ER NTN404CA NTN404LA
Transmitter type • See Note 1, Note 2, and Note 6	MLM FP	MLM FP	SLM DFB	SLM DFB
Transmitter wavelength range	1260-1360 nm	1260-1360 nm	1285-1330 nm	1480-1580 nm
Launch power (maximum)	-11.0 dBm	-8.0 dBm	+2.0 dBm	+2.0 dBm

Table 4-4 (continued)
OC-12 optical interface specifications

Parameter	OC-12 IC NTN404DA NTN404MA	OC-12 IR NTN404BA NTN404KA	OC-12 LR NTN404AA NTN404JA	OC-12 ER NTN404CA NTN404LA
Launch power (minimum)	-17.0 dBm	-15.0 dBm	-3.0 dBm	-3.0 dBm
Spectral width	4.5 nm rms	2.5 nm rms	1 nm (-20 dB)	1 nm (-20 dB)
Side mode suppression	N/A	N/A	30.0 dB	30.0 dB
Dispersion penalty	1.0 dB	1.0 dB	1.0 dB	1.0 dB
System optical return loss	N/A	N/A	20.0dB	24.0 dB
Dispersion tolerance	14 ps/nm	74 ps/nm	3000 ps/nm	3000 ps/nm
Receiver type • See Note 3 and Note 4	PIN	PIN	APD	APD
Receiver wavelength range	1260-1360 nm	1260-1360 nm	1260-1360 nm	1480-1580 nm
Receiver overload • See Note 9	-11.0 dBm	-8.0 dBm	-8.0 dBm	-8.0 dBm
Receive sensitivity (min) • (BER = 1^{-10})	-23.0 dBm	-28.0 dBm	-32.0 dBm	-33.0 dBm
Receive reflectance	N/A	N/A	-14.0 dB	-27.0 dB

Table 4-4 (continued)
OC-12 optical interface specifications

Parameter	OC-12 IC NTN404DA NTN404MA	OC-12 IR NTN404BA NTN404KA	OC-12 LR NTN404AA NTN404JA	OC-12 ER NTN404CA NTN404LA
System gain • See Note 5 • See Note 8	5.0 dB	12.0 dB	28.0 dB	29.0 dB
Target distance	1 km (0.62 miles)	22 km (13.64 miles)	65 km (40.3 miles)	105 km (65.1 miles)

Note 1: MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by MLMs in its optical spectrum.

Note 2: SLM DFB (Single Longitudinal Mode Distributed FeedBack). SLMs are less limited by dispersion in the fiber because of the single propagating mode. This allows SLMs to cover greater distances (than MLMs) at higher bit rates without the need for regeneration.

Note 3: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current.

Note 4: APD (Avalanche Photo Diode). Similar function as a PIN diode but due to inherent carrier gain close to the breakdown voltage, multiplication occurs allowing more sensitive receiver designs.See note

Note 5: Includes 1 dB penalty for dispersion.

Note 6: For more information, refer to GR-253-CORE Iss 3.

Note 7: The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 circuit packs in slots 11 and 12).

Note 8: System gain values are computed using the Tx wavelength range of the circuit pack.

Note 9: Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.

Table 4-5
OC-12x4 optical interface specifications

Parameter	OC-12 IC NTN404DA NTN404MA
Transmitter type • See Note 1, Note 2, and Note 7	MLM FP
Transmitter wavelength range	1293-1334 nm
Launch power (maximum)	-8.0 dBm
Launch power (minimum)	-15.0 dBm
Spectral width	4.0 nm rms
Side mode suppression	N/A
Dispersion penalty	1 dB

Table 4-5 (continued)
OC-12x4 optical interface specifications

Parameter	OC-12 IC NTN404DA NTN404MA
System optical return loss	N/A
Dispersion tolerance	46 ps/nm
Receiver type • See Note 3 and Note 4	PIN
Receiver wavelength range	1100-1600 nm
Receiver overload • See Note 9	-8.0 dBm
Receive sensitivity (min) • (BER = 1^{-10})	-28.0dBm
Receive reflectance	N/A
System gain • See Note 5 • See Note 6	12 dB
Target distance	21 km (13.1 miles)

Note 1: MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by MLMs in its optical spectrum.

Note 2: SLM DFB (Single Longitudinal Mode Distributed FeedBack). SLMs are less limited by dispersion in the fiber because of the single propagating mode. This allows SLMs to cover greater distances (than MLMs) at higher bit rates without the need for regeneration.

Note 3: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current.

Note 4: APD (Avalanche Photo Diode). Similar function as a PIN diode but due to inherent carrier gain close to the breakdown voltage, multiplication occurs allowing more sensitive receiver designs.

Note 5: Consistent with the minimum launch power, minimum receiver sensitivity and optical path dispersion penalty values listed in the table.

Note 6: Includes 1 dB penalty for dispersion.

Note 7: For more information, refer to GR-253-CORE Iss 3.

Note 8: The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 or OC-12x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 or OC-192 circuit packs in slots 11 and 12).

Note 9: Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.

Table 4-6
OC-48 optical interface specifications

Parameter	SR NTN440EA	SR NTN440EH	IR NTN440BA NTN440BH	LR NTN440DA	ELR NTN440FA	DWDM LR (see Table 8-8 on page 8-16 for PECs)	DWDM ER (see Table 8-8 on page 8-16 for PECs)
Transmitter type • See Note 3, Note 4, and Note 5	MLM FP	MLM FP	SLM DFB	SLM DFB	SLMQW BH	SLM DFB	SLMQW BH
Transmitter wavelength range	1260-1360 nm	1270-1351 nm	1260-1360 nm	1500-1580 nm	1500-1580 nm	ITU 200GHz λo +/–250pm	ITU 100GHz λo +/–160pm
Launch power (maximum)	-2.35 dBm	-3.0 dBm	0 dBm	4.5 dBm	4.5 dBm	4.5 dBm	4.5 dBm
Launch power (minimum)	-7.15 dBm	-10.0 dBm	-4.8 dBm	0.2 dBm	1.0 dBm	0.2 dBm	1.0 dBm
Spectral width	2.5 nm rms	3.5 nm rms	1 nm (-20 dB)	0.6 nm (-20 dB)	0.6 nm (-20 dB)	0.6 nm (-20 dB)	0.6 nm (-20 dB)
Side mode suppression	N/A	N/A	30.0 dB	33.0 dB	32.0 dB	33.0 dB	32.0 dB
Dispersion penalty (maximum)	1.0 dB	0 dB	0.5 dB	1.7 dB	2.0 dB	1.7 dB	2.0 dB
System optical return loss	24.0 dB	24.0 dB	24.0 dB	24.0 dB	24.0 dB	24.0 dB	24.0 dB
Dispersion tolerance	18 ps/nm	13.1 ps/nm	150 ps/nm	1500 ps/nm	6120 ps/nm	1500 ps/nm	6120 ps/nm
Receiver type • See Note 1 and Note 2	PIN	PIN	PIN	APD	APD	APD	APD
Receiver wavelength range	1200 - 1600 nm	1200 - 1600 nm	1200 - 1600 nm	1290 - 1610 nm	1290 - 1610 nm	1290 - 1610 nm	1290 - 1610 nm

Table 4-6 (continued)
OC-48 optical interface specifications

Parameter	SR NTN440EA	SR NTN440EH	IR NTN440BA NTN440BH	LR NTN440DA	ELR NTN440FA	DWDM LR (see Table 8-8 on page 8-16 for PECs)	DWDM ER (see Table 8-8 on page 8-16 for PECs)
Receiver overload • See Note 10)	-3.0 dBm	-3.0 dBm	-3.0 dBm	-9.0 dBm	-9.0 dBm	-9.0 dBm	-9. 0dBm
Receive sensitivity (minimum) (BER = 1^{-10})	-19.0 dBm	-18.0 dBm	-19.0 dBm	-29.0 dBm	-29.0 dBm	-29.0 dBm	-30.0 dBm
Receive reflectance	-27.0 dB	-27.0 dB	-27.0 dB	-30.0 dB	-30.0 dB	-30.0 dB	-30.0 dB
System gain • See Note 8 • See Note 9	10.85 dB	7.0 dB	13.7 dB	27.5 dB	See Table 4-9 on page 4-19	27.5 dB	See Table 4-9 on page 4-19

Table 4-6 (continued)
OC-48 optical interface specifications

Parameter	SR NTN440EA	SR NTN440EH	IR NTN440BA NTN440BH	LR NTN440DA	ELR NTN440FA	DWDM LR (see Table 8-8 on page 8-16 for PECs)	DWDM ER (see Table 8-8 on page 8-16 for PECs)
Dispersion limited distance	3 km (1.86 miles) (@ 6 ps/nm/km)	3 km (1.86 miles) (@ 6 ps/nm/km)	25 km (15.5 miles) (@ 6 ps/nm/km)	83 km (51.5 miles) (@ 18 ps/nm/km)	360 km (223.6 miles) (@ 17 ps/nm/km)	83 km (51.5 miles) (@ 18 ps/nm/km)	360 km (223.6 miles) (@ 17 ps/nm/km)
Attenuation limited distance	27 km (16.8 miles) (@ 0.4 dB/km)	17.5 km (10.9 miles) (@ 0.4 dB/km)	34 km (21.1 miles) (@ 0.4 dB/km)	92 km (57.1 miles) (@ 0.3 dB/km)	121 km (75.1 miles) (@ 0.25 dB/km)	92 km (57.1 miles) (@ 0.3 dB/km)	121 km (75.1 miles) (@ 0.25 dB/km)

Note 1: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current.

Note 2: APD (Avalanche Photo Diode). Similar function as a PIN diode but due to inherent carrier gain close to the breakdown voltage, multiplication occurs allowing more sensitive receiver designs.

Note 3: MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by multi-longitudinal modes in its optical spectrum.

Note 4: SLM DFB (Single Longitudinal Mode Distributed FeedBack). The DFB laser emits SLM light.

Note 5: For more information, refer to GR-253-CORE Iss 3.

Note 6: The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 circuit packs in slots 11 and 12).

Note 7: Wavelengths and tolerances of the DWDM circuit packs are in compliance with ITU-T G.692 specifications for a 200-GHz wavelength plan.

Note 8: System gain values are computed using the Tx wavelength range of the circuit pack.

Note 9: Includes dispersion penalty.

Note 10: Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.

Table 4-7
OC-48 STS optical interface specifications

Parameter	SR NTN440HA	IR NTN440KA	LR-2 NTN440LA
Transmitter type • See Note 3, Note 4, and Note 5	MLM FP	SLM DFB	SLM DFB
Transmitter wavelength range	1266-1360 nm	1260-1360 nm	1500-1580 nm
Launch power (maximum)	-3.0 dBm	0 dBm	3.0 dBm

Table 4-7 (continued)
OC-48 STS optical interface specifications

Parameter	SR NTN440HA	IR NTN440KA	LR-2 NTN440LA
Launch power (minimum)	-10.0 dBm	-5.0 dBm	-2.0 dBm
Spectral width	4.0 nm rms	1 nm (-20 dB)	0.6 nm (-20 dB)
Side mode suppression	N/A	30 dB	30 dB
Dispersion penalty (maximum)	1.0 dB	1.0 dB	2.0 dB
System optical return loss	24.0 dB	24.0 dB	24.0 dB
Dispersion tolerance	12 ps/nm	740 ps/nm	1600 ps/nm
Receiver type • See Note 1 and Note 2	PIN	PIN	APD
Receiver wavelength range	1100-1600 nm	1100-1600 nm	1100-1600 nm
Receiver overload See Note 9	-3.0 dBm	0 dBm	-9.0 dBm
Receive sensitivity (minimum) (BER = 1^{-10})	-18.0 dBm	-18.0 dBm	-28.0 dBm
Receive reflectance	-27.0 dB	-27.0 dB	-27.0 dB
System gain • See Note 7 • See Note 8	7.0 dB	12.0 dB	24.0 dB

Table 4-7 (continued)
OC-48 STS optical interface specifications

Parameter	SR NTN440HA	IR NTN440KA	LR-2 NTN440LA
Dispersion limited distance	2 km (1.2 miles) (@6 ps/nm/km)	123 km (76.4 miles) (@6 ps/nm/km)	94 km (58.4 miles) (@17 ps/nm/km)
Attenuation limited distance	28 km (17.4 miles) (@0.25 dB/km) 23 km (13.8 miles) (@0.3 dB/km)	48 km (29.8 miles) (@0.25 dB/km) 40 km (24.8 miles) (@0.3 dB/km)	96 km (59.6 miles) (@0.25 dB/km) 80 km (49.7 miles) (@0.3 dB/km)
Note 1: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current. ***Note 2:*** APD (Avalanche Photo Diode). Similar function as a PIN diode but due to inherent carrier gain close to the breakdown voltage, multiplication occurs allowing more sensitive receiver designs. ***Note 3:*** MLM FP (Multi Longitudinal Mode Fabry-Perot). A type of laser construction technique characterized by multi-longitudinal modes in its optical spectrum. ***Note 4:*** SLM DFB (Single Longitudinal Mode Distributed FeedBack). The DFB laser emits SLM light. ***Note 5:*** For more information, refer to GR-253-CORE Iss 3. ***Note 6:*** The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-48 circuit packs in slots 11 and 12). ***Note 7:*** Consistent with the minimum launch power, minimum receiver sensitivity and optical path dispersion penalty values listed in the table. ***Note 8:*** Includes dispersion penalty. ***Note 9:*** Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.			

Table 4-8
OC-192 optical interface specifications (see Note 9)

Parameter	IR NTN445CB
Transmitter type • See Note 3, and Note 4	SLM DFB
Transmitter wavelength range	1530-1565 nm
Launch power (maximum) (End Of Life)	2.0 dBm
Launch power (minimum) (End Of Life)	-1.0 dBm

Table 4-8 (continued)
OC-192 optical interface specifications (see Note 9)

Parameter	IR NTN445CB
Spectral width	0.3 nm
Side mode suppression	30 dB
Dispersion penalty (maximum)	2.0 dB
System optical return loss Tolerance	-24.0 dB
Dispersion tolerance	800 ps/nm
Receiver type • See Note 1 and Note 2	PIN
Receiver wavelength range	1260-1600 nm
Receiver overload (BER = 1^{-12}) • See Note 8	-1.0 dBm
Receive sensitivity (minimum) (BER = 1^{-12})	-14.0 dBm
Receive reflectance	-27.0 dB
System gain • See Note 6 and Note 7	11.0 dB

Table 4-8 (continued)
OC-192 optical interface specifications (see Note 9)

Parameter	IR NTN445CB
Dispersion limited distance	44 km (27.3 miles) (@18 ps/nm/km)
Attenuation limited distance	44 km (27.3 miles) (@ 0.25 dB/km)

Note 1: PIN (P-intrinsic-N diode). Constructed as a photodiode such that incoming photons produce electron-hole pairs and causes the flow of electrical current.

Note 2: APD (Avalanche Photo Diode). Similar function as a PIN diode but due to inherent carrier gain close to the breakdown voltage, multiplication occurs allowing more sensitive receiver designs.

Note 3: SLM DFB (Single Longitudinal Mode Distributed FeedBack). The DFB laser emits SLM light.

Note 4: For more information, refer to GR-253-CORE Iss 3.

Note 5: The maximum number of simultaneous SDCC-provisionable ports on an OPTera Metro 3500 shelf is 34 (the shelf must be equipped with eight unprotected OC-3x4 circuit packs in slots 3 through 10, and a protected pair of OC-192 circuit packs in slots 11 and 12).

Note 6: System gain values are computed using the Tx wavelength range of the circuit pack.

Note 7: Includes 1 dB penalty for dispersion.

Note 8: Exceeding the receiver overload optical power can permanently damage the circuit pack. Use proper attenuation when performing optical loopbacks.

Note 9: Final OC-192 LR and DWDM specifications were not available at time of printing. Please contact your Nortel Networks sales representative if you require additional information. The optical specifications will be included in future updated version of the documentation.

Table 4-9
System gain in OC-48 Extended Reach circuit packs (NTN440FA), (NTN408AS, CW, AA, AN, AE, AJ, CN, CJ, DA)

Fiber length (km)	System gain (dB) (see Note 1)	System gain (dB) (see Note 2)
0	31.00	30.00
45	30.75	29.75
90	30.50	29.50
135	30.25	29.25
180	30.00	29.00
225	29.75	28.75
270	29.50	28.50

Table 4-9 (continued)
System gain in OC-48 Extended Reach circuit packs (NTN440FA), (NTN408AS, CW, AA, AN, AE, AJ, CN, CJ, DA)

Fiber length (km)	System gain (dB) (see Note 1)	System gain (dB) (see Note 2)
315	29.25	28.25
360	29.00	28.00

Note 1: System gain is calculated assuming fiber dispersion of 17 ps/nm/km and a BER of 10^{-10}.

Note 2: System gain is calculated assuming fiber dispersion of 17 ps/nm/km and a BER of 10^{-12}.

Table 4-10
Circuit pack power requirements

Circuit pack	Power requirement (Maximum)
DS1	11.5 W
DS3x3	11.9 W
DS3x12	19.6 W
DS3x12e	14.7 W
DS3VTx12	15.5 W
OC-3	10.5 W
OC-3x4	19.2 W
OC-12	11.5 W
OC-12x4 STS	30.8 W
OC-48 SR, IR	38.7 W
OC-48 LR, ELR	43.0 W
OC-48 DWDM	48.0 W
OC-48 STS SR, IR, LR	25.0 W
OC-192 IR, LR G.709 FEC	50.0W
OC-192 DWDM G.709 FEC	72.0 W
VTX-48, VTX-48e	39.2 W
STX-192	64.0 W
EC-1x3	13.2 W

Table 4-10 (continued)
Circuit pack power requirements

Circuit pack	Power requirement (Maximum)
EC-1x12	16.7 W
DSM DS1x84TM (see Note 1)	22.5 W
2x100BT-P2P	26.0 W
4x100BT	25.0 W
4x100FX-MM	27.8 W
4x100FX-SM	27.0 W
2x1000SX	47.0 W
2x1000LX	47.0 W
2xGigE/FC-P2P	30.0 W (see Note 3)
SPx (NTN423BA)	15.0 W
SPx (NTN423BH)	11.0 W
ILAN	3.5 W
NPx (NTN424BA)	14.4 W
NPx (NTN424BH)	14.0 W
PSC	4.5 W (8.0 W during protection)
Cooling unit assembly (NTN458QA)	65.0 W (see Note 3)
Cooling unit assembly (NTN458GA)	45.0 W (see Note 4)
Note 1: For full specifications on the DSM shelf (NTN407MA) and its sub-components, see DSM specifications on page 4-26. ***Note 2:*** This values includes the 2 SFP modules. ***Note 3:*** When equipped in shelf (NTN476DA) it consumes 32.0 W when running at half speed (typical in CO environment). ***Note 4:*** When equipped in shelf (NTN476AH) it consumes 12.0 W when running at half speed (typical in CO environment).	

Table 4-11
Propagation delay periods

Circuit pack	Latency
DS1 (NTN430AA) • DS1 to OC-48 to DS1	 131µs
DS1 (NTN430BA) • DS1 to OC-48 to DS1	 131µs
DS3x3 (NTN437AA) • DS3 to OC-48 to DS3	 28µs
DS3x12 (NTN435AA) • DS3 to OC-48 to DS3	 31µs
DS3x12 (NTN435AH) • DS3 to OC-48 to DS3	 31µs
DS3x12e (NTN435BA) • DS3 to OC-48 to DS3	 24µs
DS3VTx12 (NTN435FA) • DS3 to DS3 hairpin (no OC-48) • DS3 to OC-48 to DS3 (2WAY)	 185 µs 231 µs
EC-1x3 (NTN436AA) • EC-1 to OC-48 to EC-1 (2WAY)	 19µs
EC-1x12 (NTN436DA) • EC-1 to OC-48 to EC-1 (2WAY)	 18µs

Table 4-12
Protection switching specifications

Value	Comment
Optical interface protection	
Protection ratio	1+1 non-revertive for OC-192, OC-48, OC-12X4, OC-12, OC-3x4, OC-3, EC-1x12, EC-1x3, DS3VTx12, DS3x12e, DS3x12, DS3x3, DS1TM
	1:n revertive for DS1
Signal degrade threshold values	
(Path) range 10^{-5} to 10^{-9}	One value, user provisionable for all STS and VT, when in UPSR mode

Table 4-12 (continued)
Protection switching specifications

Value	Comment
(Line) range 10^{-5} to 10^{-9}	• User provisionable for 1+1 protected linear OC-3, OC-3x4, OC-12, OC-12X4, OC-48 or OC-192 optical interface circuit pack (one value for each OC-3x4, OC-12, OC-12x4, OC-48 facility) • User provisionable for BLSR protected OC-48 or OC-192 optical interface circuit pack (one value for each OC-48 or OC-192 facility)
Switching performance (1+1 GR253)	
Trouble condition	signal failure, signal degrade, unit failure
Detection time	less than 10 ms
Switching time	less than 50 ms
Switching performance (UPSR GR1400)	
Trouble condition	path failure, path degrade
Detection time	less than 10 ms
Switching time	less than 50 ms
Switching performance (BLSR GR1230-core)	
Trouble condition	signal failure, signal degrade, unit failure
Detection time	less than 10 ms
Switching time	less than 50 ms

Table 4-13
Operations interface specifications

Interface type	Comments
Craft interfaces	TL1 line-by-line user interface PC-based graphical user interface, UNIX HPUX-11i graphical user interface, Sun Solaris 8 RS-232 DTE data terminal modem port
OS interfaces	Single-ended TL1 Site Manager Rel 6.0 through host SPx or NPx
Office alarms	Critical, major, minor Visual and audible alarm Shelf status LEDs

Table 4-14
OPTera Packet Edge System optical specifications

Parameter	2x1000SX NTN438AA	2x1000LX NTN438BA	4x100FX-MM NTN433EA	4x100FX-SM NTN433FA
Wavelength range	770-860 nm	1270-1355 nm	1270-1380 nm	1270-1340 nm
Launch power (maximum)	-4.0 dBm	-3.0 dBm	-14.0 dBm	-14.0 dBm
Launch power (minimum)	-9.5 dBm	-11.0 dBm	-20.0 dBm	-20.0 dBm
Receive sensitivity minimum (BER = 10^{-9})	-17.0 dBm	-19.0 dBm	-31.0 dBm	-31.0 dBm
Receiver optical overload (BER = 10^{-9})	0 dBm	-3.0 dBm	-14.0 dBm	-14.0 dBm
Connector type	SC	SC	MT-RJ	MT-RJ
Receiver type	PIN	PIN	PIN	PIN
Transmitter type	VCSEL	FP	LED	SMQW FP
Operating distance • See Note 1, Note 2	• 500-550m (50µm MMF) (see Note 3) • 220-275m (62.5µm MMF) (see Note 4)	• 5km (10µm SMF) • 550m (50, 62.5µm MMF)	• 2km (62.5 µm MMF)	• 15km (10 µm SMF)
Link budget	7.5 dB	8.0 dB	11.0 dB	11.0 dB

Note 1: This is a typical operating distance based on four connectors, a splice every 2 km and 0.4 dB/km cable attenuation. The distance will vary depending on the number of connections and splices.

Note 2: Optical OPE circuit pack distances are IEEE-specified segment lengths, based on the assumptions that all distances are for full-duplex transmission. The IEEE distances reflect worst-case attenuation scenarios.

Note 3: The 2x1000SX 50µm MMF can be 400MHz/km fiber (which accommodates 500m), or 500MHz/km fiber (which accommodates 550m).

Note 4: The 2x1000SX 62.5µm MMF can be 160MHz/km fiber (which accommodates 220m), or 200MHz/km fiber (which accommodates 275m).

Table 4-15
Small form Factor Pluggable (SFP) for 2xGigE/FC-P2P interfaces

Parameter	Single Mode		Multi Mode	
	GigE	FC	GigE	FC
	2xGigE/FC-P2P 1000BASE-LX NTTP51BD		2xGigE/FC-P2P 1000BASE-SX NTTP51AA	
Data rate	1250 Mb/s	1062.5 Mb/s	1250 Mb/s	1062.5 Mb/s
Wavelength range	1270 nm -1345 nm		770 nm - 860 nm	
Launch power (maximum) See Note 1	-3.0 dBm		0.0 dBM	
Launch power (minimum)	-11.0 dBm		-9.5 dBm	
Minimum receive optical power (BER = 10^{-12}) See Note 2	-19.0 dBm		-17.0 dBm	
Maximum receive optical power (BER = 10^{-12}) See Note 2	-3.0 dBm		-3.0dBm	
Connector type	LC		LC	
Receiver type	PIN		PIN	
Transmitter type	FP		VCSEL	
Operating distance	• 2m to 5km over non-dispersion shifted single mode fiber • 2m to 550m over multi-mode fiber See Note 3	• 2m to 10km over non-dispersion shifted single mode fiber	• 2m to 500m over 50µm 400MHz.km • 2m to 550m over 50µm 500MHz.km • 2m to 220m over 62.5µm 160MHz.km • 2m to 275m over 62.5µm 200MHz.km	• 0.5m to 500m over 50µm 500MHz.km • 0.5m to 300m over 62.5µm 200MHz.km

Note 1: Measured average power coupled into single mode fiber (SMF). For 50 µm or 62.5 µm multimode fiber (MMF) operation, the output power is 0.5 dBm less and is measured after a single mode fiber offset-launch mode conditioning path cord as specified in IEEE 802.3z.

Note 2: Measure with 2^7-1 PRBS at 1250 Mb/s at 1300 nm wavelength

Note 3: 50µm 400MHz.km, 50um 500MHz.km or 62.5um 500MHz.km at 1300nm. Requires single-mode fiber offset-launch mode-conditioning patch code as per 1EEE802.3, sec 38.11.4.

Table 4-16
DSM specifications

Parameter	Specification
Transmission capacity	OC-3 line rate
Protection ratio	1 + 1 protection mode (with bidirectional line APS)
High-speed interface	
Optical interface	
Line bit rate	155.52 Mb/s (OC-3)
Modulation method	PCM
Line code	Scrambled NRZ
Low-speed interface	
DS1	
Bit rate	1.544 Mb/s +/- 130 PPM
Signal format	AMI or B8ZS
Impedance	100 Ω +/- 5%
Shelf characteristics	
Shelf dimensions	Height: 5.83 in. (148 mm) Depth: 11.02 in. (280 mm) Width: 17.32 in. (440 mm)
Weight	Fully equipped: 21.16 lb (9.6 kg)
Features	Universal mounting brackets for 19 in. (486.60 mm) and 23 in. (584.20 mm) frames Top cable access Front cover padlockable, removable, or 180° open
Regulatory	FCC part 15 Class A UL listed FDA - lasers on file
Connectors	
J1, J2 (mated with DS1 cable)	64 pin AMP CHAMP
Optical connectors for the OC-3 interface	FC, ST, SC, LC (See Note 1)

Table 4-16 (continued)
DSM specifications

Parameter	Specification
Power requirement	
Input voltage to shelf	-40V to -60V (see Note 2)
Maximum power consumption of DSM shelf (NTN407MA)	13 W
Maximum power consumption of DS1x84TM circuit pack (NTN313AA or NTN313AC)	67 W
Maximum power consumption of DSM shelf (NTN407MA) with two DS1x84TM circuit packs installed	22.5 W
Maximum current	1.5 A
Typical current	1.2 A
Operating environment	
Temperature	Uncontrolled environment: -49°F to +149°F (-45°C to +65°C)
Humidity	Uncontrolled environment: 5% to 95% (non-condensing)
Earthquake	GR-63 4.4 for Zone 4
Immunity (with covers on or off)	GR-1089 3.3 DS-8465 Issue 3 (Bell Canada)
Note 1: The connector types for DS1x84TM are FC/ST/SC for NTN313AA, or LC for NTN313AC. ***Note 2:*** A filtered battery is required.	

Table 4-17
DSM DS1x84 interface specifications

Parameter	Comment
Wavelength (nominal)	1260-1360 nm
Launch power (maximum)	-8 dBm
Launch power (minimum)	-15 dBm
Receive sensitivity (minimum)	-28 dBm
System optical return loss	N/A
Receiver optical overload	-8 dBm
Optical path penalty	1 dB

Table 4-18
DSM protection switching specifications

Value	Comment
Optical interface protection	
Protection ratio	1 + 1 non-revertive
Signal degrade threshold values	
Range	range 10^{-5} to 10^{-9}
Switching performance	
Trouble Condition	Protection switching if there is a signal degrade, signal failure, or a circuit pack failure on the DSM DS1x84 TM or the OC-3 circuit pack.
Detection Time	10 ms
Switching Time	50 ms

Table 4-19
DSM operations interface specifications

Interface type	Comments
Craft interfaces	TL1 line-by-line user interface PC-based graphical user interface, UNIX HPUX-11i graphical user interface, Sun Solaris 8 RS-232 DTE data terminal modem port
OS interfaces	Single-ended TL1 Preside Site Manager Rel 6.0 through host SPx or NPx
Office alarms	Critical, major, minor Visual and audible alarm Shelf status LEDs

Table 4-20
Breaker Interface Panel (BIP) (NTN458RA) specifications

Parameter	Specification
Electrical	
Input/Output voltage	-48Vdc nominal (-40.0 V to -60.0 V operating range)
Input feeder	Max. 100 A per side (A & B)
Maximum input load rating of each panel	Within the nominal input rating
L+ and L- (BATT & RTN) input terminals & cables	Two hole compression lugs, with #10 (4.5 mm dia.) studs and 5/8" (15.88 mm) stud centers. Nortel Networks recommends the use of a #2 AWG wire for future expendability; the input terminals will accept cable sizes from #6 to #2 AWG.
Ground terminals	Two hole compression lugs, with #10 (4.5 mm dia.) studs and 5/8" (15.88 mm) stud centers. Nortel Networks recommends the use of #6 AWG ground wire. Refer to Table 4-23 on page 4-32 for specification.
Output breakers	8 breakers per side Breakers 1 to 4 are 20 A Breaker 5 is 15 A Breakers 6 to 8 are 5 A
Output load (continuous)	16 A (max.) for each 20 A breaker 12 A (max.) for each 15 A breaker 4 A (max.) for each 5 A breaker
Output terminals	Eight universal, high current two-pin (L- & L+), mate and lock (AMP style) female connectors rated at 30 A each.
Alarms	
Alarms Input/Output Termination	Wire Wrap Pin Field for #24 wire (#22 - #26 AWG, max.6 A at 60 Vdc or 2 A at 30 Vdc)
Alarm Inputs	Minor (yellow), Major (red) & Critical (red) (dry contacts)
Alarm Outputs	Minor, Major & Critical, Power Alarm, Breaker Visual Alarm & Breaker Audible Alarm (all dry contacts: C, NO & NC)
Alarm LEDS	Minor (yellow), Major (red) & Critical (red) (dry contacts, Power On "A" (green), Power On "B" (green) & Breaker Alarm

Table 4-20 (continued)
Breaker Interface Panel (BIP) (NTN458RA) specifications

Parameter	Specification
Resets Push button	Breaker Alarm Reset (LED & Breaker Alarm Output)
Mechanical	
Dimensions	Height: 1.72 in. (43.69 mm) with brackets installed Depth: 11.09 in. (281.6 mm) Width: 19 in. (482.6 mm) with brackets installed Width: 23 in. (584.2 mm) with brackets installed
Weight	Shipping ~ 5.5 kg (~ 12 lb) Install 4.5 kg (~10 lb)
Torque values	1.8 N•m (16 in. -lb) maximum, input and ground terminals (Output is connectorized; No torquing involved.)
Environmental	
Operating temperature range	-10°C to +60°C (14°F to +140°F)
Storage temperature	-20°C to +70°C (-4°F to +158°F)
Operating humidity range	0-90%, noncondensing

Table 4-21
Input Cable Ampacity

Wire Size	Nominal Ampacity per NEC (See Note 1)	De-rated Ampacity (See Note 2)	De-rated Ampacity (See Note 3)
AWG	**A**	**A**	**A**
1/0	170	139	111.5
1	150	123	98.4
2	130	106.6	85.2
4	95	77.9	62.3
6	75	61.5	49.2

Note 1: Per NEC Table 310-16, 90°C temperature rated conductors in 30°C ambient
Note 2: De-rated to 50°C ambient (as per GR-63)
Note 3: De-rated to 50 50°C ambient and a bundle of 4 conductors (as per NEC Table 310-15(b)(2)(a)

Table 4-22
Input feeder cable (BDFB to BIP) selection and feed distance

Required feeder Size	100 A	60 A	50 A	40 A	30 A	20 A
Cable Size	*Calculated for a 1 Volt drop on the cable loop*					
1/0 AWG (see Note)	49 ft 14.9 m	-	-	-	-	-
1 AWG (see Note)	38.7 ft 11.8 m	-	-	-	-	-
2 AWG	30.8 ft 9.4 ft	51.4 ft 15.6 m	61.7 ft 18.8 m	77.1 ft 23.5 m	102 ft 31.3 m	154 ft 47 m
4 AWG	19.3 ft 5.8 m	32.1 ft 9.8 m	38.6 ft 11.7 m	48.2 ft 14.7 m	64.3 ft 19.6 m	96.5 ft 29.4 m
6 AWG	N/A	20.3 ft 6.2 m	24.3 ft 7.4 m	30.4 ft 9.2 m	40.6 ft 12.9 m	60.96 ft 18.59 m
Note: 1/0 AWG or 1 AWG cables are required only if the BIP is used to its full input capacity. These cables would require "C"-tapping into a 2 AWG cable before being terminated in the BIP.						

Table 4-23
Ground terminal specification

Wire SIZE (AWG)	Reference Area in CM	Reference Area in mm^2
6	26240	13
16 mm^2	31576	16

Table 4-24
DWDM OMX specifications

Parameter	Value/Range	
	NT0H32xE	NT0H32xF
Connector type	SC	SC
Maximum total input power	17 dB	17 dB
Minimum Band isolation (drop)	20 dB	35 dB
Minimum Band isolation (Thru out)	12 dB	20dB
Insertion loss (port to port) add path	3.2 dB (typical) 4.5 dB (maximum)	2.1 dB (typical) 2.8 dB (maximum)

Table 4-24 (continued)
DWDM OMX specifications

Insertion loss (port to port) drop path	3.5 dB (typical) 4.9 dB (maximum)	2.4 dB (typical) 3.1dB (maximum)
Insertion loss (port to port) pass-through per band	0.7 dB (typical) 1.2 dB (maximum)	0.7 dB (typical) 1.0 dB (maximum)
Minimum return loss (all ports)	40 dB	45 dB

Table 4-25
OC-48 DWDM circuit packs with the band/channel number and ITU grid wavelength

PEC	Band/Channel	Wavelength
NTN442AA, NTN408AA	Band1/Ch1 (C-Band)	1528.77nm
NTN442AB, NTN408AN	Band1/Ch2 (C-Band)	1533.47nm
NTN442AC, NTN408AE	Band1/Ch3 (C-Band)	1530.33nm
NTN442AD, NTN408AJ	Band1/Ch4 (C-Band)	1531.90nm
NTN442BA	Band2/Ch1 (C-Band)	1538.19nm
NTN442BB	Band2/Ch2 (C-Band)	1542.94nm
NTN442BC	Band2/Ch3 (C-Band)	1539.77nm
NTN442BD	Band2/Ch4 (C-Band)	1541.35nm
NTN442CA	Band3/Ch1 (C-Band)	1547.72nm
NTN442CB, NTN408CN	Band3/Ch2 (C-Band)	1552.52nm
NTN442CC	Band3/Ch3 (C-Band)	1549.32nm
NTN442CD, NTN408CJ	Band3/Ch4 (C-Band)	1550.92nm
NTN442DA, NTN408DA	Band4/Ch1 (C-Band)	1557.36nm
NTN442DB	Band4/Ch2 (C-Band)	1562.23nm
NTN442DC	Band4/Ch3 (C-Band)	1558.98nm
NTN442DD	Band4/Ch4 (C-Band)	1560.61nm
NTN442JA	Band5/Ch1 (L-Band)	1570.42nm
NTN442JB	Band5/Ch2 (L-Band)	1575.37nm
NTN442JC	Band5/Ch3 (L-Band)	1572.06nm
NTN442JD	Band5/Ch4 (L-Band)	1573.71nm
NTN442LA	Band7/Ch1 (L-Band)	1590.41nm

Table 4-25 (continued)
OC-48 DWDM circuit packs with the band/channel number and ITU grid wavelength

PEC	Band/Channel	Wavelength
NTN442LB	Band7/Ch2 (L-Band)	1595.49nm
NTN442LC	Band7/Ch3 (L-Band)	1592.10nm
NTN442LD	Band7/Ch4 (L-Band)	1593.80nm
NTN442EA, NTN408AS	N/A	1535.04nm
NTN442FB, NTN408CW	N/A	1555.75nm
Note: Wavelengths and tolerances of DWDM circuit packs are in compliance with ITU-T G.694 specifications.		

Table 4-26
OC-192 DWDM G.709 FEC circuit packs with band/channel number and ITU grid wavelength

PEC	Band/Channel	Wavelength
NTN445EA	Band1/Ch1 (C-Band)	1528.77nm
NTN445EB	Band1/Ch2 (C-Band)	1533.47nm
NTN445EC	Band1/Ch3 (C-Band)	1530.33nm
NTN445ED	Band1/Ch4 (C-Band)	1531.90nm
NTN445FA	Band2/Ch1 (C-Band)	1538.19nm
NTN445FB	Band2/Ch2 (C-Band)	1542.94nm
NTN445FC	Band2/Ch3 (C-Band)	1539.77nm
NTN445FD	Band2/Ch4 (C-Band)	1541.35nm
NTN445JA	N/A	1535.04nm
Note: Wavelengths and tolerances of DWDM circuit packs are in compliance with ITU-T G.694 specifications.		

European deployment

BIP for European deployment only (NTFW56BA)

Table 4-27
Breaker Interface Panel (BIP) (NTFW56BA) specifications

Parameter	Specification
Electrical	
Power dissipation	17 W
Input/Output voltage	-48Vdc nominal (-40.0 V to -60.0 V operating range)
Transient overload voltage	to - 64 V dc for up to 0.5 s
Maximum input load rating of each panel	46 A (15 + 15 + 8 + 8) per feed
BATT & RTN bus input terminals	Dual-hole compression lugs, 5/8" (15.88 mm) centers, over dual #10 (4.5 mm dia) studs. One #6 to #2 AWG wire per lug, depending on input interruption device.
Ground terminals	Not applicable
Output breakers	4 breakers each side (all 15 Amp)
Max output load each side (each phase)	46 A
Maximum output load	15 A (breakers A1, A3, B1, B3), 8A (breakers A2, A4, B2, B4)
Output terminals	Use # 14 AWG wire (min. size) for 15 A outputs
Mechanical Dimensions	
Dimensions Height	74 mm (2.91 in.)
Depth	295 mm (11.61 in.)
Width	534 mm (21 in.)
Weight Install	8.2 kg (3.73 lb.)
Torque values	1.8 Nm (16 in.-lb.) maximum, input and ground terminals 1 Nm (8 in.-lb.) maximum, output terminals
Alarms	
Terminals	48 wire-wrap pins
Power on	LED White (at least one - 48 V dc power source is available on the breaker interface panel when lit)
Bay alarm LEDs	Minor is yellow Major is red Critical is red

Table 4-27 (continued)
Breaker Interface Panel (BIP) (NTFW56BA) specifications

Parameter	Specification
Environmental	
ACO push-button	Alarm cut off (ACO) push-button disables audible office alarms and tests all alarm lamps/LEDs switch resets breaker alarm LEDs, and breaker alarm relay.
Non-operational (shipping/storage) ambient temperature	The equipment withstands non-operational temperatures between - 40° and + 70° C
Operating ambient temperature range (Central office environment)	Normal operating 0 to +40° C (96°F). Short-term operating - 5° to + 45° C (see Note)
Relative Humidity (Continuous operation)	20 to 55% relative humidity or 3.6 kPa water vapor pressure, whichever is less, over the normal temperature range; no condensation.
Temperature	+ 4.5° to + 38° C.
Note: Short-term is defined to be no more than 72 consecutive hours and a total of not more than 15 days in one year.	

Table 4-28
BIP cable details

Item	Code	Description	Qty
1	25P TM00 802 EOO	Cable Lug, M6, 16mm^2 (#6 AWG)	4
2	93W LR51 089 AAH	Cable 16 mm^2 (#6 AWG) Black	2
3	93W LR51 089 AAA	Cable 16 mm^2 (#6 AWG) Blue	2
4	25P CL00 801 QOO	Cable tie - natural, (large 270mm LG) (10.62 in.)	As required
5	25P CL00 801 AMO	Cable tie - black, (small 92mm LG) (3.62 in.)	As required
Miscellaneous cables			
6	NTFW5630	Shelf alarm cable (Posn 1 to BIP)	-
7	NTFW5632	Shelf alarm cable (Posn 3 to BIP)	-

Declaration of conformity for European deployment

1142p

NORTEL NETWORKS™

Code: ED0H0003
Stream/Issue: 01/01
Template: v7;980518

Declaration of Conformity

Suppliers Name & Address: Nortel Limited, of Doagh Road, Newtownabbey, County Antrim, Northern Ireland, BT36 6XA

We hereby declare that the products identified in Section 1 comply with the standards listed in Section 2 and fulfil our obligations under the EU Directives listed in Section 3.

Section 1 - Products Covered

Product Name	Product Type
OPTera Metro 3500	Permissible configurations that use OPTera Metro 3500 as documented in C-MAC Safety Technical file KP000384-CR-SAF-02-01 and C-MAC EMC report number KP000384-CR-EMC-01.01

Section 2 - Standards Applied

The Product(s) described above is in conformity with the following standards:

Stds Ref	Standard Number	Edition	Subject of Standard
1	EN300 386-2	1997-12	Electromagnetic compatibility and radio spectrum Matters(ERM); Telecommunication network equipment. Electromagnetic Compatibility requirements; Part2: Product family standards
2	EN60950	2000	Safety of IT equipment
3	EN60825-1	1994	Safety of Laser Products- Equipment classification, requirements and user's guide.
4	EN60825-2	2000	Safety of Laser Products-Safety of optical fiber communications systems.

Section 3 - European Union Directives

Directive Number	Abbreviated Directive Title	Stds Ref	CE Marking Information (if applicable)
89/336/EEC	EMC Directive	1	01
92/31/EEC	Amendment to EMC Directive	n/a	n/a
73/23/EEC	Low Voltage Directive	2,3,4	01
93/68/EEC	CE Marking Amending Directive	n/a	n/a

Section 4 - Authority of Issuer

Declaration Issued By:	Michael Langlois,	John Freebairn
Position of Issuer:	Director, Hardware Development	Director, Quality and Business Improvement
Signed:	Mike Langlois	J Freebairn
Date:	NOV/8TH/2001	12 November 2001

The instructions for installation, use and maintenance form part of the product compliance and must be observed.

This declaration has been made in accordance with ISO/IEC Guide 22, General criteria for suppliers' declaration of conformity

Engineering rules

This section highlights the new engineering rules introduced by OPTera Metro 3500. The following areas are covered:

- shelf equipping rules
- DWDM requirements
- Site Manager technical specifications

Shelf equipping rules

Slots 4, 6, 8, and 10 are used for DS3x3, DS3x12, DS3x12e, DS3VTx12, EC-1x3, or EC-1x12 circuit pack protection. If any of these circuit packs are unprotected in an odd slot (n), the even slot (n+1) must remain empty.

Note 1: You may provision unprotected optical interface circuit packs in all of the slots in the range of slot 3 through slot 10.

Note 2: If there is a 1-28 DS1 I/O module installed, and if slots 5 and 6 are not equipped with DS1 mappers, you may not install DS3x3, DS3x12, DS3x12e, DS3VTx12, EC-1x3, EC-1x12, 4x100BT, or 2x100BT-P2P circuit packs in slots 5 or 6 (there is not enough room for slot 5 or slot 6's I/O modules).

Note 3: If there is a 29-56 DS1 I/O module installed, and if slots 7 and 8 are not equipped with DS1 mappers, you may not install DS3x3, DS3x12, DS3x12e, DS3VTx12, EC-1x3, EC-1x12, 4x100BT, 2x100BT-P2P circuit packs in slots 7 and 8 (there is not enough room for slot 7 or slot 8's I/O modules).

Note 4: If there is a 29-84 DS1 I/O module installed, and if slots 7 through 10 are not equipped with DS1 mappers, you may not install DS3x3, DS3x12, DS3x12e, DS3VTx12, EC-1x3, EC-1x12, 4x100BT, or 2x100BT-P2P circuit packs in slots 7 through 10 (there is not enough room for slot 7 through slot 10's I/O modules).

Note 5: To support the OC-12 line rate in slots 11 and 12, your shelf must be equipped with the VTX-48e circuit pack (NTN414AB). The VTX-48 circuit pack (NTN414AA) only supports the OC-48 line rate in slots 11 and 12.

Note 6: To support the OC-192 line rate in slots 11 and 12, your shelf must be equipped with the STX-192 circuit pack (NTN415AA).

Note 7: For a complete list of electrical and optical interfaces supported by VTX-48, VTX-48e and STX-192 equipped OPTera Metro 3500 shelf, refer to Table 3-7 on page 3-54 in Part 1 of this guide.

Both the OPTera Metro 3500 shelf and Universal OPTera Metro 3500 shelf require cooling fans. For details of the fan modules, see Hardware feature descriptions on page 3-1 in Part 1 of this guide.

The following conditions apply:

If a 2x100BT-P2P, 4x100FX, 4x100BT or 2xGigE/FC-P2P circuit pack is inserted into an odd slot (n_{odd}), then you can only insert one of the following circuit packs into the even slot (n_{odd}+1):

- 2x100BT-P2P
- 4x100BT
- 4x100FX
- 2xGigE/FC-P2P

If a 2x100BT-P2P, 4x100FX, 4x100BT or 2xGigE/FC-P2P circuit pack is inserted into an even slot (n_{even}), then you can only insert one of the following circuit packs into the odd slot (n_{even}-1):

- 2x100BT-P2P
- 4x100BT
- 4x100FX
- 2xGigE/FC-P2P

Note: There is no equipment protection for 4x100BT, 4x100FX 2x100BT-P2P or 2xGigE/FC- P2P circuit packs.

BLSR requirements

OPTera Metro 3500 supports OC-48 and OC-192 2-Fiber BLSR networks in its protection scheme and configuration portfolios.

A 2-Fiber bidirectional line-switched ring (BLSR) is a ring network of nodes interconnected by a pair of fibers. Like the unidirectional path-switched ring (UPSR), the BLSR provides 100% restoration of restorable traffic for single failures by reserving 50% of the ring's capacity for protection. Consequently, a 2-Fiber OC-48 or OC-192 ring effectively has a span capacity of STS-24 and STS-96 respectively.

A BLSR offers a network-level protection capability, and differs from a UPSR in that the nodes in a BLSR are aware of the larger configuration. In a BLSR, switching nodes communicate to each other through K-bytes. A UPSR node has no network knowledge and does not rely upon any APS communication with other nodes.

OC-48 BLSR

OPTera Metro 3500 supports OC-48 2-Fiber BLSR on shelves equipped with OC-48 double slot cards in slots 11 and 12 and with VTX-series circuit packs in slots 13 and 14.

> ***Note:*** Shelves equipped with STX-192 circuit packs in slots 13 and 14 will support OC-192 2-Fiber BLSR only.

OC-48 2-Fiber BLSR will support:

- VT assigned end-to-end connections
- Full VT access (Full VT mode) end-to-end connections
- STS-managed end-to-end connections

OC-192 BLSR

OPTera Metro 3500 supports OC-192 2-Fiber BLSR on shelves equipped with OC-192 cards in slots 11 and 12 and with STX-192s circuit packs in slots 13 and 14.

> ***Note:*** Shelves equipped with STX-192 circuit packs in slots 13 and 14 will support OC-192 2-Fiber BLSR only.

OC-192 2-Fiber BLSR will support:

- STS-managed end-to-end connections only.

DWDM requirements

In a DWDM system, each OPTera Metro 3500 shelf operates at a different wavelength. Each OC-48 or OC-192DWDM circuit pack transmits a specific DWDM wavelength. The circuit packs are labeled with the DWDM band and channel number.

Each OMX module supports a specific DWDM band. Each OC-48 or OC-192 DWDM circuit pack should be used with a specific OMX module.

> ***Note:*** The OMX does not support 1535.04 nm or 1555.75 nm wavelengths.

The OMX module is a passive optical coupler and does not regenerate or amplify signals. Optical reach between OPTera Metro 3500 shelves is dependent on the number of intermediate OMX modules. OMX modules of

the same DWDM band introduce some signal loss when a wavelength is added or dropped, and OMX modules for different DWDM bands introduce pass-through signal loss. The optical signal is regenerated at the OPTera Metro 3500 shelf.

Optical link budgets

Link budgets are specified for typical conditions and apply to all optical fiber types (NDSF). Repair margin or connector losses at a fiber distribution frame are not included and should be allocated as required. The recommended repair margin is 10% of the total fiber plant loss for each site-to-site fiber span.

Link budgets are accurate for operating temperature between 0ºC and 40ºC (32ºF to 104ºF).

The link budgets for unamplified networks are based on power calculations for each band.

The optical link budget specifies the typical loss supported for a connection between the point where it originates and the point where it terminates. The link budgets are calculated by adding the loss for each individual fiber sections between the two ends of a connection. The loss must be calculated for each band because the various bands are subject to different attenuation depending on the path and the number of network elements that it passes through.

Note: The link budgets listed are based on NDSF optical fiber.

Calculating the link budget

Link budgets are calculated for every band for both directions, from each shelf on a particular band in a site to an adjacent site that contains a shelf with the same band.

To calculate the link budget, you need to determine the number and type of OPTera Metro 3500 shelves that any one band must pass through to establish its connection.

See Figure 5-1 for loss for one band in an add/drop configuration.
See Table 5-1 for loss details for this configuration.

Table 5-1
Loss summary

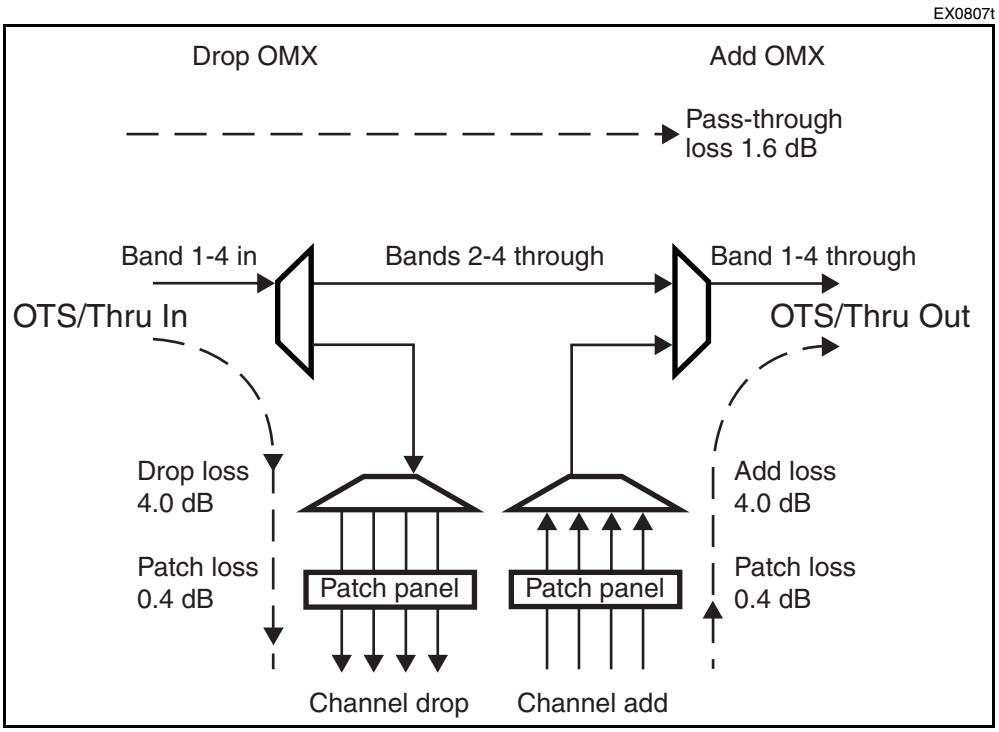
Parameter	Loss (dB)
Add loss	4.0 dB
Drop loss	4.0 dB
Connector loss	0.4 dB

Table 5-1
Loss summary

Parameter	Loss (dB)
Pass-through loss	1.6 dB
Seam add/drop values	0.5 dB for each band
Fiber loss	Fiber loss with additional 0.5 dB for connectors/splice or other interconnection loss
Transmit power	0 dBm
Receive sensitivity requirement	-27.9 dBm

Note: For receive powers greater than -9 dBm, there must be sufficient attenuation in the fiber path so that the overload requirement of -9 dBm is not exceeded.

Figure 5-1
Optical loss in an add/drop configuration

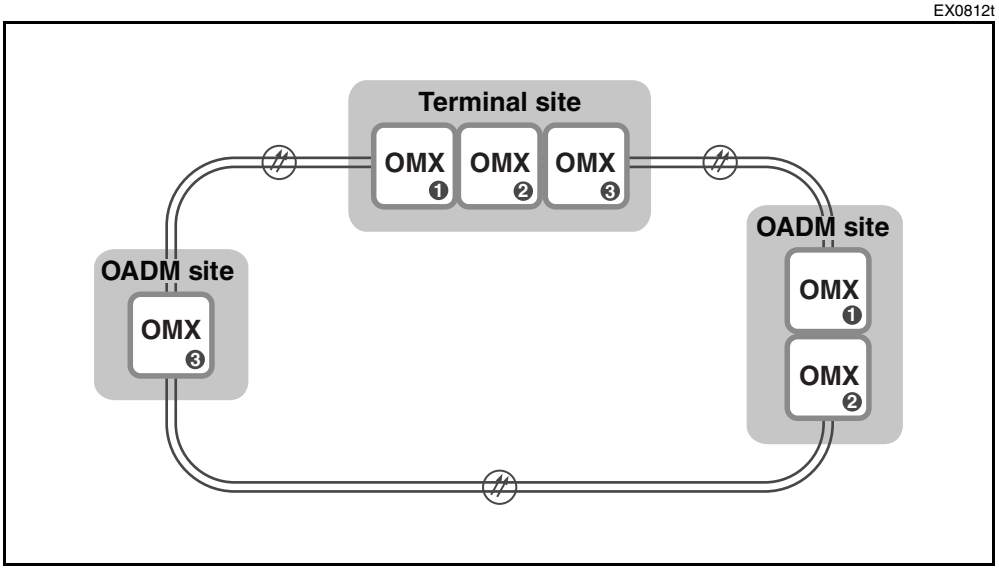


Link budgets for a hubbed-ring configuration

The band link budget for a three band unamplified hubbed-ring configuration in Figure 5-2 is 15.9 dB. The span length is based on 0.3 dB/km loss.

Figure 5-2
Physical connections in a hubbed-ring configuration

EX0812t



See Table 5-2 for link budget estimates of other hub-based configurations.

Table 5-2
Estimates of link budgets for hub-based configurations

Number of bands	Number of channels	Power budget (dB)	Furthest add/drop span (km)	For equally spaced sites	
				Total circumference (km) (See Note)	Distances between remotes (km)
1	4	19.1	64	127	64
2	8	17.5	58	88	29
3	12	15.9	53	71	18
4	16	14.3	48	60	12
Note: The link budget specifies the maximum loss of the ring circumference. The loss for individual fiber sections does not affect the link budget because the channel travels along the ring circumference.					

Section trace interworking

Interworking works correctly if the OPTera Metro 3500 network element and the other network elements have provisioned a numeric value for section trace.

Some products pad the character strings differently. Some products perform the cyclic redundancy check (CRC) differently.

See Table 5-3 for details of OPTera Metro 3500 section trace interworking.

Table 5-3
OPTera Metro 3500 section trace interworking

Product	Line rate	Section trace format		
		Numeric	ASCII string	
			Requires padding	Does not require padding
OC-192	OC-3	Yes	No	No
	OC-12	Yes	Yes	Yes
	OC-48	Yes	Yes	Yes
OC-48	OC-3 half-height circuit pack (See Note)	Yes	Yes	Yes
Note: The Remote parameter for the OC-3 facility on the OPTera Metro 3500 must be set to OC-48.				

Site Manager technical specifications

Site Manager runs on PCs and HP workstations. You can run one Site Manager session on a PC with minimum hardware requirements. You can run ten simultaneous Site Manager sessions on an HP platform.

For information about the minimum and recommended hardware requirements for Site Manager, refer to Table 5-4 and Table 5-5.

For more information about Site Manager hardware requirements and installation, refer to *Site Manager Planning and Installation Guide*.

Table 5-4
Minimum requirements for Site Manager Interface Compatibility

Requirement	PC	Preside AP workstation (co-resident)	HP-UX 11i workstation (stand alone)
Free hard disk space	100 Mbyte	As required by Preside AP (See the *Preside Applications Platform Guide* for the release you installed on the Preside AP workstation.)	Use the default software parameters with respect to the Installation Guide option of the HP-UX operating system software. (See the Site Manager Release 6.0 Planning and Installation Guide).
Processor speed	Pentium class CPU at 233 MHz		
RAM	64 Mbyte		
CD-ROM drive or network card	1		

Table 5-5
Recommended requirements for Site Manager

Requirement	PC	Preside AP workstation	HP-UX 11 workstation
Hard disk space	200 Mbyte	As required by Preside AP (See the *Preside Applications Platform Guide* for the release you installed on the Preside AP workstation.)	Same as the supported platform in Preside AP requirements (see Note) (See Hardware requirements for supported platforms in *Preside Applications Platform Release 9.1 Planning Guide*)
Processor speed	Pentium class CPU at 400 MHz or higher		
RAM	128 Mbyte		
CD-ROM drive or network card	1		
Note: Use the default software parameters with respect to the Guide Installation option of the HP-UX software.			

OPTera Metro 3500 / OPTera Connect DX subtending UPSR Interworking

In interworking scenarios involving OPTera Metro 3500 and OPTera Connect DX subtending UPSR, the following engineering rules and restrictions must be considered:

- All cross-connects (add / drop and pass-through) on the OPTera Connect DX network element must be bidirectional.
- VT add / drop connections can be used on the OPTera Metro 3500. However, VT pass-through connections should not be used in the subtending ring. All pass-through connections for VT traffic must be at the STS-1 rate. To ensure that VT pass-through connections are not provisioned, Site Manager Nodal Connection Manager must be used. Site Manager End-to End Connection Manager cannot be used to provision VT connections on OPTera Connect DX subtending UPSR.

See 'Subtending unidirectional path switched rings' in *OPTera Connect DX Optical Switch SONET Planning Guide*, NTRR10DF, for more related OPTera Connect DX engineering rules.

For more information on OPTera Connect Dx and OPTera Metro 3500 interworking, see *Interworking Application Guide* NTRN15AA.

Cable and connector details

This chapter provides the cable assembly information for the OPTera Metro 3500 network element and Universal OPTera Metro 3500 network element. This chapter provides the part numbers for cables used with both shelves and detailed cable assembly drawings for each cable. Specifications are provided for the following cables and cable assemblies.

OPTera Metro 3500 Multiservice Platform cables

DS1 cable pinout and assembly

Two DS1 cable assemblies are required for every 28 DS1s (one for 28 DS1 in, and one for 28 DS1 out).

Note 1: The color codes and pinout provided apply to the suggested DS1 cables. Color codes and pinout may vary by manufacturer.

Note 2: You are recommended to use 'straight' cables for front-facing I/O modules.

Note 3: You are recommended to use 'right-angle' cables for rear-facing I/O modules.

Figure 6-1
DS1 straight cable assembly

EX0916p

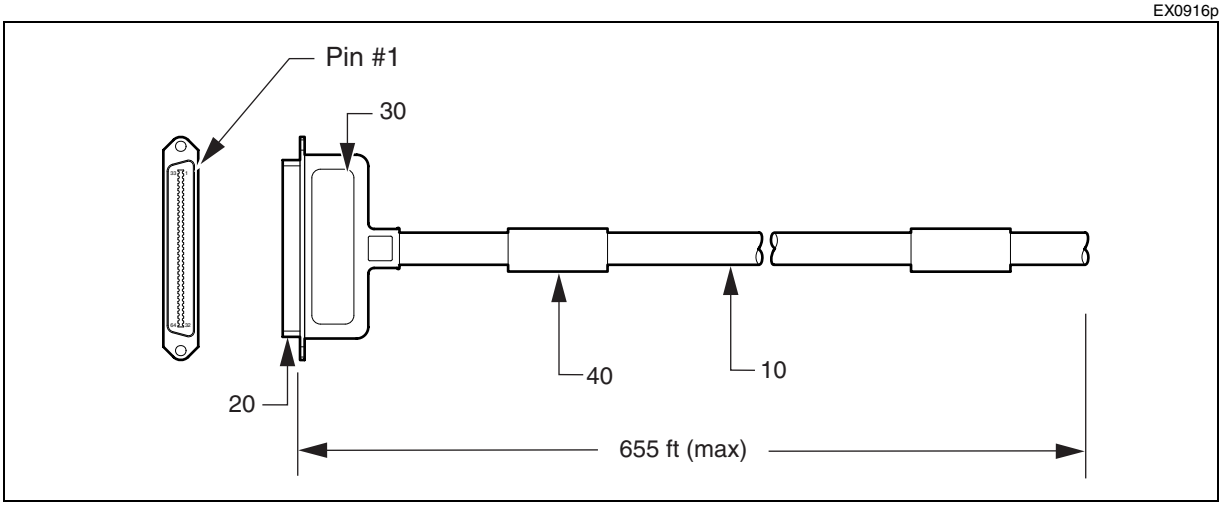


Figure 6-2
DS1 right-angle cable assembly

EX0861p

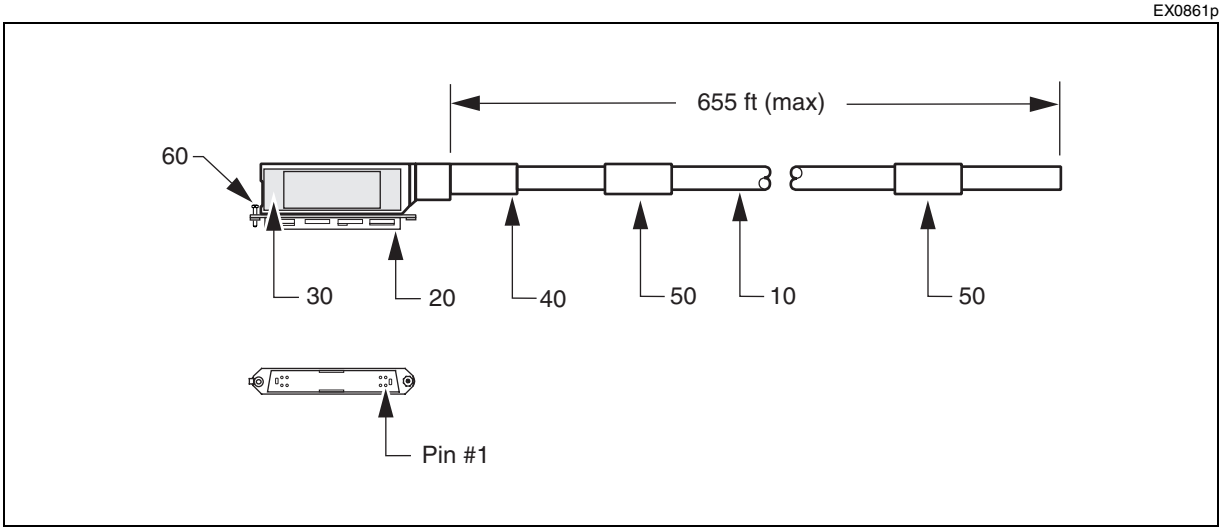


Table 6-1
DS1 J3 and J4 signal routing

DS1 Tributary	Pin #	Color
1 (ring)	1	bl/w
1 (tip)	33	w/bl
2 (ring)	2	o/w
2 (tip)	34	w/o
3 (ring)	3	gr/w
3 (tip)	35	w/gr
4 (ring)	4	br/w
4 (tip)	36	w/br
5 (ring)	5	sl/w
5 (tip)	37	w/sl
6 (ring)	6	bl/r
6 (tip)	38	r/bl
7 (ring)	7	o/r
7 (tip)	39	r/o
8 (ring)	8	gr/r
8 (tip)	40	r/gr
9 (ring)	9	br/r
9 (tip)	41	r/br
10 (ring)	10	sl/r
10 (tip)	42	r/sl
11 (ring)	11	bl/bk
11 (tip)	43	bk/bl
12 (ring)	12	o/bk
12 (tip)	44	bk/o
13 (ring)	13	gr/bk
13 (tip)	45	bk/gr
14 (ring)	14	br/bk
14 (tip)	46	bk/br

Table 6-1 (continued)
DS1 J3 and J4 signal routing

DS1 Tributary	Pin #	Color
15 (ring)	15	sl/bk
15 (tip)	47	bk/sl
16 (ring)	16	bl/y
16 (tip)	48	y/bl
17 (ring)	17	o/y
17 (tip)	49	y/o
18 (ring)	18	gr/y
18 (tip)	50	y/gr
19 (ring)	19	br/y
19 (tip)	51	y/br
20 (ring)	20	sl/y
20 (tip)	52	y/sl
21 (ring)	21	bl/v
21 (tip)	53	v/bl
22 (ring)	22	o/v
22 (tip)	54	v/o
23 (ring)	23	gr/v
23 (tip)	55	v/gr
24 (ring)	24	br/v
24 (tip)	56	v/br
25 (ring)	25	sl/v
25 (tip)	57	v/sl
26 (ring)	26	bl/w
26 (tip)	58	w/bl
27 (ring)	27	o/w
27 (tip)	59	w/o
28 (ring)	28	gr/w
28 (tip)	60	w/gr

Table 6-1 (continued)
DS1 J3 and J4 signal routing

DS1 Tributary	Pin #	Color
GND	29	—
GND	61	—
GND	30	—
GND	62	—
GND	31	—
GND	63	—
GND	32	—
GND	64	bare (see Note)
Note: Unclad sheath drain wire		

Table 6-2
Suggested individual DS1 cable parts

Quantity: Two cable assemblies are required for every 28 DS1s (1 for 28 IN, 1 for 28 OUT)			
Quantity	**Description**	**Vendor**	**Part #**
655 ft (182.88m) max.	1x22, 30 pr, Tin CU Cable (see Note 1)	Lucent	613C 30/22 RVAR
1 piece	Connector key Telephone 2x32 array 0.085 Pitch Au MA (see Note 1)	AMP Inc.	552303-1
1 piece	Connector Hood key Telephone 2x32 array (see Note 1)	AMP Inc.	552082-1
2 pieces	Wire and cable marker labels	WH Brady Co.	DAT-7-292-10
1 piece	AMP MI-1 64 position hand tool	AMP	231880-1
Note 1: Ensure that the appropriate gauge wire, plug and snap on cover are used. ***Note 2:*** The listed connectors must be used to ensure proper mating with the DS1 AMP connectors on the Top I/O.			

Table 6-3
Suggested DS1 cable assemblies

Quantity: Two cable assemblies are required for every 28 DS1s (1 for 28 IN, 1 for 28 OUT)

Description	PEC
DS1 straight cable assembly, 50 ft. (15.24 m)	NTN458MD
DS1 straight cable assembly, 100 ft. (30.48 m)	NTN458ME
DS1 right angle cable assembly, 50 ft. (15.24 m)	NTN458MQ
DS1 right angle cable assembly, 100 ft. (30.48 m)	NTN458MR

Table 6-4
DS1 Connector kits

Quantity: One connector kit is required per cable assembly

Description	PEC
DS1 straight cable **connector kit**	NTN458ND
DS1 right angle cable connector kit	NTN458NE

DS3/EC-1 cable pinout and assembly

Table 6-5
Suggested individual DS3 cable parts

Quantity: Two cable assemblies are required for every DS3 or EC-1 (1 for IN, 1 for OUT)			
Quantity	**Description**	**Vendor**	**Vendor part #**
For 734A type cable:			
450 ft (137.16 m) max.	75-ohm Coaxial Cable	Lucent	734A
1 piece	BNC Coax Straight Plug Connector or BNC Coax Straight Plug Connector	Trompeter Elec. Huber & Suhner AG	105-1484-025 11 BNC-75-5-16C/122NT
2 in. (50.8 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp AMP Inc.	FIT-221V-1/2 603328-1
For 735A type cable:			
230 ft (70.1 m) max.	75-ohm Coaxial Cable	Lucent	735A COAX
1 piece	BNC Coax Straight Plug Connector or BNC Coax Straight Plug Connector	Trompeter Elec. Huber & Suhner AG	105-1484-026 11 BNC-75-2-29C/122NT
2 in. (50.8 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1
For RG-59B/U type cable:			
275 ft (83.82 m) max.	75-ohm Coaxial Cable 75-ohm Coaxial Cable	Comm Scope Inc. Beldon Electric	5563 8263
1 piece	BNC Coax Straight Plug Connector or BNC Coax Straight Plug Connector	Trompeter Elec. Huber & Suhner AG	105-1484-013 11 BNC-75-4-35C/122NT
2 in. (50.8 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Table 6-5 (continued)
Suggested individual DS3 cable parts

Quantity: Two cable assemblies are required for every DS3 or EC-1 (1 for IN, 1 for OUT)			
Quantity	**Description**	**Vendor**	**Vendor part #**
For 728A type cable:			
450 ft (137.16 m) max.	75 ¾ Coaxial Cable	Beldon Electric	9231
1 piece	BNC Coax Straight Plug Connector	Trompeter Elec.	UPL220-016
2 in. (50.8 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Table 6-6
Suggested DS3 cable assemblies

Description	**PEC**	**CPC**	**In Table 6-7, go to Engineering rule #**
Extra connectors (see Note)			
BNC connector (734A)	CX01PS007	A0609865	2
BNC connector (735A)	CX01PS008	A0609866	2
735A-type DS3 cabling (see Note)			
DS3 735A F/A coaxial cables (25 ft / 7.62 m) (BNC) (1-12)		A0776684	1, 3, 5
DS3 735A coaxial cable (32.81 ft / 10 m) (BNC)	NT7E43BB	A0408004	3, 5
DS3 735A coaxial cable (98.43 ft / 30 m) (BNC)	NT7E43BD	A0408006	3, 5
DS3 735A coaxial cable (196.85 ft / 60 m) (BNC)	NT7E43BG	A0408009	3, 5

Table 6-6 (continued)
Suggested DS3 cable assemblies

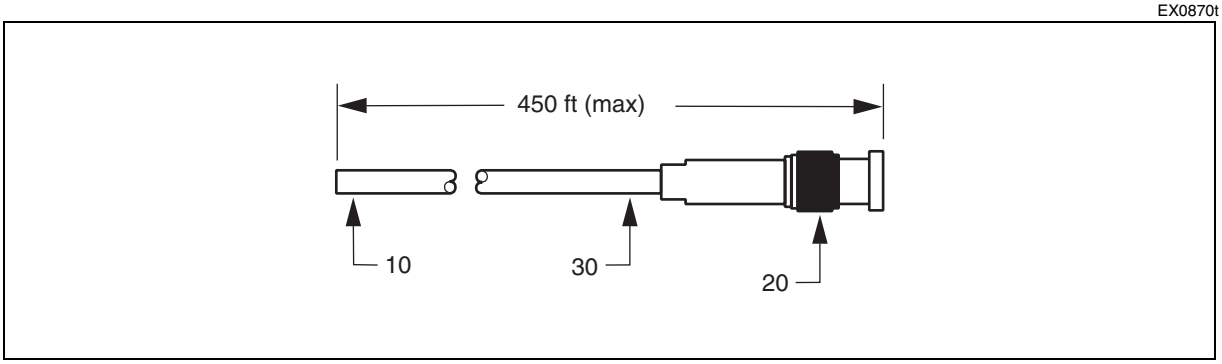
Description	PEC	CPC	In Table 6-7, go to Engineering rule #
734A-type DS3 cabling (see Note)			
DS3 734A coaxial cable (32.81 ft / 10 m) (BNC)	NT7E43AB	A0370975	3, 4
DS3 734A coaxial cable (98.43 ft / 30 m) (BNC)	NT7E43AD	A0370977	3, 4
DS3 734A coaxial cable (196.85 ft / 60 m) (BNC)	NT7E43AG	A0370980	3, 4
DS3 734A coaxial cable (459.32 ft / 140 m) (BNC)	NT7E43AK	A0373189	3, 4
Note: Each of the cable assemblies are single-ended. You must purchase BNC connectors for the open end of each cable assembly.			

Table 6-7
Engineering rules for DS3 cabling

Rule #	Description
1	These are the preferred cables when DS3 cable runs are less than 30 m (100 ft). Each cable of the bundle are separately labelled.
2	Use these connectors to terminate DS3 cabling at the customer interface equipment.
3	The 735A coaxial cables have a smaller diameter than the 734A coaxial cables.
4	Order a BNC connector (734A)(A0609865) since the cable is terminated with a BNC connector at one end only.
5	Order a BNC connector (735A)(A0609866) since the cable is terminated with a BNC connector at one end only.

Figure 6-3
DS3/EC-1 cable pinout and assembly

EX0870t



TBOS cable pinout and assembly

One cable assembly is required for each shelf, if using TBOS.

Figure 6-4
TBOS cable assembly

EX0868P

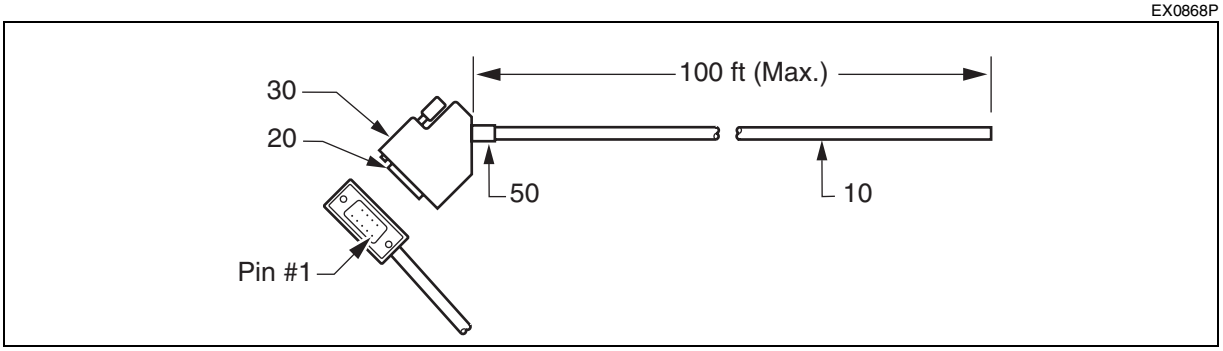


Table 6-8
TBOS signal routing

Pin #	Signal	Color	Pin #	Signal	Color
1	Out +	o-2w	6	N/C	
2	Out -	o-1w	7	N/C	
3	N/C		8	N/C	
4	In +	g-2w	9	N/C	
5	In -	g-1w	—	—	

Table 6-9
Suggested individual TBOS cable parts

Quantity: One cable assembly is required per shelf if using TBOS.			
Quantity	**Description**	**Vendor**	**Vendor part #**
100 ft (30.48 m) max.	4 pairs of 24 AWG Stranded Aluminum Poly Shield	Belden Wire and Cable Company	9504
1piece	Conn. D-Sub D-Sub Array 0.109 Pitch, Male or Conn. D-Sub D-Sub Array 0.109 Pitch, Male	Cinch Connector AMP Inc.	234-09-24-120 205204-4

Table 6-9
Suggested individual TBOS cable parts

Quantity: One cable assembly is required per shelf if using TBOS.			
Quantity	**Description**	**Vendor**	**Vendor part #**
1 piece	Conn. Hood D-Sub D-Sub Array	CONEC Corp.	165X00579A
4 piece	Connector Contact D-Sub 20-24 AU or Connector Contact D-Sub 20-24 AU	Cinch Connector AMP Inc.	402-30-14-212 2-66506-4
4 in. (101.6 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Table 6-10
Suggested TBOS cable assembly

Description	**PEC**	**CPC**
TBOS (30 ft / 9.14 m) cable		A0778319

RS-232 null modem cable pinout and assembly

Use one RS-232 null modem cable assembly for each shelf as required.

Figure 6-5
RS-232 null modem cable assembly

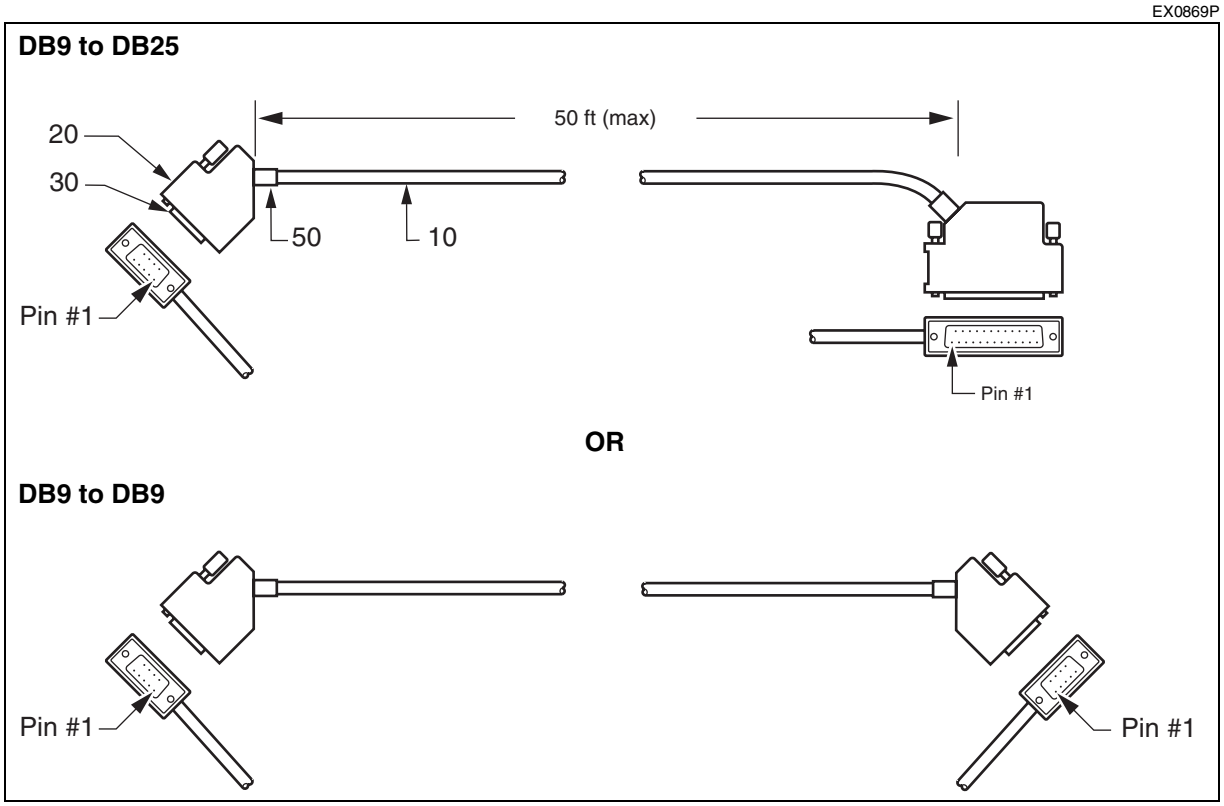


Table 6-11
RS-232 null modem signal routing, DB9 to DB9

9-pin male connector pin #	Signal	Color	9-pin male connector pin #
1	DCD	V	1
2	RxD	R	2
3	TxD	BR	3
4	DTR	W/BK/BR	4
5	GND	BL	5
6	DSR	G	6

Table 6-11 (continued)
RS-232 null modem signal routing, DB9 to DB9

9-pin male connector pin #	Signal	Color	9-pin male connector pin #
7	RTS	O	7
8	CTS	Y	8
9	N/C	BK	9

Table 6-12
RS-232 null modem signal routing, DB9 to DB25

9-pin male connector pin #	Signal	Color	25-pin male connector pin #
1	DCD	V	8
2	RxD	R	3
3	TxD	BR	2
4	DTR	W/BK/BR	20
5	GND	BL	7
6	DSR	G	6
7	RTS	O	4
8	CTS	Y	5
9	N/C	BK	N/C

Table 6-13
Suggested individual RS-232 null modem cable parts

Quantity: One cable assembly is required per shelf.

Item	Quantity	Description	Vendor	Part #
10	50 ft (15.38m) max)	24 AWG 10 Cond. TND PVC Ins., SHD W or 24 AWG 10 Cond. TND PVC Ins., SHD W	Belden Wire and Cable Company Madison Cable Corp.	9540 10RFB00004
20	1 piece	Conn. Hood D-Sub D-Sub Array	CONEC Corp.	165X00579A

Table 6-13 (continued)
Suggested individual RS-232 null modem cable parts

Quantity: One cable assembly is required per shelf.

Item	Quantity	Description	Vendor	Part #
30	1 piece	Conn. Housing D-Sub D-Sub Array or Conn. Housing D-Sub D-Sub Array	Cinch connector AMP Inc.	234-09-21-120 205204-1
40	8 piece	Connector Contact D-Sub 20-24 AU or Connector Contact D-Sub 20-24 AU	Cinch connector AMP Inc.	402-30-14-212 2-66506-4
50	4 in. (101.6 mm)	Heat Shrink Tubing TBG, Polyolefin, B or Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Table 6-14
Suggested RS-232 null modem cable assembly

Description	PEC
RS-232 (50 ft / 15.24 m) (DSUB/DSUB)	NTN458AB
Note: Use the NTN458AB cable in conjunction with the A0790559 adapter to provide an RS-232 interface from a laptop computer to the shelf processor for temporary craft access. To close the OPTera Metro 3500 front cover, the cable and adaptor must be disconnected from the shelf processor.	

Shelf power cable pinout and assembly

One power cable assembly is required for each shelf. Use the power cable assembly appropriate for your equipment frame power distribution panel.

Standard shelf power cable assembly

The OPTera Metro 3500 shelf can be powered by a Nortel Networks breaker interface panel (BIP). Several options exist for power distribution depending on the BIP cables you order.

Cables for BIP NTN458RA

Use the following to assemble the shelf power cable between the BIP and the OPTera Metro 3500 shelf or DS1 service module (DSM):

- Use BIP cable NTN458MS or NTN458MU to connect power to:
  - — one OPTera Metro 3500 shelf, or
  - — one Universal OPTera Metro 3500 shelf, or
  - — one DSM shelf

  Note 1: NTN458MS is 12 AWG cabling. See Figure 6-8 on page 6-18.

  Note 2: NTN458MU is 10 AWG cabling. See Figure 6-9 on page 6-19.
- Use BIP cable NTN458ZB to connect power to:
  - — up to four OPTera Metro 3500 shelves, or

— up to four Universal OPTera Metro 3500 shelves, or

— up to five DSM shelves, or

— any combination up to five elements within the bay

Note: NTN458ZB is 10 AWG cabling. See Figure 6-10 on page 6-21.

- Use BIP cable NTN458ZC to connect power to:

  — one OPTera Metro 3500 shelf and seven DSM shelves, or

  — one Universal OPTera Metro 3500 shelf and seven DSM shelves, or

  — up to eight DSM shelves

  Note: NTN458ZC is 12 AWG cabling. See Figure 6-11 on page 6-24.

- Use BIP cable NTN458ZD to connect power to:

  — up to four OPTera Metro 3500 shelves, or

  — up to four OPTera Metro 3500 shelves, or

  — up to eight DSM shelves, or

  — any combination up to eight elements within the bay

  Note: NTN458ZD is 10 AWG cabling. See Figure 6-12 on page 6-27.

See BIP cable assembly from a shelf to the BIP on page 6-17.

DSM BIP cable assembly (required for Hardware Rel 5 of DSM OAM or earlier)

In Hardware Release 5 of the DSM OAM or earlier, the DSM BIP cable assembly for the NTN458RA BIP is made up of two segments, one short segment and one long segment. The short segment is delivered with the DSM and consists of ring terminal connectors at the DSM shelf connected by wire to Mate-N-Lok connectors. The long segment can be NTN458MS, NTN458MU, NTN458ZB, NTN458ZC, or NTN458ZD. See the DSM adapter cable (required only for DSM OAM HW Rel 5 or earlier) on page 6-16. See also: BIP cable assembly from a shelf to the BIP on page 6-17.

Note: For Hardware Rel 6 and later versions of the DSM OAM, you do not need a DSM adapter cable. The Mate-N-Lok connectors on the BIP cable connect directly to receptacles on the DSM OAM.

Figure 6-6
DSM adapter cable (required only for DSM OAM HW Rel 5 or earlier)

EX0961p

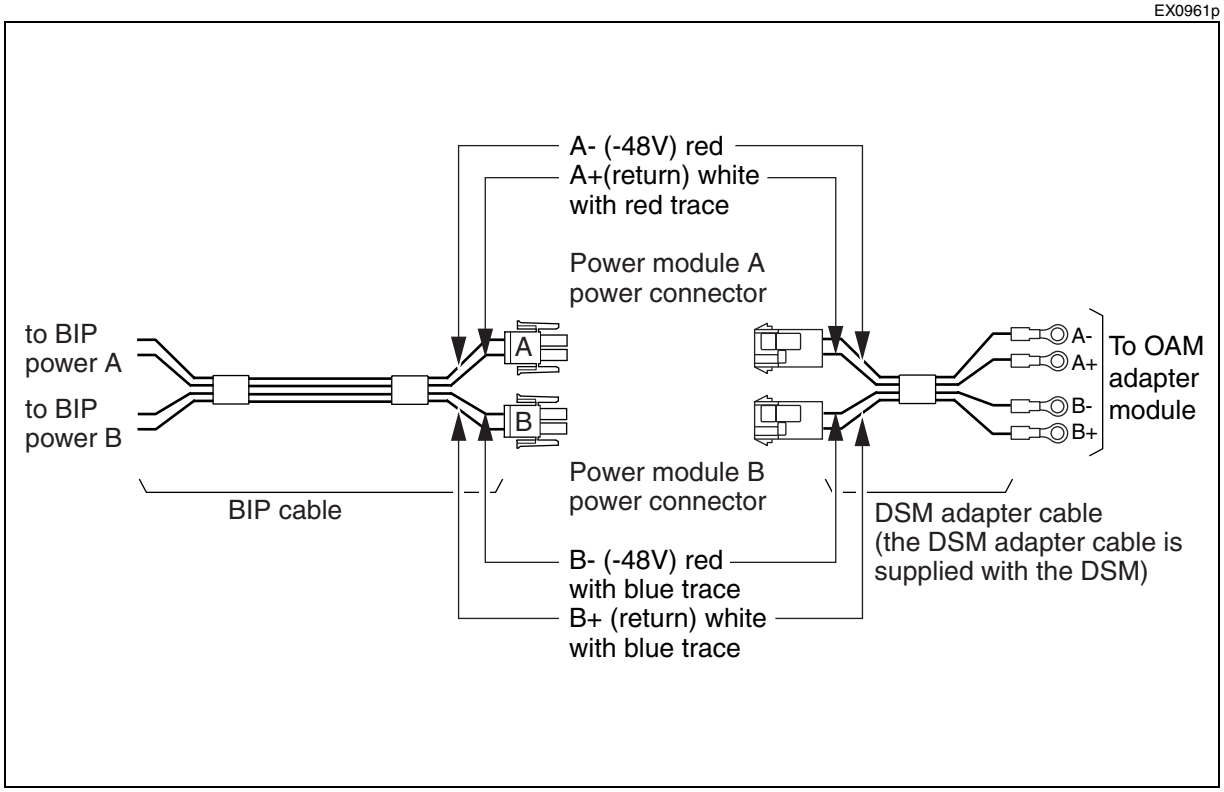


Figure 6-7
BIP cable assembly from a shelf to the BIP

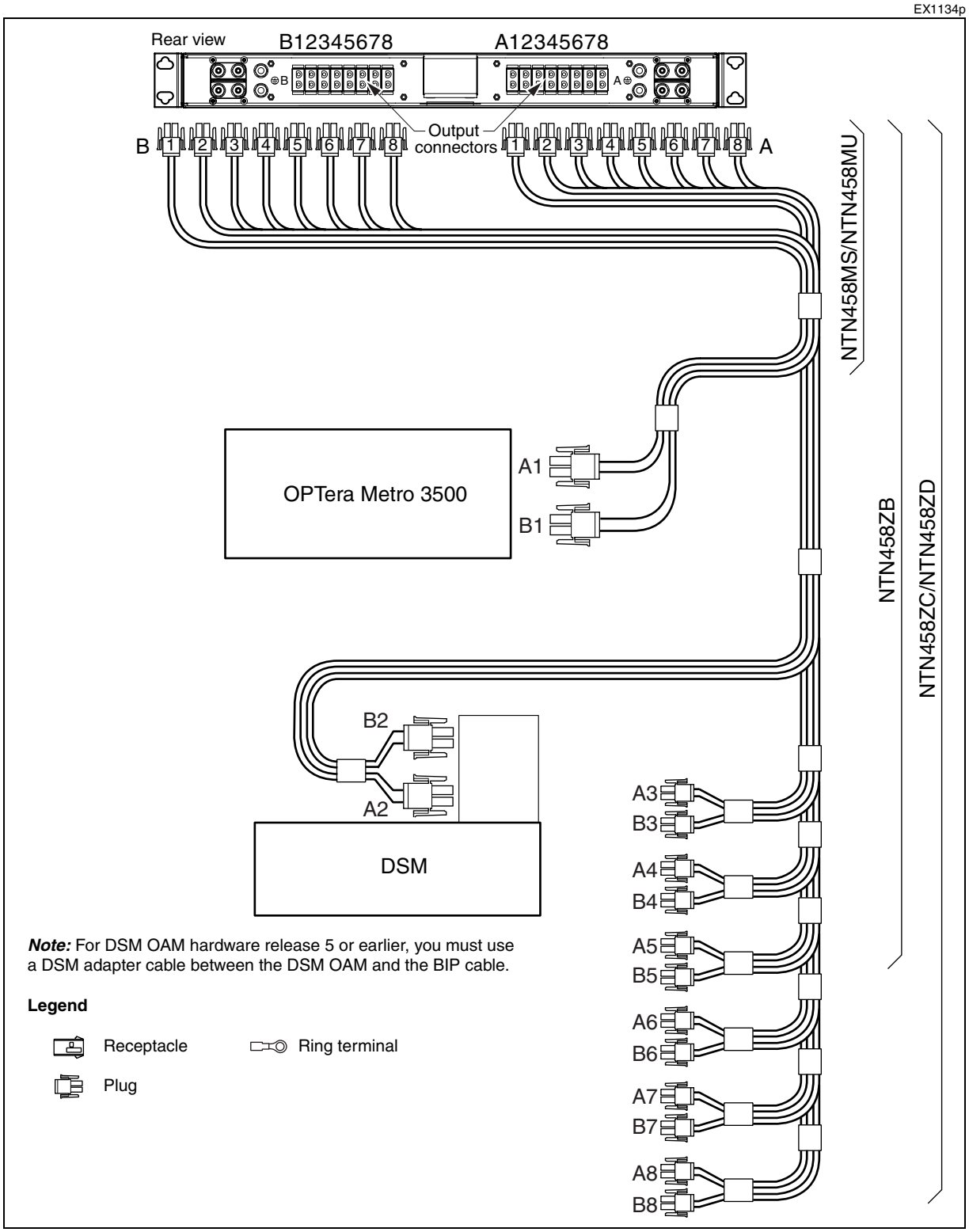


Figure 6-8
BIP cable components for NTN458MS

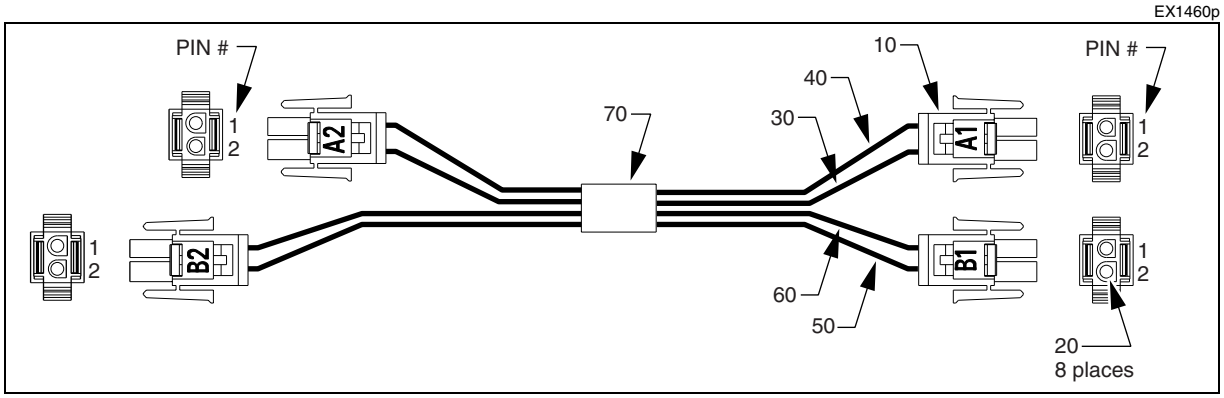


Table 6-15
Cable connector orientation for NTN458MS

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
1	A1	1	A2	White/Red	A-RET
2	A1	2	A2	Red	A-BATT
1	B1	1	B2	White/Blue	B-RET
2	B1	2	B2	Red/Blue	B-BATT

Table 6-16
Cabling stock list for NTN458MS

Item	Quantity	Description	Vendor	Part #
10	4	Connector body, plug, Mate-N-Lok 1x2	AMP/Tyco	770017-1
20	8	Connector contact, socket, Mate-N-Lok for 12-14 AWG	AMP/Tyco	194213-1
30	131.0 in (332.74 cm)	12 AWG 65x30 cable, Red	Judd Wire	H0104023 Red
40	131.0 in (332.74 cm)	12 AWG 65x30 cable, Wht1Red	Judd Wire	H0104023 Wht1Red
50	140.0 in (355.60 cm)	12 AWG 65x30 cable, Red1Blu	Judd Wire	H0104023 Red1Blu
60	140.0 in (355.60 cm)	12 AWG 65x30 cable, Wht1Blu	Judd Wire	H0104023 Wht1Blu
70	1	Wire and cable marker labels, 0.8 in (2.03 cm) W x 1.437 in (3.65 cm) H	WH Brady Co.	THT-63-427-3.5 or similar

Figure 6-9
BIP cable components for NTN458MU

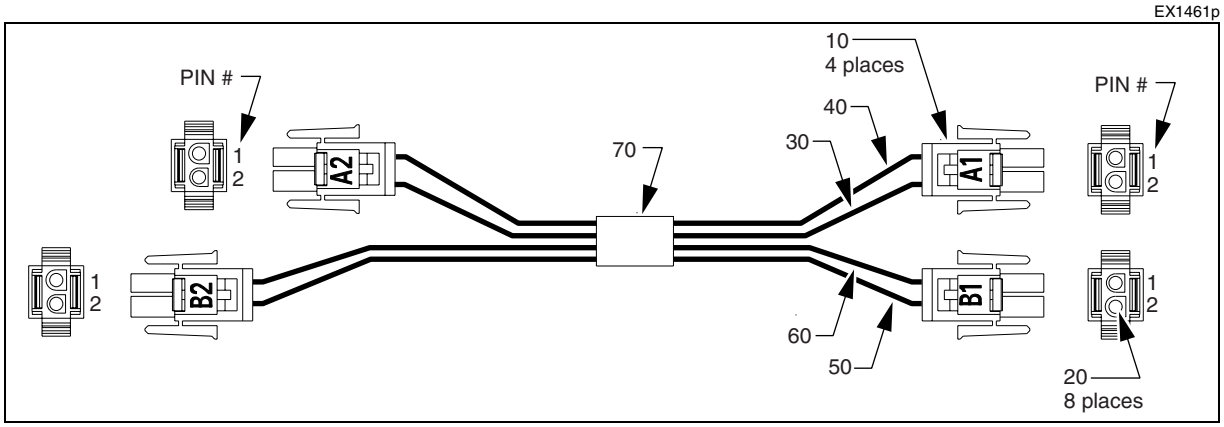


Table 6-17
Cable connector orientation for NTN458MU

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
1	A1	1	A2	White/Red	A-RET
2	A1	2	A2	Red	A-BATT
1	B1	1	B2	White/Blue	B-RET
2	B1	2	B2	Red/Blue	B-BATT

Table 6-18
Cabling stock list for NTN458MU

Item	Quantity	Description	Vendor	Part #
10	4	Connector body, plug, Mate-N-Lok 1x2	AMP/Tyco	770017-1
20	8	Connector contact, socket, Mate-N-Lok for 10 AWG	AMP/Tyco	194211-1
30	131.0 in (332.74 cm)	10 AWG 105x30 cable, Red	Judd Wire	H0104016 Red
40	131.0 in (332.74 cm)	10 AWG 105x30 cable, Wht1Red	Judd Wire	H0104016 Wht1Red

Table 6-18 (continued)
Cabling stock list for NTN458MU

Item	Quantity	Description	Vendor	Part #
50	140.0 in (355.60 cm)	10 AWG 105x30 cable, Red1Blu	Judd Wire	H0104016 Red1Blu
60	140.0 in (355.60 cm)	10 AWG 105x30 cable, Wht1Blu	Judd Wire	H0104016 Wht1Blu
70	1	Wire and cable marker labels, 0.8 in (2.03 cm) W x 1.437 in (3.65 cm) H	WH Brady Co.	THT-63-427-3.5 or similar

Figure 6-10
BIP cable components for NTN458ZB

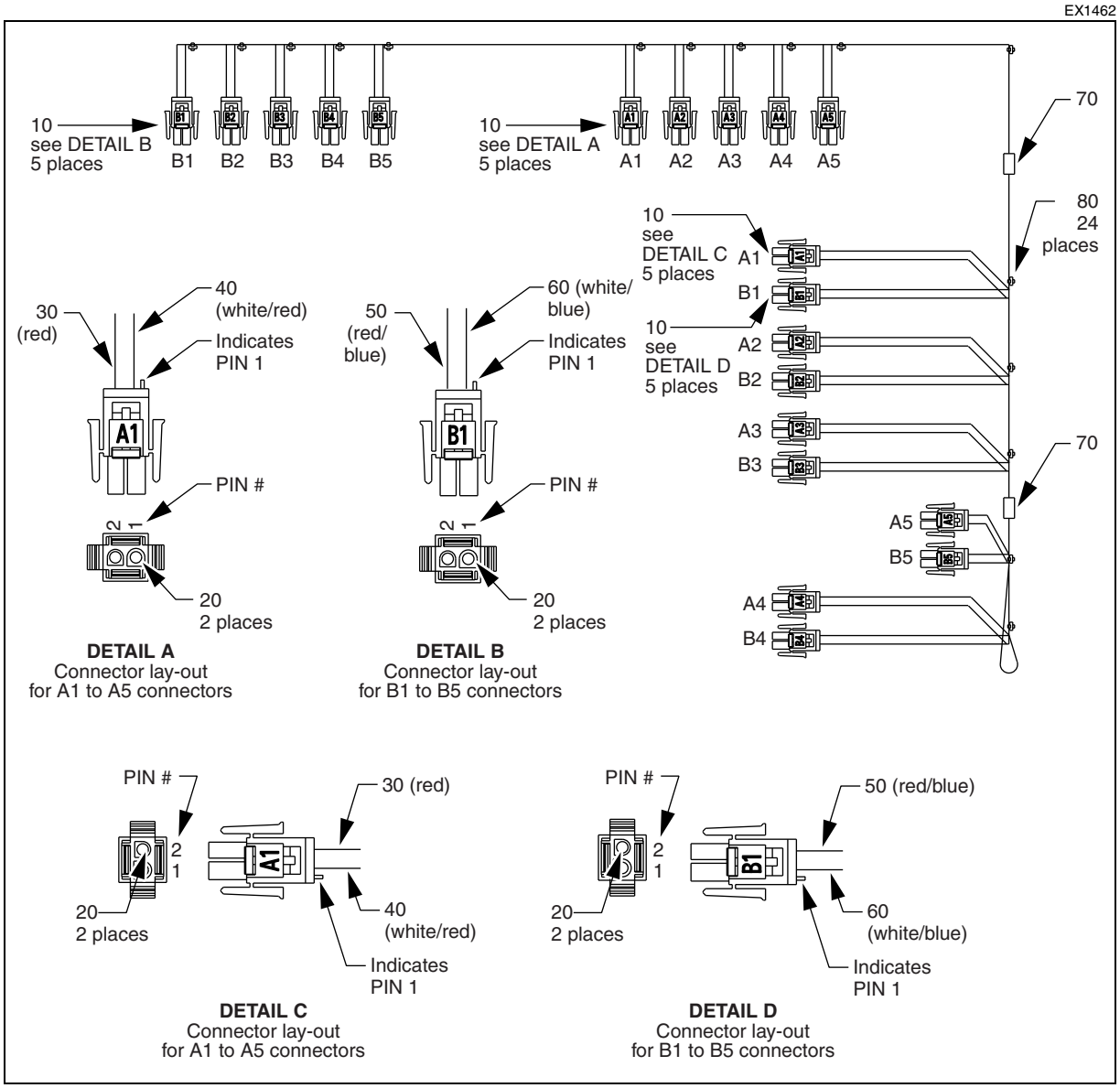


Table 6-19
Cable connector orientation for NTN458ZB

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
1	A1	1	A1	White/Red	A-RET
2	A1	2	A1	Red	A-BATT
1	B1	1	B1	White/Blue	B-RET

Table 6-19 (continued)
Cable connector orientation for NTN458ZB

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
2	B1	2	B1	Red/Blue	B-BATT
1	A2	1	A2	White/Red	A-RET
2	A2	2	A2	Red	A-BATT
1	B2	1	B2	White/Blue	B-RET
2	B2	2	B2	Red/Blue	B-BATT
1	A3	1	A3	White/Red	A-RET
2	A3	2	A3	Red	A-BATT
1	B3	1	B3	White/Blue	B-RET
2	B3	2	B3	Red/Blue	B-BATT
1	A4	1	A4	White/Red	A-RET
2	A4	2	A4	Red	A-BATT
1	B4	1	B4	White/Blue	B-RET
2	B4	2	B4	Red/Blue	B-BATT
1	A5	1	A5	White/Red	A-RET
2	A5	2	A5	Red	A-BATT
1	B5	1	B5	White/Blue	B-RET
2	B5	2	B5	Red/Blue	B-BATT

Table 6-20
Cabling stock list for NTN458ZB

Item	Quantity	Description	Vendor	Part #
10	20	Connector body, plug, Mate-N-Lok 1x2	AMP/Tyco	770017-1
20	40	Connector contact, socket, Mate-N-Lok for 10 AWG	AMP/Tyco	194211-1
30	357.0 in (906.78 cm)	10 AWG 105x30 cable, Red	Judd Wire	H0104016 Red
40	357.0 in (906.78 cm)	10 AWG 105x30 cable, Wht1Red	Judd Wire	H0104016 Wht1Red

Table 6-20 (continued)
Cabling stock list for NTN458ZB

Item	Quantity	Description	Vendor	Part #
50	408.0 in (1036.32 cm)	10 AWG 105x30 cable, Red1Blu	Judd Wire	H0104016 Red1Blu
60	408.0 in (1036.32 cm)	10 AWG 105x30 cable, Wht1Blu	Judd Wire	H0104016 Wht1Blu
70	2	Wire and cable marker labels, 0.8 in (2.03 cm) W x 1.437 in (3.65 cm) H	WH Brady Co.	THT-63-427-3.5 or similar
80	24	Cable tie, locking - max bundle diameter: 0.87 in (2.21 cm)		

Figure 6-11
BIP cable components for NTN458ZC

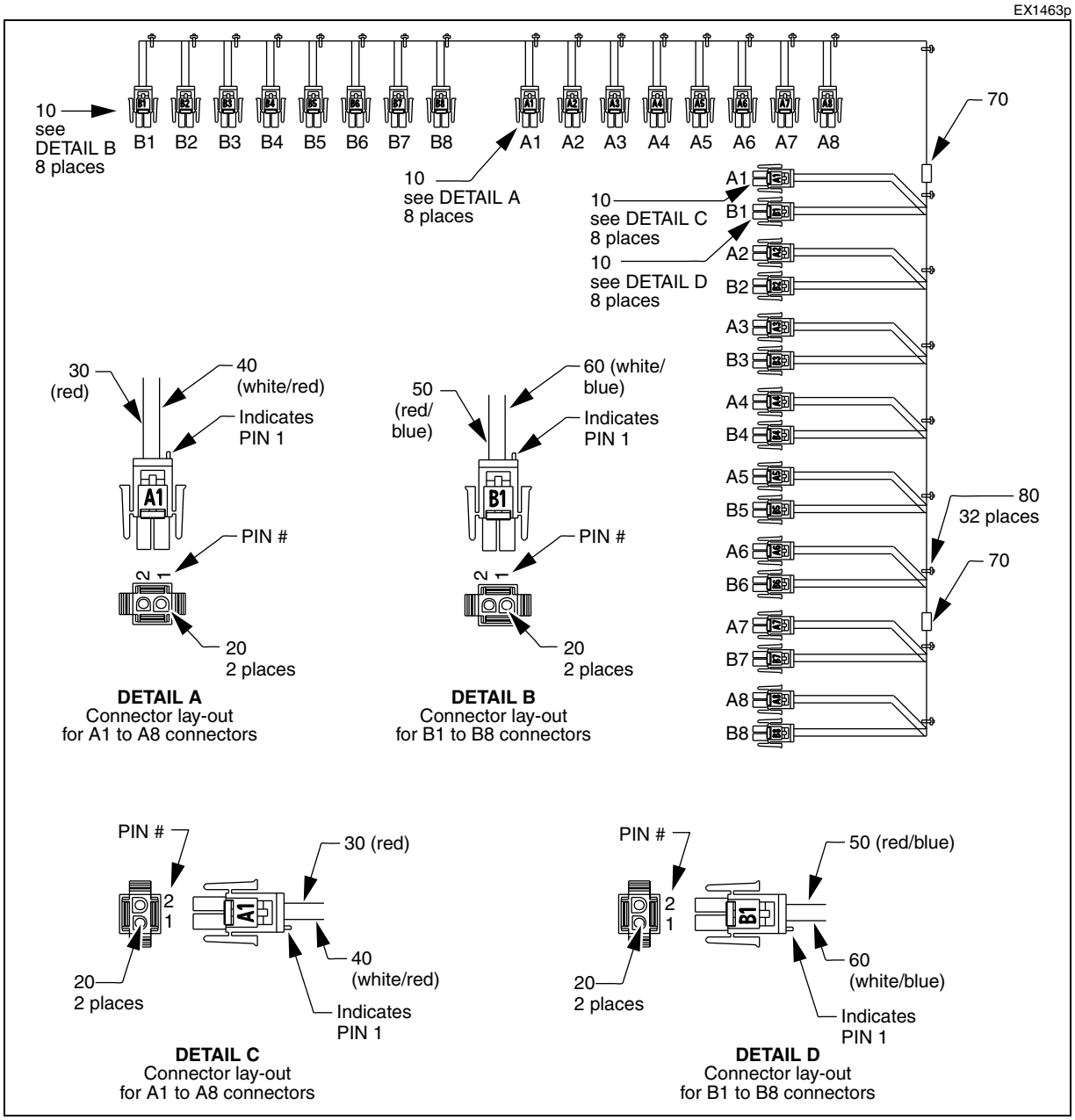


Table 6-21
Cable connector orientation for NTN458ZC

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
1	A1	1	A1	White/Red	A-RET
2	A1	2	A1	Red	A-BATT
1	B1	1	B1	White/Blue	B-RET
2	B1	2	B1	Red/Blue	B-BATT
1	A2	1	A2	White/Red	A-RET
2	A2	2	A2	Red	A-BATT
1	B2	1	B2	White/Blue	B-RET
2	B2	2	B2	Red/Blue	B-BATT
1	A3	1	A3	White/Red	A-RET
2	A3	2	A3	Red	A-BATT
1	B3	1	B3	White/Blue	B-RET
2	B3	2	B3	Red/Blue	B-BATT
1	A4	1	A4	White/Red	A-RET
2	A4	2	A4	Red	A-BATT
1	B4	1	B4	White/Blue	B-RET
2	B4	2	B4	Red/Blue	B-BATT
1	A5	1	A5	White/Red	A-RET
2	A5	2	A5	Red	A-BATT
1	B5	1	B5	White/Blue	B-RET
2	B5	2	B5	Red/Blue	B-BATT
1	A6	1	A6	White/Red	A-RET
2	A6	2	A6	Red	A-BATT
1	B6	1	B6	White/Blue	B-RET
2	B6	2	B6	Red/Blue	B-BATT
1	A7	1	A7	White/Red	A-RET
2	A7	2	A7	Red	A-BATT
1	B7	1	B7	White/Blue	B-RET

Table 6-21 (continued)
Cable connector orientation for NTN458ZC

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
2	B7	2	B7	Red/Blue	B-BATT
1	A8	1	A8	White/Red	A-RET
2	A8	2	A8	Red	A-BATT
1	B8	1	B8	White/Blue	B-RET
2	B8	2	B8	Red/Blue	B-BATT

Table 6-22
Cabling stock list for NTN458ZC

Item	Quantity	Description	Vendor	Part #
10	32	Connector body, plug, Mate-N-Lok 1x2	AMP/Tyco	770017-1
20	64	Connector contact, socket, Mate-N-Lok for 12-14 AWG	AMP/Tyco	194213-1
30	597.0 in (1516.38 cm)	12 AWG 65x30 cable, Red	Judd Wire	H0104023 Red
40	597.0 in (1516.38 cm)	12 AWG 65x30 cable, Wht1Red	Judd Wire	H0104023 Wht1Red
50	732.0 in (1859.28 cm)	12 AWG 65x30 cable, Red1Blu	Judd Wire	H0104023 Red1Blu
60	732.0 in (1859.28 cm)	12 AWG 65x30 cable, Wht1Blu	Judd Wire	H0104023 Wht1Blu
70	2	Wire and cable marker labels, 0.8 in (2.03 cm) W x 1.437 in (3.65 cm) H	WH Brady Co.	THT-63-427-3.5 or similar
80	32	Cable tie, locking - max bundle diameter: 0.87 in (2.21 cm)		

Figure 6-12
BIP cable components for NTN458ZD

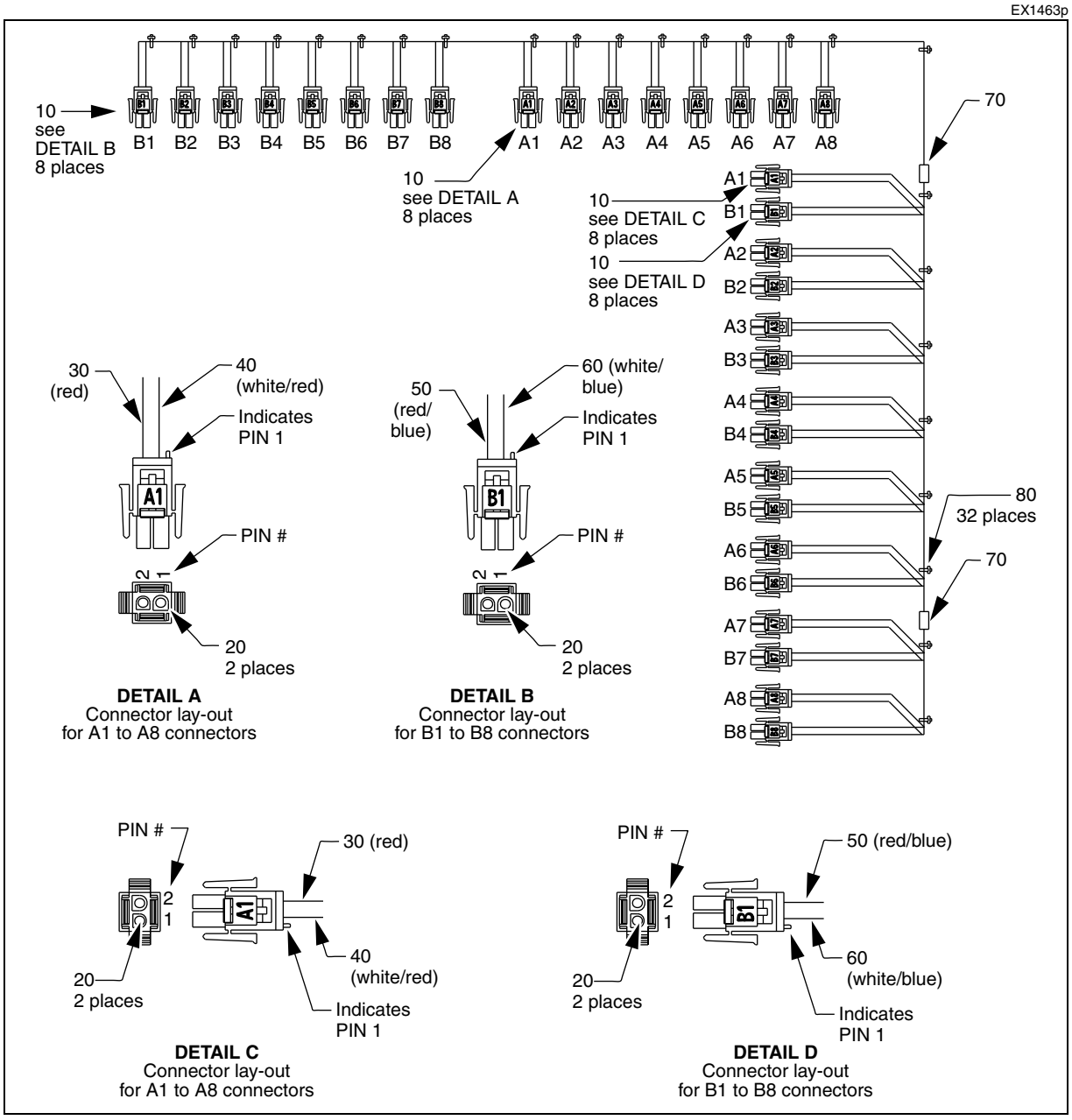


Table 6-23
Cable connector orientation for NTN458ZD

From		To		With colour	Signal
Pin #	**Connector**	**Pin #**	**Connector**		
1	A1	1	A1	White/Red	A-RET
2	A1	2	A1	Red	A-BATT
1	B1	1	B1	White/Blue	B-RET
2	B1	2	B1	Red/Blue	B-BATT
1	A2	1	A2	White/Red	A-RET
2	A2	2	A2	Red	A-BATT
1	B2	1	B2	White/Blue	B-RET
2	B2	2	B2	Red/Blue	B-BATT
1	A3	1	A3	White/Red	A-RET
2	A3	2	A3	Red	A-BATT
1	B3	1	B3	White/Blue	B-RET
2	B3	2	B3	Red/Blue	B-BATT
1	A4	1	A4	White/Red	A-RET
2	A4	2	A4	Red	A-BATT
1	B4	1	B4	White/Blue	B-RET
2	B4	2	B4	Red/Blue	B-BATT
1	A5	1	A5	White/Red	A-RET
2	A5	2	A5	Red	A-BATT
1	B5	1	B5	White/Blue	B-RET
2	B5	2	B5	Red/Blue	B-BATT
1	A6	1	A6	White/Red	A-RET
2	A6	2	A6	Red	A-BATT
1	B6	1	B6	White/Blue	B-RET
2	B6	2	B6	Red/Blue	B-BATT
1	A7	1	A7	White/Red	A-RET
2	A7	2	A7	Red	A-BATT
1	B7	1	B7	White/Blue	B-RET

Table 6-23 (continued)
Cable connector orientation for NTN458ZD

From		To		With colour	Signal
Pin #	Connector	Pin #	Connector		
2	B7	2	B7	Red/Blue	B-BATT
1	A8	1	A8	White/Red	A-RET
2	A8	2	A8	Red	A-BATT
1	B8	1	B8	White/Blue	B-RET
2	B8	2	B8	Red/Blue	B-BATT

Table 6-24
Cabling stock list for NTN458ZD

Item	Quantity	Description	Vendor	Part #
10	32	Connector body, plug, Mate-N-Lok 1x2	AMP/Tyco	770017-1
20	64	Connector contact, socket, Mate-N-Lok for 10 AWG	AMP/Tyco	194211-1
30	597.0 in (1516.38 cm)	10 AWG 105x30 cable, Red	Judd Wire	H0104016 Red
40	597.0 in (1516.38 cm)	10 AWG 105x30 cable, Wht1Red	Judd Wire	H0104016 Wht1Red
50	732.0 in (1859.28 cm)	10 AWG 105x30 cable, Red1Blu	Judd Wire	H0104016 Red1Blu
60	732.0 in (1859.28 cm)	10 AWG 105x30 cable, Wht1Blu	Judd Wire	H0104016 Wht1Blu
70	2	Wire and cable marker labels, 0.8 in (2.03 cm) W x 1.437 in (3.65 cm) H	WH Brady Co.	THT-63-427-3.5 or similar
80	32	Cable tie, locking - max bundle diameter: 0.87 in (2.21 cm)		

RS-232 DCE DB25 cable pinout and assembly

Use one DCE DB25 cable assembly for each shelf as required.

Figure 6-13
RS-232 DCE cable assembly

EX0867p

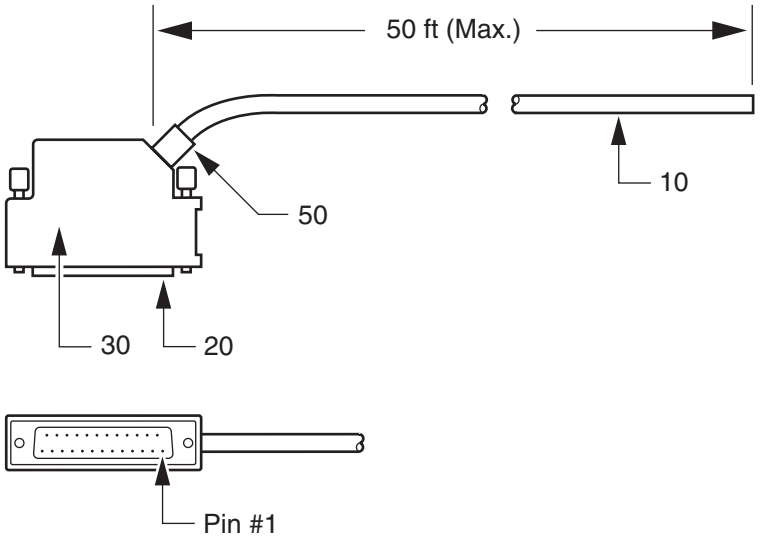


Table 6-25
RS-232 DCE signal routing

Pin #	Signal	Color
1	GND	BK
2	Rx	BR
3	Tx	R
4	RTS	O
5	CTS	Y
6	DSR	G
7	GND	BL
8	DCD	V
9	N/C	
10	N/C	
11	N/C	
12	N/C	
13	N/C	
14	N/C	

Table 6-25 (continued)
RS-232 DCE signal routing

Pin #	Signal	Color
15	N/C	
16	N/C	
17	N/C	
18	N/C	
19	N/C	
20	DTR	W/BK/BR
21	N/C	
22	N/C	
23	N/C	
24	N/C	
25	N/C	

Table 6-26
Suggested individual RS-232 DCE parts

Item	Quantity	Description	Vendor	Vendor part #
10	50 ft (15.38 m) max.	24AWG 7x32,Tin CU Stranded SHD 24AWG 7x32,Tin CU Stranded SHD	Alpha Wire Delco Wire & Cable	5120/25C 31825
20	1	Conn. Housing D-Sub D-Sub Array Conn. Housing D-Sub D-Sub Array	AMP Inc. Cinch Connector	207464-2 234-25-24-120
30	1	Conn. Hood D-Sub D-Sub Array	CONEC Corp	165X00599A
40	8	Conn. Contact D-Sub 20-24 AU Conn. Contact D-Sub 20-24 AU	AMP Inc. Cinch Connector	2-66506-4 402-30-14-212
50	3 in. (76.2 mm)	Heat Shrink Tubing TBG, Polyolefin, B Heat Shrink Tubing TBG, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Figure 6-14
BITS wire wrap cable pinout and assembly

EX0863p

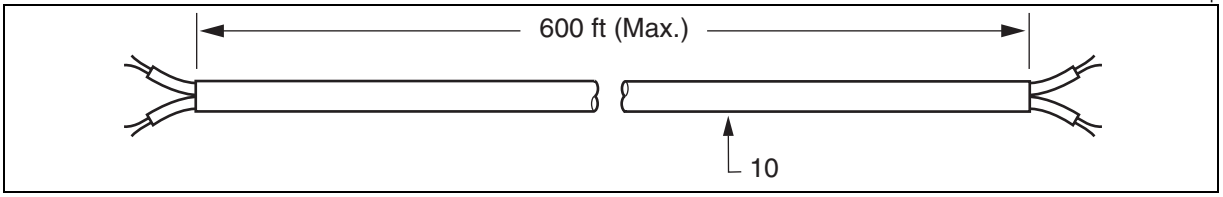


Table 6-27
Suggested individual BITS cable parts

Item	Quantity	Description	Vendor	Part #
10	600 ft (182.88 m) max.	2 pr, Solid, Individual pr. shield	General Cable Co.	By description

Table 6-28

Item	Quantity	Description	Vendor	Part #
10	600 ft max.	2 pr, Solid, Individual pr. shield	General Cable Co.	By description

Office alarm cable pinout and assembly

Office alarm cables are used as required for each shelf.

Figure 6-15
LOAM wire wrap cable assembly

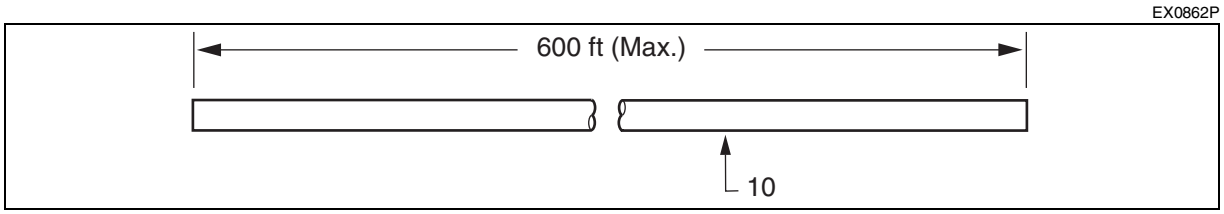


Table 6-29
Suggested individual office alarm cable parts

Item	Quantity	Description	Vendor	Part #
10	600 ft (182.88 m) max.	22AWG, 12x22 pr. Solid Shielded Cable	Lucent	607C 12/22 RVAR

Environmental alarm cable pinout and assembly

Environmental alarm cables are used as required for each shelf.

Figure 6-16
LOAM wire wrap cable assembly

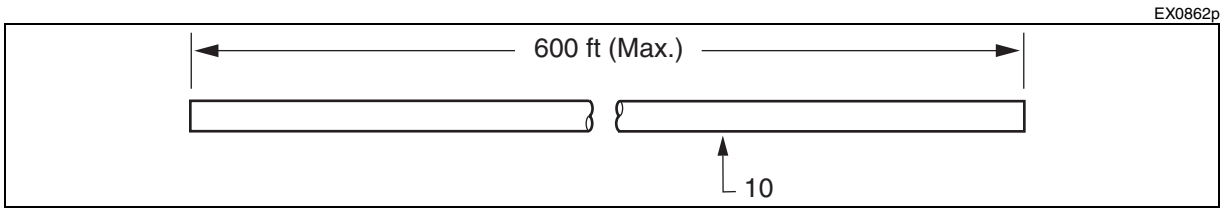
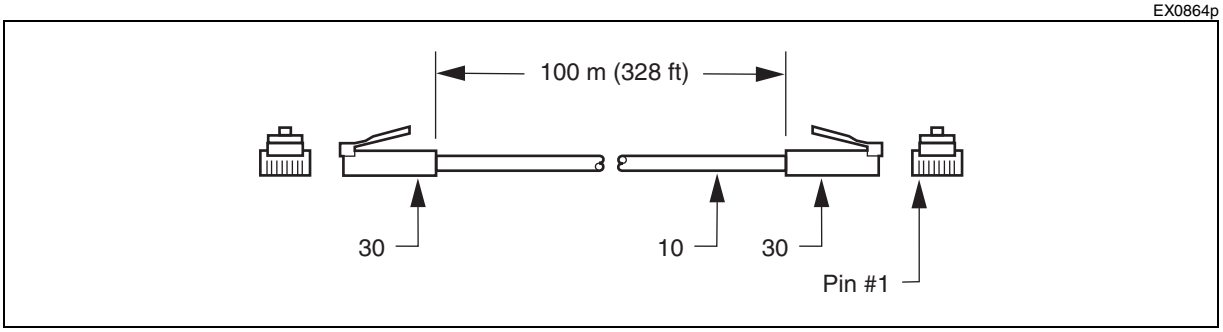


Table 6-30
Suggested individual environmental alarm cable parts

Item	Quantity	Description	Vendor	Part #
10	600 ft (182.88 m) max.	22 AWG, 16 pr. Solid Cable	Lucent	608 16/22 RVAR

Figure 6-17
NPx Ethernet RJ-45 MDI cable pinout and assembly

EX0864p



Note 1: All connection to and from ILAN to another ILAN always use flipped cables.

Note 2: Direct connections from COLAN to Preside or to a PC require flipped cables. Connections to any device from COLAN through a third party hub requires straight cables.

Note 3: The Ethernet cables NT7E44JE/JU/JV can be used to connect ILAN to an OC-48 Shelf Processor (NT7E20GD/KA).

Table 6-31
Ethernet signal routing—straight

Connector #1			Connector #2		
Pin #	**Signal**	**Color**	**Pin #**	**Signal**	**Color**
1	Ethernet Out+	SL	1	Ethernet Out+	SL
2	Ethernet Out-	Y	2	Ethernet Out-	Y
3	Ethernet In+	O	3	Ethernet In+	O
4	N/C		4	N/C	
5	N/C		5	N/C	
6	Ethernet In-	W	6	Ethernet In-	W
7	N/C		7	N/C	
8	N/C		8	N/C	

Table 6-32
Ethernet signal routing—flipped

Connector #1			Connector #2		
Pin #	**Signal**	**Color**	**Pin #**	**Signal**	**Color**
1	Ethernet Out+	SL	3	Ethernet In+	SL
2	Ethernet Out-	Y	6	Ethernet In-	Y
3	Ethernet In+	O	1	Ethernet Out+	O
4	N/C		4	N/C	
5	N/C		5	N/C	
6	Ethernet In-	W	2	Ethernet Out-	W
7	N/C		7	N/C	
8	N/C		8	N/C	

Table 6-33
Suggested individual Ethernet RJ-45 cable parts

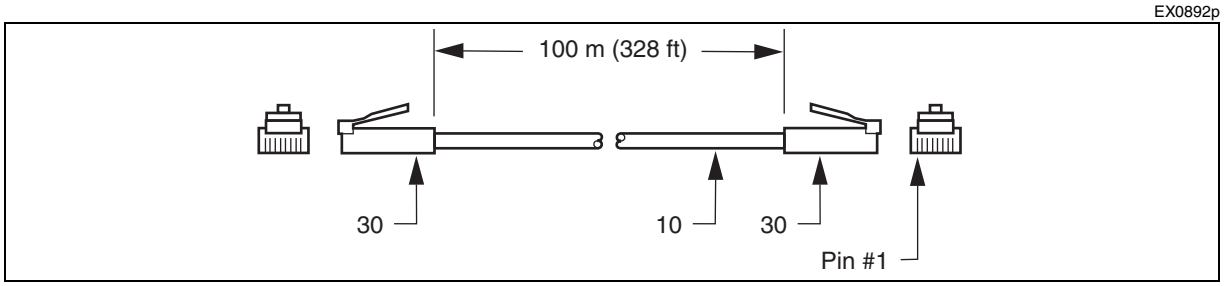
Item	Quantity	Description	Vendor	Part #
10	328 ft (99.97 m) max.	IBDN plus Cable 4 PR 24 AWG, CMR, Category 5	Nordx/CDT	24570036 **Note**: Nordx part numbers 24570036 and 24570034 are electrically equivalent.
20	2 piece	Wire & Cable Marker Label Wire & Cable Marker Label	W H Brady Co. Eletronic Programming Corp.	DAT-52-642-10 AVW10F
30	2 piece	Conn. Teledapt Tel Array	AMP Inc.	5-555179-2

Note 1: For the purpose of SDCC visibility, only use flipped Ethernet cables to connect to ILAN ports on the I/O of the OPTera Metro 3500 shelf.

Note 2: For ESWD or telnet capabilities, connect a straight Ethernet cable to the COLAN port.

Note 3: For any IP capabilities, (i.e: telnet, FTP, ESWD) you need the COLAN port. ESWD uses the FTP protocol to deliver the loads to the network processor.

Figure 6-18
OPE Ethernet RJ-45 MDI cable pinout and assembly



Note 1: Use flipped cables for connections to and from 4x100BT to another 4x100BT (or COLAN).

Note 2: Direct connections from COLAN to Preside or to a PC require flipped cables. Connections to any device from COLAN through a third party hub requires straight cables.

Note 3: The Ethernet cables NT7E44JE/JU/JV can be used to connect ILAN to an OC-48 Shelf Processor (NT7E20GD/KA).

Table 6-34
Ethernet signal routing—straight

Connector #1			Connector #2		
Pin #	**Signal**	**Color**	**Pin #**	**Signal**	**Color**
1	Ethernet Out+	SL	1	Ethernet Out+	SL
2	Ethernet Out-	Y	2	Ethernet Out-	Y
3	Ethernet In+	O	3	Ethernet In+	O
4	Termination 1		4	Termination 1	
5	Termination 2		5	Termination 2	
6	Ethernet In-	W	6	Ethernet In-	W
7	Termination 3		7	Termination 3	
8	Termination 4		8	Termination 4	

Table 6-35
Ethernet signal routing—flipped

Connector #1			Connector #2		
Pin #	**Signal**	**Color**	**Pin #**	**Signal**	**Color**
1	Ethernet Out+	SL	3	Ethernet In+	SL
2	Ethernet Out-	Y	6	Ethernet In-	Y
3	Ethernet In+	O	1	Ethernet Out+	O
4	Termination 1		4	Termination 1	
5	Termination 2		5	Termination 2	
6	Ethernet In-	W	6	Ethernet Out-	W
7	Termination 3		7	Termination 3	
8	Termination 4		8	Termination 4	

Table 6-36
Suggested individual Ethernet RJ-45 cable parts

Item	Quantity	Description	Vendor	Part #
10	328 ft (99.97 m) max	IBDN plus Cable 4 PR 24 AWG, CMR, Category 5	Nordx/CDT	24570036 **Note**: Nordx part numbers 24570036 and 24570034 are electrically equivalent.
20	2 piece	Wire & Cable Marker Label Wire & Cable Marker Label	W H Brady Co. Eletronic Programming Corp.	DAT-52-642-10 AVW10F
30	2 piece	Conn. Teledapt Tel Array	AMP Inc.	5-555179-2

Figure 6-19
X.25 DSUB cable assembly

EX0866p

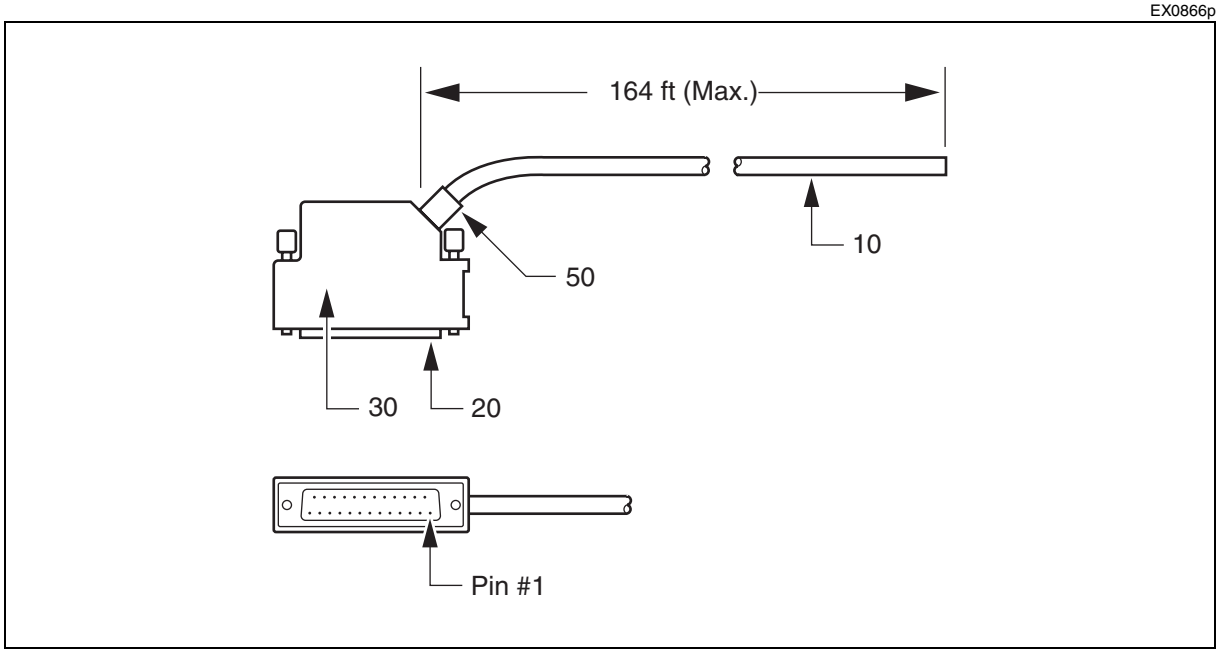


Table 6-37
X.25 DSUB signal routing

Pin #	Signal	Color
1	N/C	
2	TXD	R
3	RXD	BR
4	RTS	BL
5	CTS	V
6	N/C	
7	GND	Y
8	N/C	
9	N/C	
10	N/C	
11	N/C	
12	N/C	
13	N/C	
14	N/C	
15	TCLK	G
16	N/C	
17	RCLK	BK
18	N/C	
19	N/C	
20	DTR	O
21	N/C	
22	N/C	
23	N/C	
24	N/C	
25	N/C	

Table 6-38
Suggested individual X.25 DSUB cable parts

Item	Quantity	Description	Vendor	Part #
10	164 ft (49.99 m) max.	24 AWG 7x32, Tin CU SHD 24 AWG 7x32, Tin CU SHD	Belden Wire & Cable Madison Cable Corp.	9540 10RFB00004
20	1 piece	Conn. Hood D-Sub D-Sub Array	CONEC Corp.	165X00599A
30	1 piece	Conn. Housing D-Sub D-Sub Array Conn. Housing D-Sub D-Sub Array	AMP Inc. Cinch Connector	205208-1 234-25-22-120
40	8 piece	Conn. Contact D-Sub 20-24 AU Conn. Contact D-Sub 20-24 AU	AMP Inc. Cinch Connector	2-66506-4 402-30-14-212
50	7.87 in. 200 mm	Heat Shrink Tubing, Polyolefin, B Heat Shrink Tubing, Polyolefin, B	Alpha Wire Corp. AMP Inc.	FIT-221V-1/2 603328-1

Figure 6-20
LOAM–connectors

EX0792p

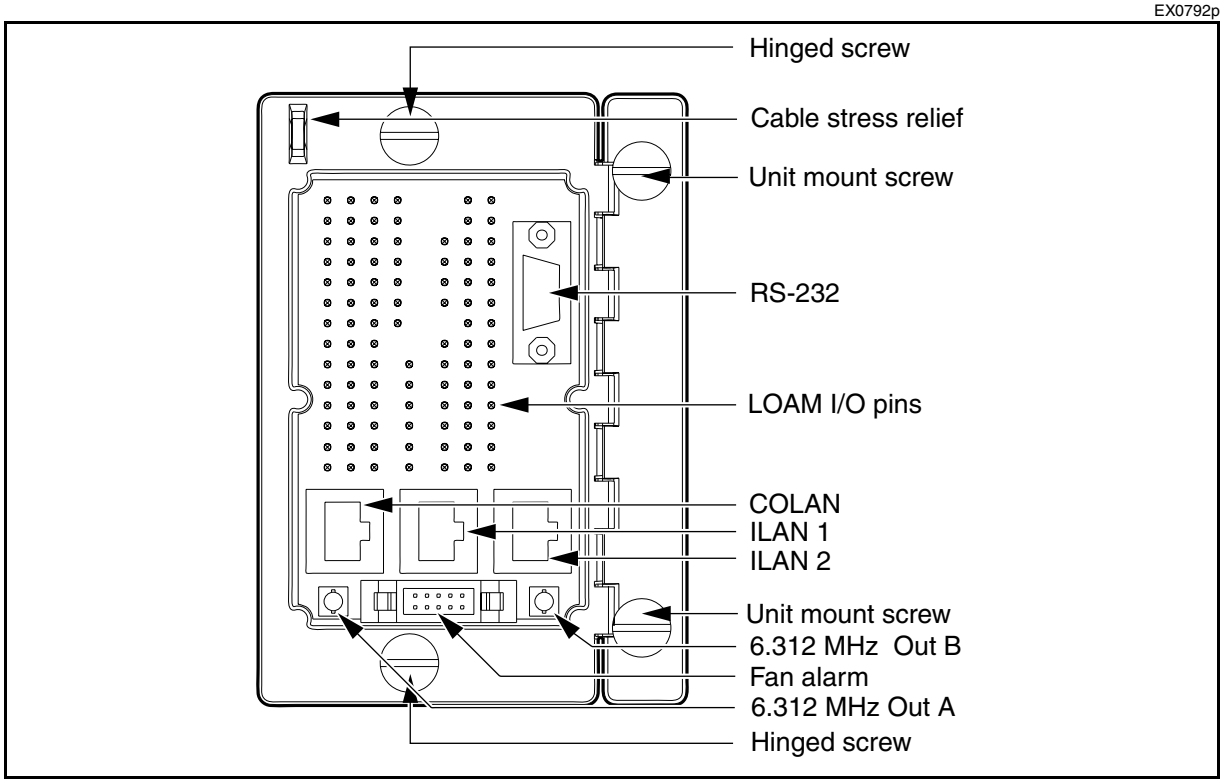


Figure 6-21
LOAM interface pinout

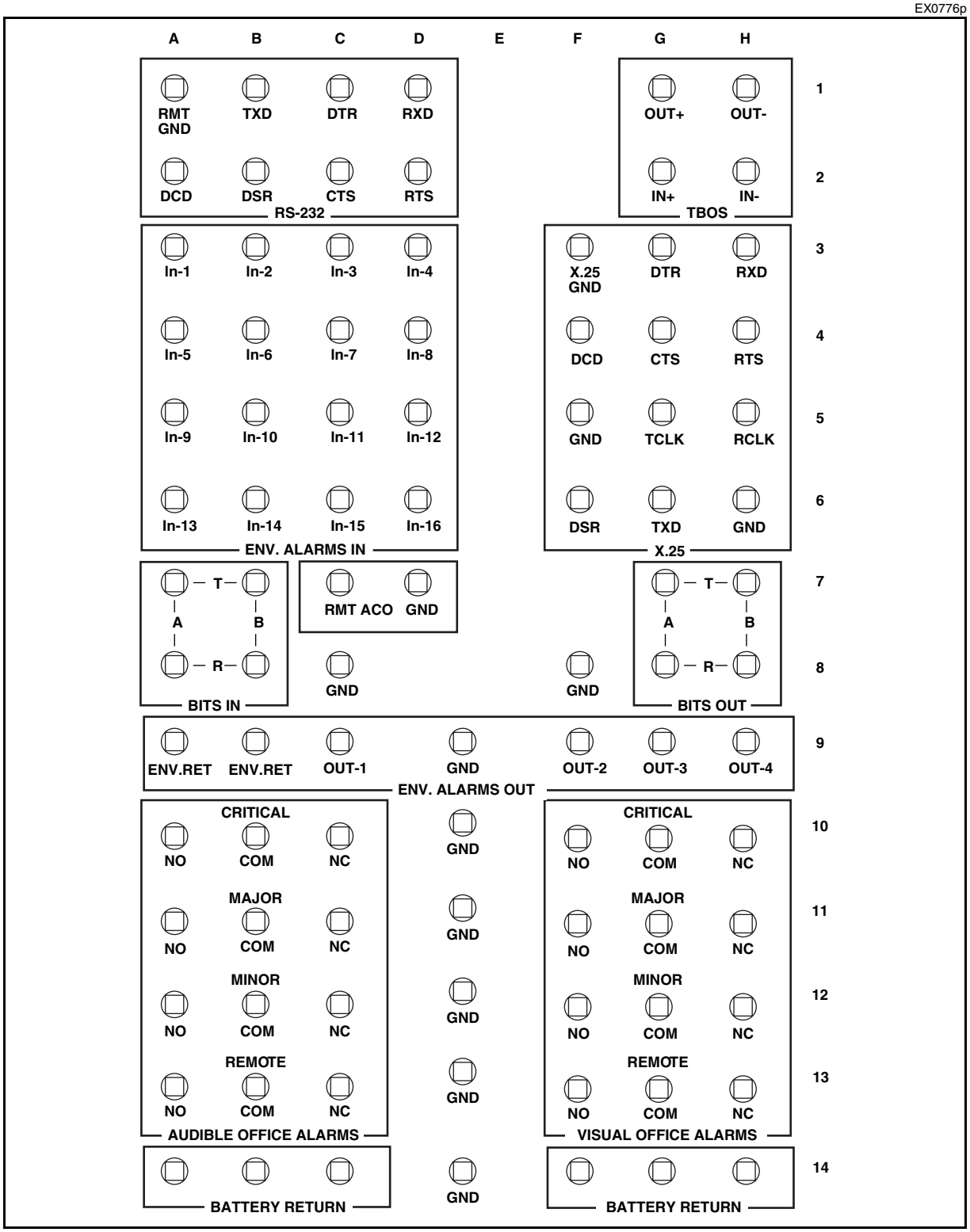
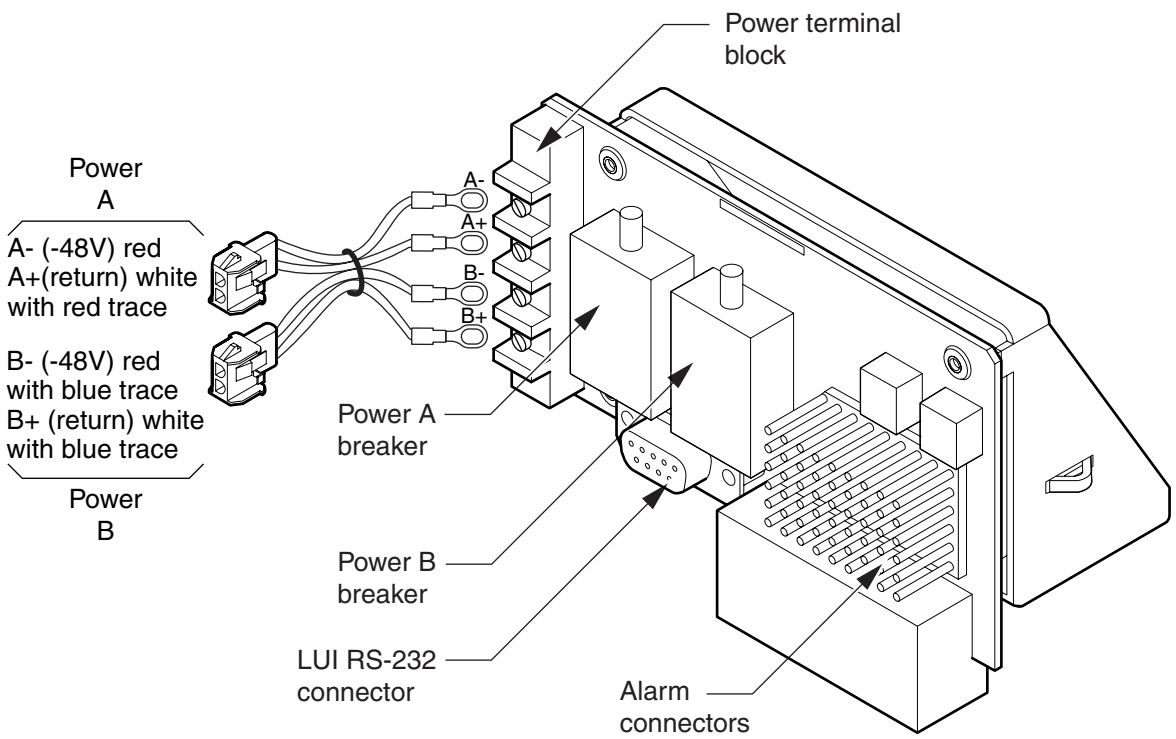


Figure 6-22
DSM OAM adapter module (Hardware Release 5) with cover off

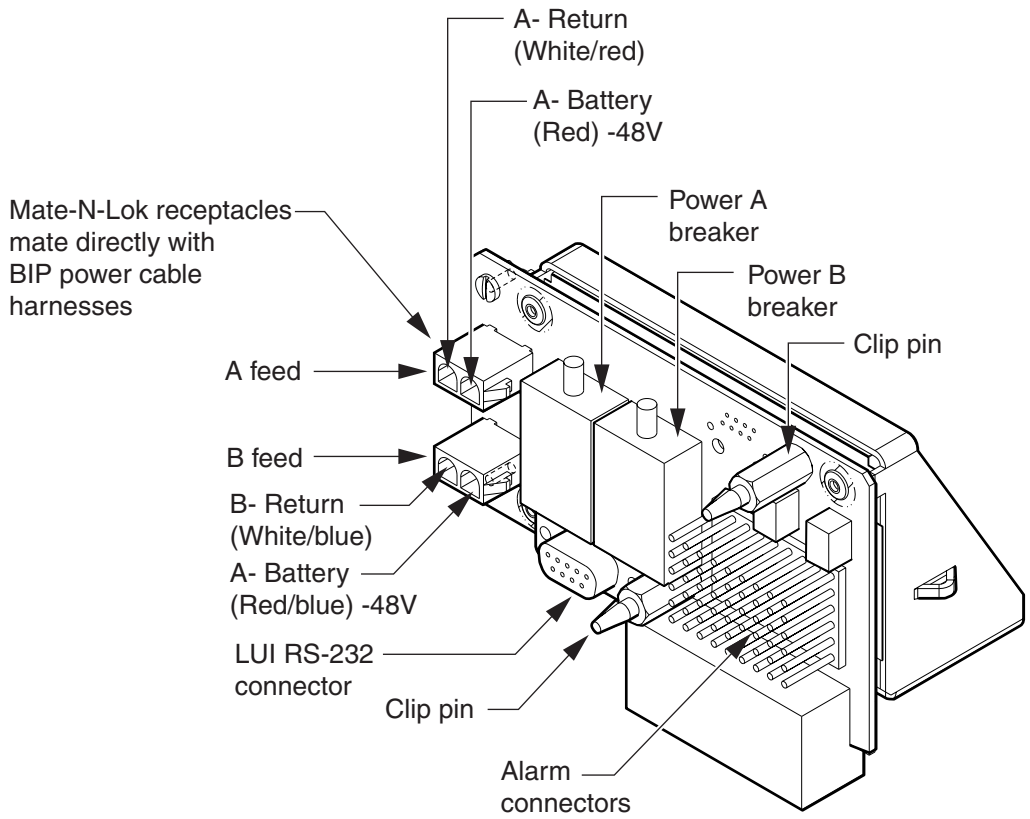
EX0960p



Note: The local user interface (LUI) is an RS-232c port with D-type nine pin connector. The LUI is used for retrieving messages when performing low-level trouble shooting on the DSM. Used to access the active DS1x84 TM circuit pack, it provides remote login to the host in the case of an OAM fail.

Figure 6-23
DSM OAM adapter module (Hardware Release 6) with cover off

EX0960p



Note: The local user interface (LUI) is an RS-232c port with D-type nine pin connector. The LUI is used for retrieving messages when performing low-level trouble shooting on the DSM. Used to access the active DS1x84 TM circuit pack, it provides remote login to the host in the case of an OAM fail.

Table 6-39
Local user interface (LUI) cable pinout

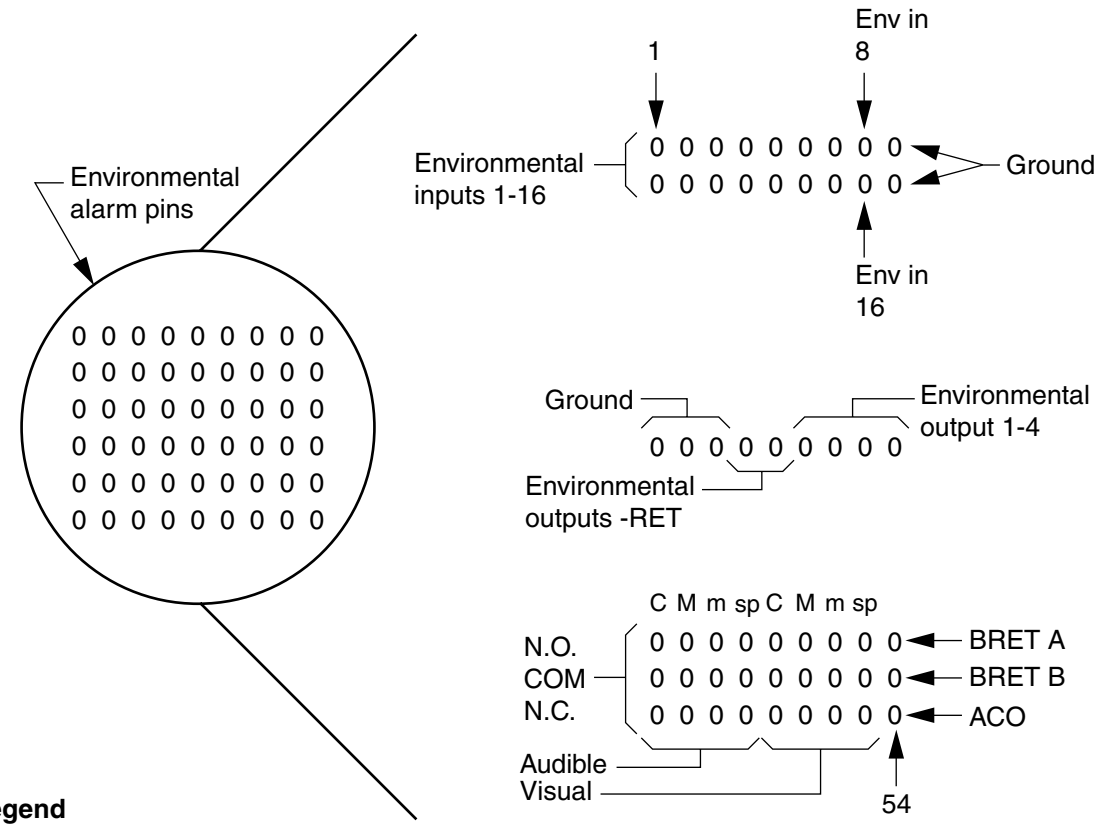
Pin Number	Signal name	Description	Direction
1	DCD	Receive carrier Detected	DSM
2	RxD	Received Data	DSM out
3	TxD	Transmitted Data	DSM in
4	DTR	Data Terminal Ready	DSM in

Table 6-39
Local user interface (LUI) cable pinout (continued)

Pin Number	Signal name	Description	Direction
5	Common	Signal Common	in/out
6	DSR	Data Set Ready	DSM
7	RTS	Request to Send	DSM in
8	CTS	Clear to Send	DSM
9	Not connected/Not used		

Figure 6-24
DSM - OAM adapter module environmental alarm pinout

EX1133p



Legend

N.O. = Normally Open
N.C. = Normally Closed

Wirewrap matrix pinout

#	1	2	3	4	5	6	7	8	9
1	ENVIN1	ENVIN2	ENVIN3	ENVIN4	ENVIN5	ENVIN6	ENVIN7	ENVIN8	GND
2	ENVIN9	ENVIN10	ENVIN11	ENVIN12	ENVIN13	ENVIN14	ENVIN15	ENVIN16	GND
3	GND	GND	GND	ENVOUT -RET	ENVOUT -RET	ENVOU1	ENVOU2	ENVOU3	ENVOU4
4	AUD CR N.O.	AUD MJ N.O.	AUD MN N.O.	AUD spare N.O.	VIS CR N.O.	VIS MJ N.O.	VIS MN N.O.	VIS spare N.O.	BRET A
5	AUD CR COM	AUD MJ COM	AUD MN COM	AUD spare COM	VIS CR COM	VIS MJ COM	VIS MN COM	VIS spare COM	BRET B
6	AUD CR N.C.	AUD MJ N.C.	AUD MN N.C.	AUD spare N.C.	VIS CR N.C.	VIS MJ N.C.	VIS MN N.C.	VIS spare N.C.	ACO

Shelf mounting guidelines

Rack requirements

The OPTera Metro 3500 shelf is 17.5 in. (445 mm) high and 11.8 in. (299 mm) deep. The shelf is 17.1 in. (435 mm) wide and the cover is 20.3-in. (515 mm) wide. The OPTera Metro 3500 shelf fits 19-in. and 23-in. racks and meets ANSI and ETSI specifications. The shelf dimensions allow four shelves with air deflectors to be deployed in a 7-ft Nortel Networks, Newton, or Hendry bay. The OPTera Metro 3500 shelf weighs 44 lbs (19.96 kg) when empty and 68 lbs (30.84 kg) when fully equipped.

> ***Note:*** The configuration of four OPTera Metro 3500 shelves in one 7-ft bay (2.13 m) (NT7E70AA) exceeds objective 04-12 for equipment heat release in the Telcordia GR-63-CORE document. Therefore, to be compliant, you must have an 8.0 ft. (2.44 m) Nortel Networks bay (NT7E70CA).

The Universal OPTera Metro 3500 system (NTN476AH) is compliant to NEBS level 3 requirements.

The OMX + Fiber Manager 4CH (see Table 8-17 on page 8-26 for PEC codes) (hereafter called 'OMX') or Enhanced OMX + Fiber Manager 4CH (see Table 8-18 on page 8-26 for PEC codes) are used in OPTera Metro 3500 DWDM networks and is a stand-alone unit. The OMX and enhanced OMX multiplexes and demultiplexes up to four channels in one band. The distinguishing features of the OMXs are:

- Each OMX is a 1U high external drawer that contains optical filters, a small patch panel with bulkhead connectors, and fiber management components. The drawers can be mounted anywhere in the rack. Nortel Networks recommends that you install the trays directly beneath the shelf.
- Each OMX uses bulkhead connectors and patch cords to connect circuit packs.

The OMX shelf (NTN449ZW) is only required in conjunction with OMX modules (NTN449AA, BA, CA, DA). The OMX shelf is 17.1 in. (434 mm) wide, 11 in. (279 mm) deep, and 1.75 in. (44 mm) high. The OMX shelf fits between OPTera Metro 3500 shelves in a bay.

Note 1: The OMX shelf (NTN449ZW) has been manufacture discontinued, although it is still referenced in this document,

Note 2: The OMX + Fiber Manager 4CH does not require an OMX shelf (NTN449ZW) or an external Fiber Manager (NT0H57BB).

Note 3: If you already have OMX modules (NTN449AA, BA, CA, DA), you must also have an OMX shelf (NTN449ZW).

The DS1 service module (DSM) shelf is 15.5 in. (440 mm wide), 20.5 in. wide (520 mm) with the door, 6 in. (148 mm) high, and 11.5 in. (292.10 mm) deep. Like the OMX shelf, the DSM shelf fits between OPTera Metro 3500 shelves in a bay. The DSM shelf weighs 21.2 lbs (9.6 kg) when fully equipped.

The DSM shelf is compliant to NEBS level 3 requirements.

Environmental considerations

The OPTera Metro 3500 Shelf Assembly (NTN476AA, NTN476DA) is designed for temperature operation between 0ºC (32ºF) and +50ºC (122ºF) in a central office environment. The OPTera Metro 3500 shelf includes cooling fans for convective cooling.

The OMX + Fiber Manager 4CH (NT0H32AE, BE, CE, DE, EE, FE, GE, HE), Enhanced OMX + Fiber Manager 4CH (NT0H32AF, BF, CF, DF, EF, FF, GF, HF) the OMX Shelf (NTN449ZW), and the Fiber Manager (NT0H57BB) are designed for commercial temperature operation between 0ºC (32ºF) and +50ºC (122ºF) in a central office environment.

The OPTera Metro 3500 Universal Shelf Assembly (NTN476AH) is designed for temperature operation between -40ºC (-40ºF) to +65ºC (+149ºF). The Universal OPTera Metro 3500 shelf includes cooling fans for convective cooling.

To allow self heating, the shelf generates heat in natural convection cooling mode (fans off) at low temperatures. The installation should not force 0ºC (32ºF) or lower temperature air through the shelf.

Space considerations

A typical configuration in any of the five bays used for the OPTera Metro 3500 network element is dependent on the following:

- the height of your bay
- the type and number of breaker interface panels (BIP) you will have in a bay
- the number of network elements in your bay
- the space required to house those network elements and allow for air circulation

See Table 7-1 on page 7-3 and Table 7-2 on page 7-3 for equipment and bay space details.

Table 7-1
Equipment spacing requirements

Equipment	Rack Units required	Additional space requirements
OPTera Metro 3500 Universal Shelf (NTN476AH)	10U	1U below for air inlet + 1U above for top I/O + cable access
BIP (NTN458RA)	1U	None
BIP (NTFW56BA)	2U	None
OMX + Fiber Manager 4CH (NT0H32*E)	1U	None
Enhanced OMX + Fiber Manager 4CH (NT0H32*F)	1U	None
Fiber Manager (NT0H57BB)	1U	None
DSM shelf (NTN407MA)	4U	None
Drip Tray (NTN450ZW)	1U	None
Patch Panel	1U	None

Table 7-2
Available Rack Units in a bay

Bay	Height	Rack Units available
NT7E70AA	7ft	44
NT7E70BA	7.5ft	47
NT7E70CA	8ft	51
NT7E70DA	9ft	57
NT7E70EA	11.5ft	75

BIP requirements

The OPTera Metro 3500 shelf can be powered by a Nortel Networks breaker interface panel (BIP). If the shelves are to be powered by non-Nortel Networks BIPs, each -48 V input feed must be fitted with a power filter of at least 10,000 µf. This filter is provided in a Nortel Networks BIP. There are two BIPs that can be used to deliver power to the shelves from the bay as follows:

- NTN458RA, provides power for up to five OPTera Metro 3500 shelves and three DS1 service modules (DSMs), or eight DSMs depending on the power cable you order

- NTFW56BA (for European deployment only) provides power for up to four OPTera Metro 3500 shelves or four DS1 service modules

  Note: The NTFW56BA breaker interface panel contains a Class B conformant EMC filter unit which is fitted over the logic board on the right hand side of the BIP.

The NTN458RA BIP can be used in various configurations. See Table 7-3 on page 7-5.

The NTFW56BA (for European deployment only) BIP is equipped with the following interfaces: the office alarm interface, the shelf power interface, the shelf alarm interface, and the modem interface.

Office alarm interface for NTFW56BA

The BIP contains an office alarm interface panel, which allows four wire-wrap connections to each alarm signal, and two sets of office alarm relays: the visible relays and the audible relays. When an alarm is raised, the associated relay is activated. The visible relays remain activated until the alarm is released by the shelf. However, the audible relays can be disabled at any time by pressing the alarm cut-off button on the BIP of the offending shelf.

When the alarm cut-off (ACO) button on the BIP is pressed, the audible alarm inputs from each shelf alarm interface are masked, causing the audible office relays in the BIP to be disabled and the audible office alarms to be silenced. An ACO lamp is lit to indicate that the audible office relays have been disabled. This lamp is lit when there are no audible office alarms active and at least one visible alarm is active. A subsequent alarm re-enables the audible relays, causing the audible office alarms to sound again and extinguishing the ACO lamp. This sequence repeats when any audible and visible alarms are removed, until the bay is returned to an alarm-free state and the ACO lamp is extinguished.

Shelf power interface for NTFW56BA

The BIP provides a battery A feed and a battery B feed to each shelf. Each feed is equipped with a 15A circuit breaker, which in turn feeds equipment in the rack. If any of the breakers are tripped from their default state (which can be defined as “active” or “inactive”), the circuit breaker trip lamp is lit and a minor alarm is raised. If both breakers feeding the same shelf trip, the BIP raises a critical alarm and the circuit breaker trip lamp is lit.

Shelf alarm interface for NTFW56BA

The alarm signals from individual shelves on the rack are interfaced to the BIP by way of a 25-pin D-subminiature connector.

Table 7-3
Typical configurations in an 8 ft (243.84 cm) bay with BIP NTN458RA

Type and number of shelves to install			Equipment layout	Power connection layout	Number of BIP	BIP cables PEC code & (required number)
OPTera Metro 3500	OMX and fiber storage tray	DS1 service module				
4	1	0	See OPTera Metro 3500 with DWDM (NTN449ZW) (8-foot bay) on page 7-7	See OPTera Metro 3500 with or without DWDM-power connection on page 7-9	1	NTN458ZB (1)
3	0	2	Install all OPTera Metro 3500 on top of DS1 service modules	OPTera Metro 3500 shelves must connect to 20-A power breakers	1	NTN458ZB (1)
2	0	4	Install all OPTera Metro 3500 on top of DS1 service modules	Install all OPTera Metro 3500 on top of DS1 service modules	1	NTN458ZB and NTN458MS or NTN458MU (1 each)
1	0	7	See OPTera Metro with DS1 service modules - one BIP (8-foot bay) on page 7-12	See OPTera Metro with DS1 service modules - one BIP power connection on page 7-13	1	NTN458ZC or NTN458ZD (1)
0	0	8	See Eight DS1 service modules (8-foot bay) on page 7-10	See Eight DS1 service modules - power connection on page 7-11	1	NTN458ZC or NTN458ZD (1)

Table 7-3 (continued)
Typical configurations in an 8 ft (243.84 cm) bay with BIP NTN458RA

Type and number of shelves to install			Equipment layout	Power connection layout	Number of BIP	BIP cables PEC code & (required number)
OPTera Metro 3500	OMX and fiber storage tray	DS1 service module				
2	0	6	Install all OPTera Metro 3500 on top of DS1 service modules	Install all OPTera Metro 3500 on top of DS1 service modules. See Note.	1	NTN458ZC or NTN458ZD (1)
1	0	8	See OPTera Metro 3500 with DS1 service modules - two BIPs (8-foot bay) on page 7-14	See OPTera Metro 3500 shelf must connect to 20-A power breaker. See Note.	2	NTN458MS or NTN458MU (1) NTN458ZC or NTN458ZD (1)
Note: When two BIPs are required, Nortel Networks recommend to use BIP 1 only for OPTera Metro 3500 shelves and BIP 2 only for DS1 service modules.						

Figure 7-1
OPTera Metro 3500 with DWDM (NTN449ZW) (8-foot bay)

EX0999p

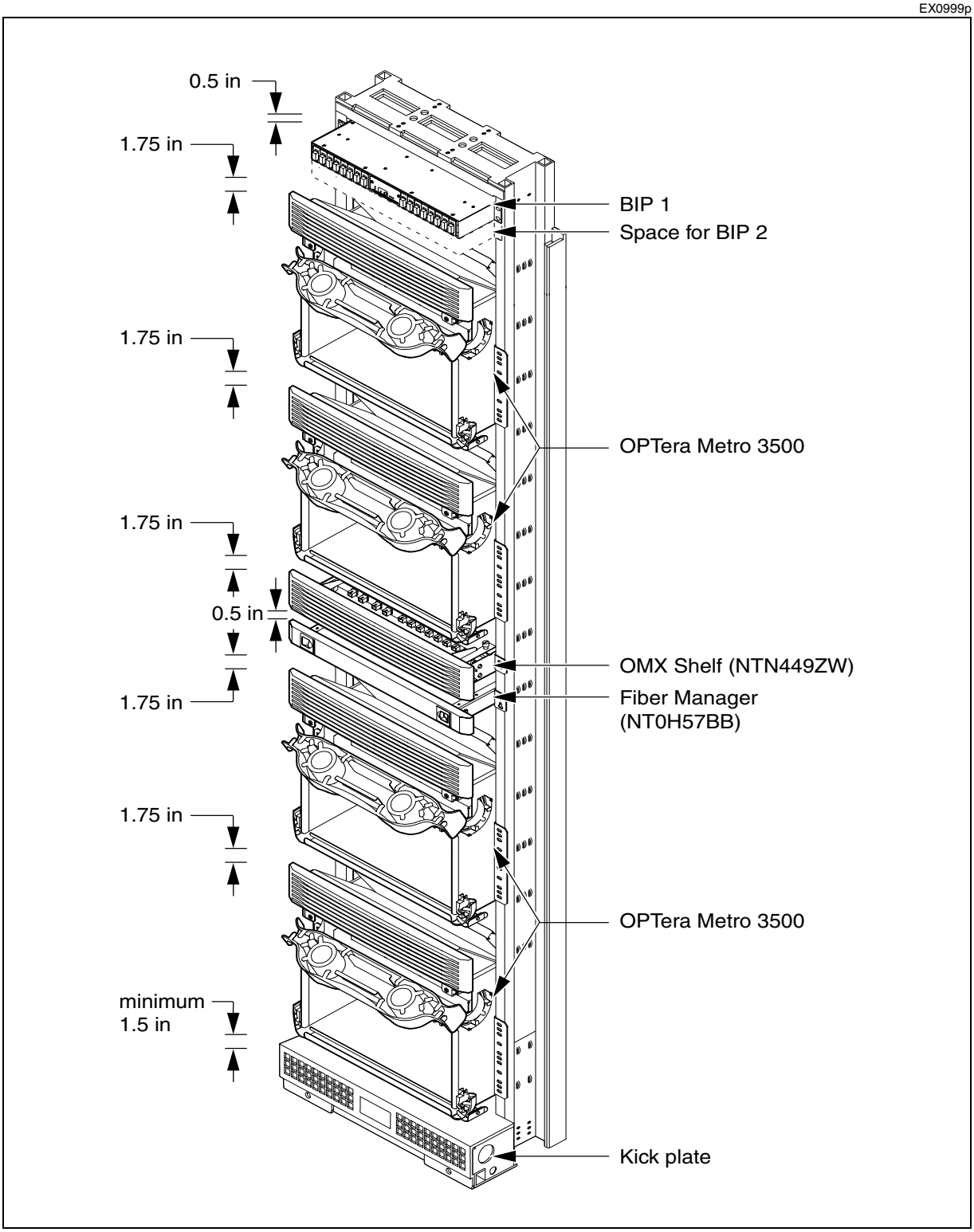


Figure 7-2
OPTera Metro 3500 with DWDM (NT0H32xE or NT0H32xF) (8-foot bay)

EX1501p

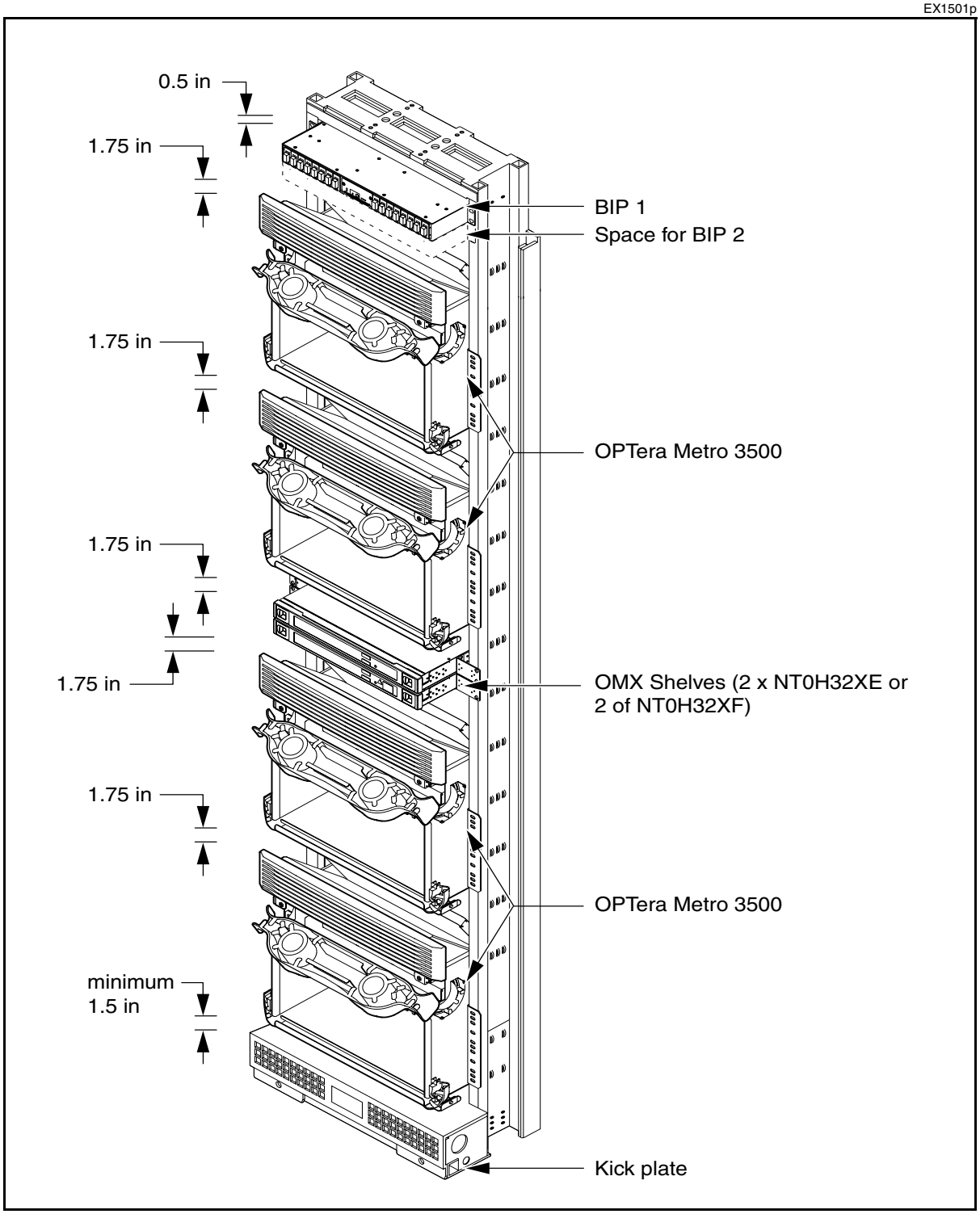
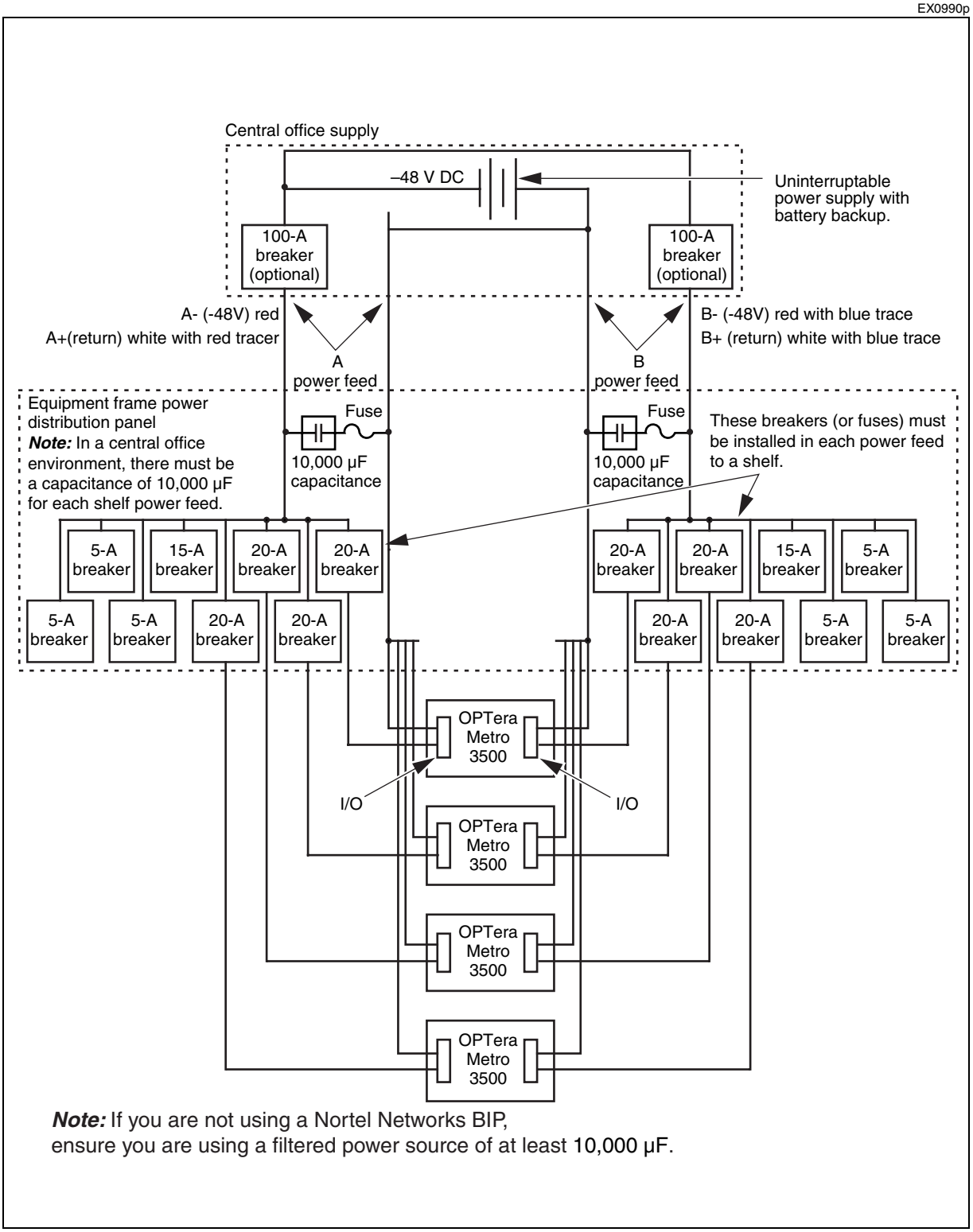


Figure 7-3
OPTera Metro 3500 with or without DWDM- power connection

EX0990p



Note: If you are not using a Nortel Networks BIP, ensure you are using a filtered power source of at least 10,000 µF.

Figure 7-4
Eight DS1 service modules (8-foot bay)

EX1001p

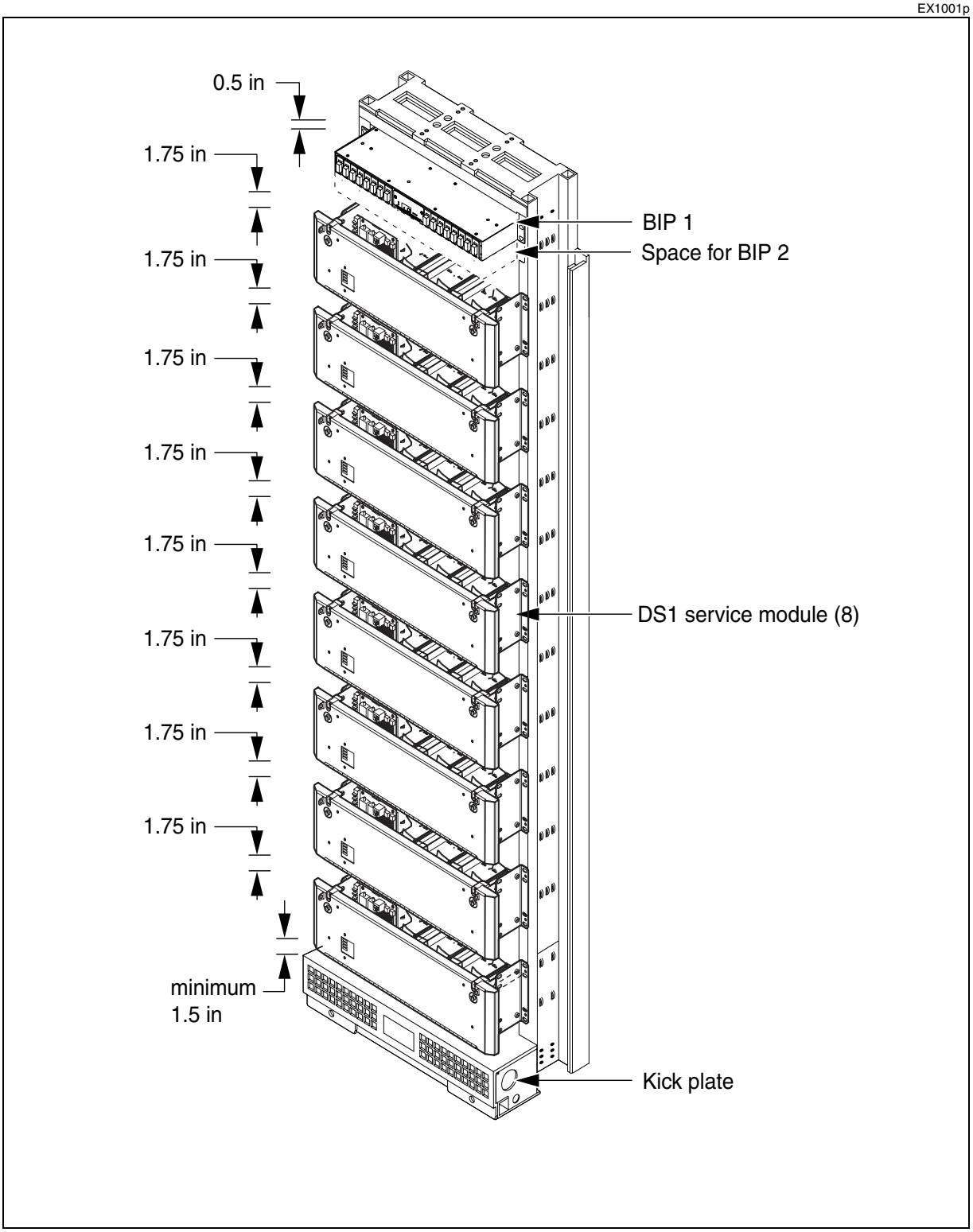
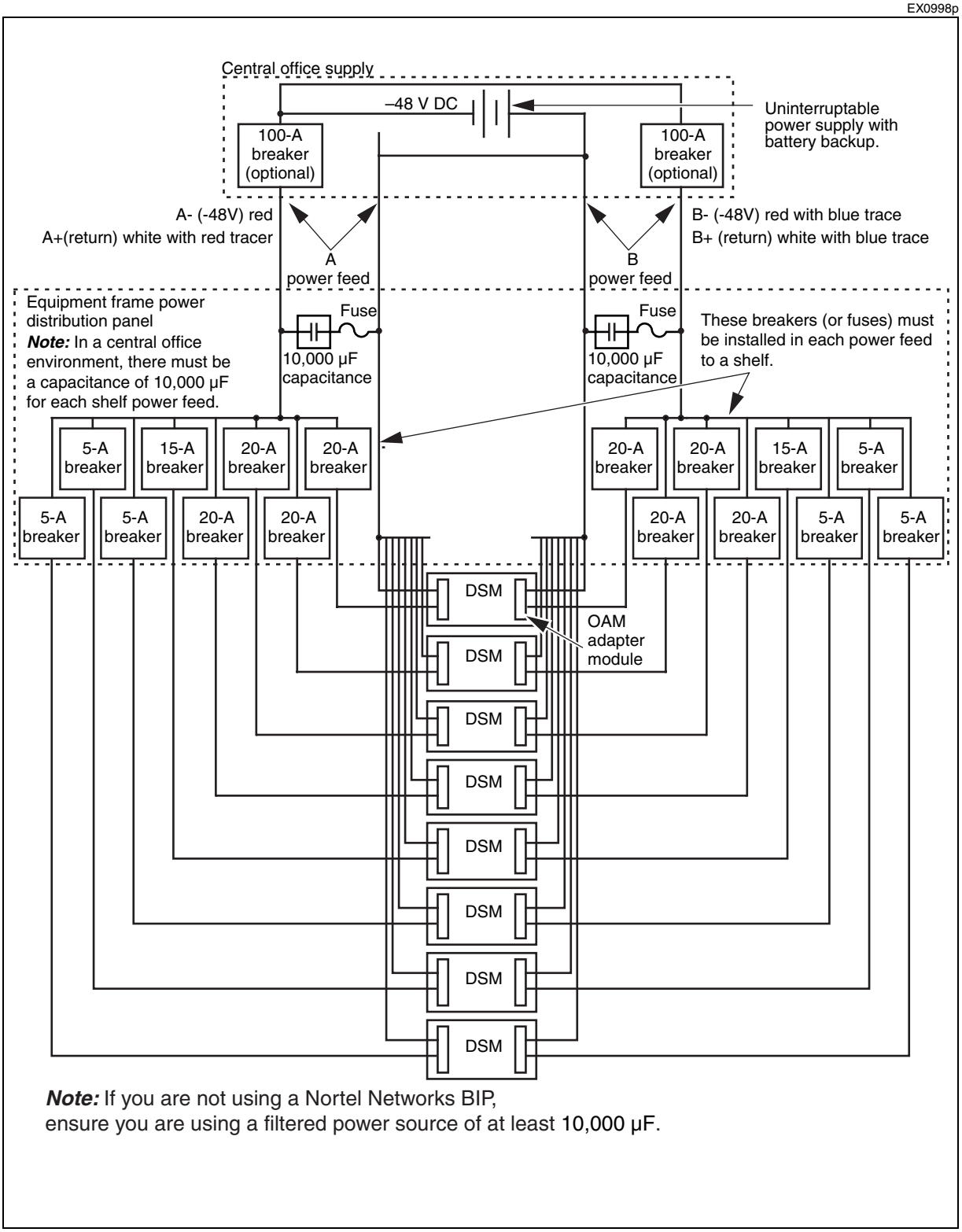


Figure 7-5
Eight DS1 service modules - power connection

EX0998p



Note: If you are not using a Nortel Networks BIP, ensure you are using a filtered power source of at least 10,000 µF.

Figure 7-6
OPTera Metro with DS1 service modules - one BIP (8-foot bay)

EX1032p

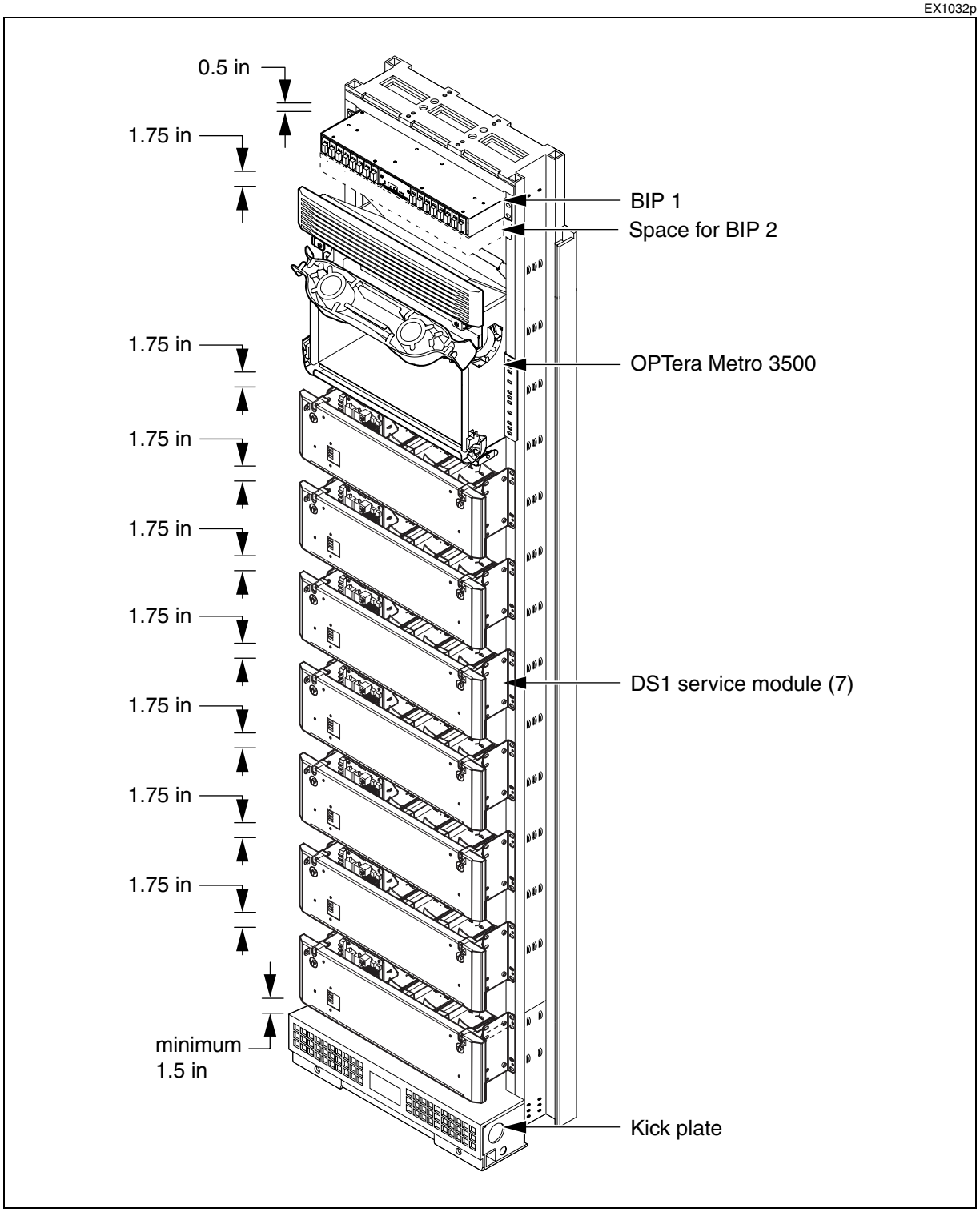
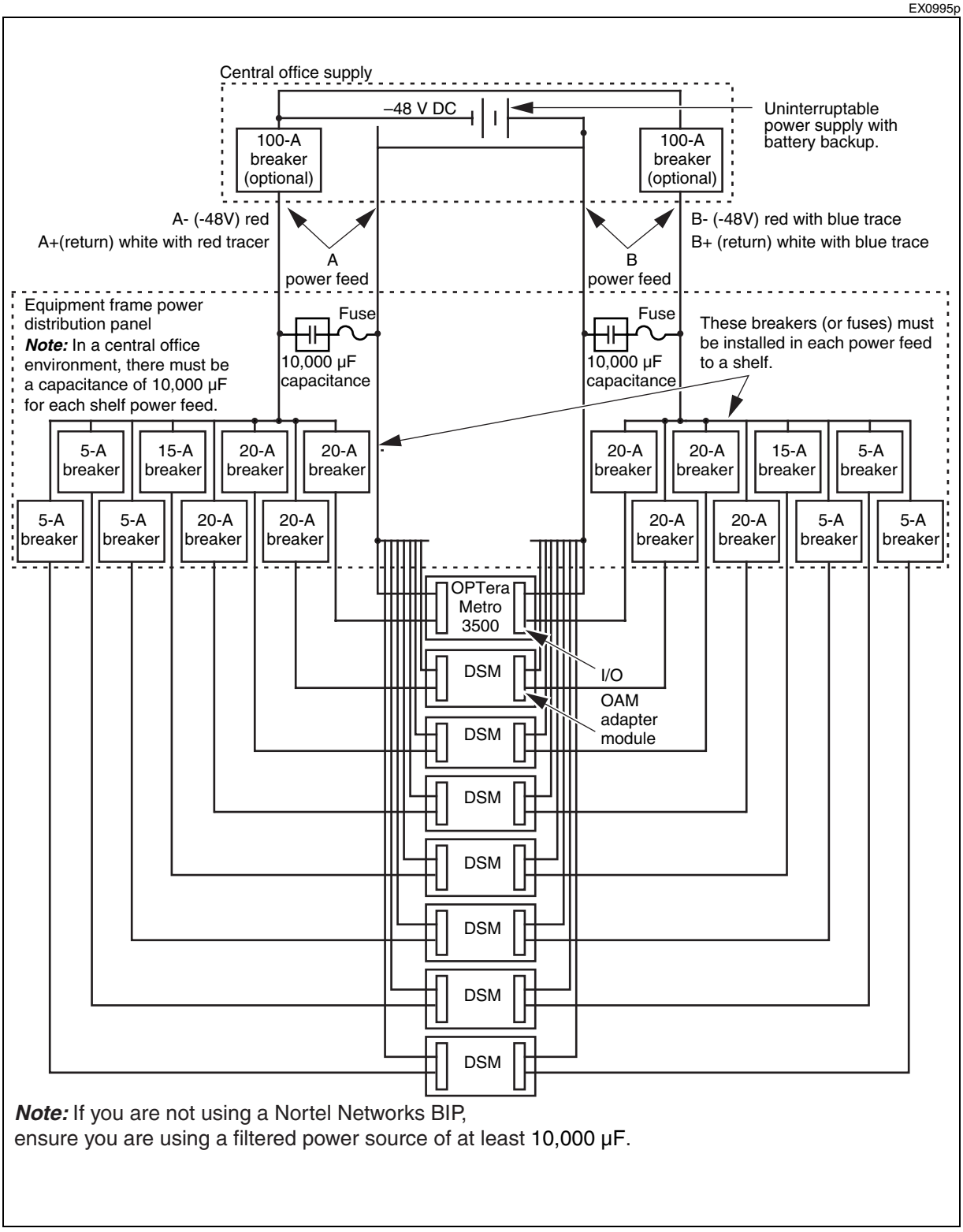


Figure 7-7
OPTera Metro with DS1 service modules - one BIP power connection

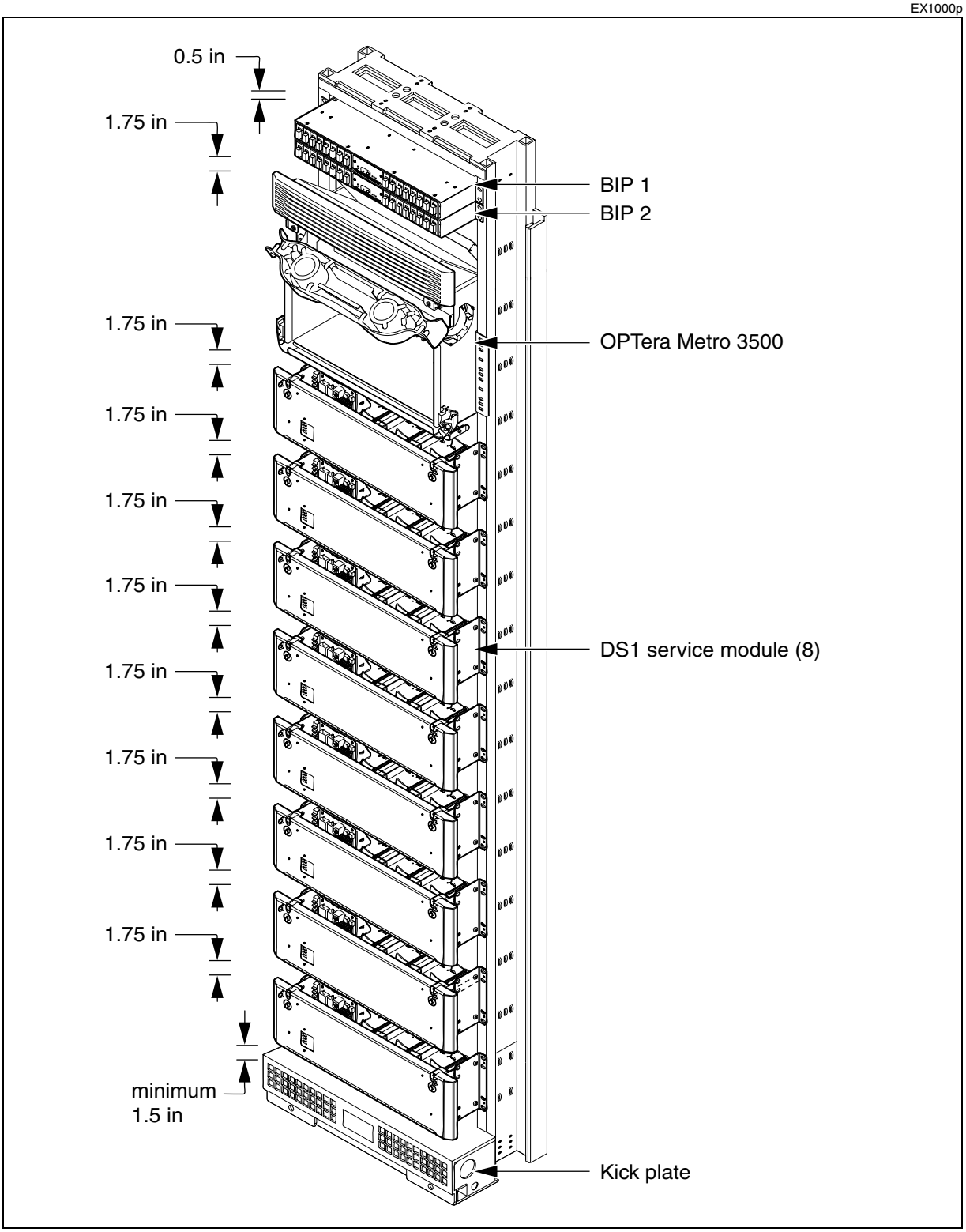
EX0995p



Note: If you are not using a Nortel Networks BIP, ensure you are using a filtered power source of at least 10,000 µF.

Figure 7-8
OPTera Metro 3500 with DS1 service modules - two BIPs (8-foot bay)

EX1000p



Mounting configurations

The following pages describe supported mounting configurations for the OPTera Metro 3500 shelf.

OMX and DSM mounting

You must have an 8.0 ft. (2.44 m) Nortel Networks bay (NT7E70CA) to mount an OMX or DSM shelf with four OPTera Metro 3500 shelves.

Figure 7-9
Mounting brackets–19-in. configuration

EX0786p

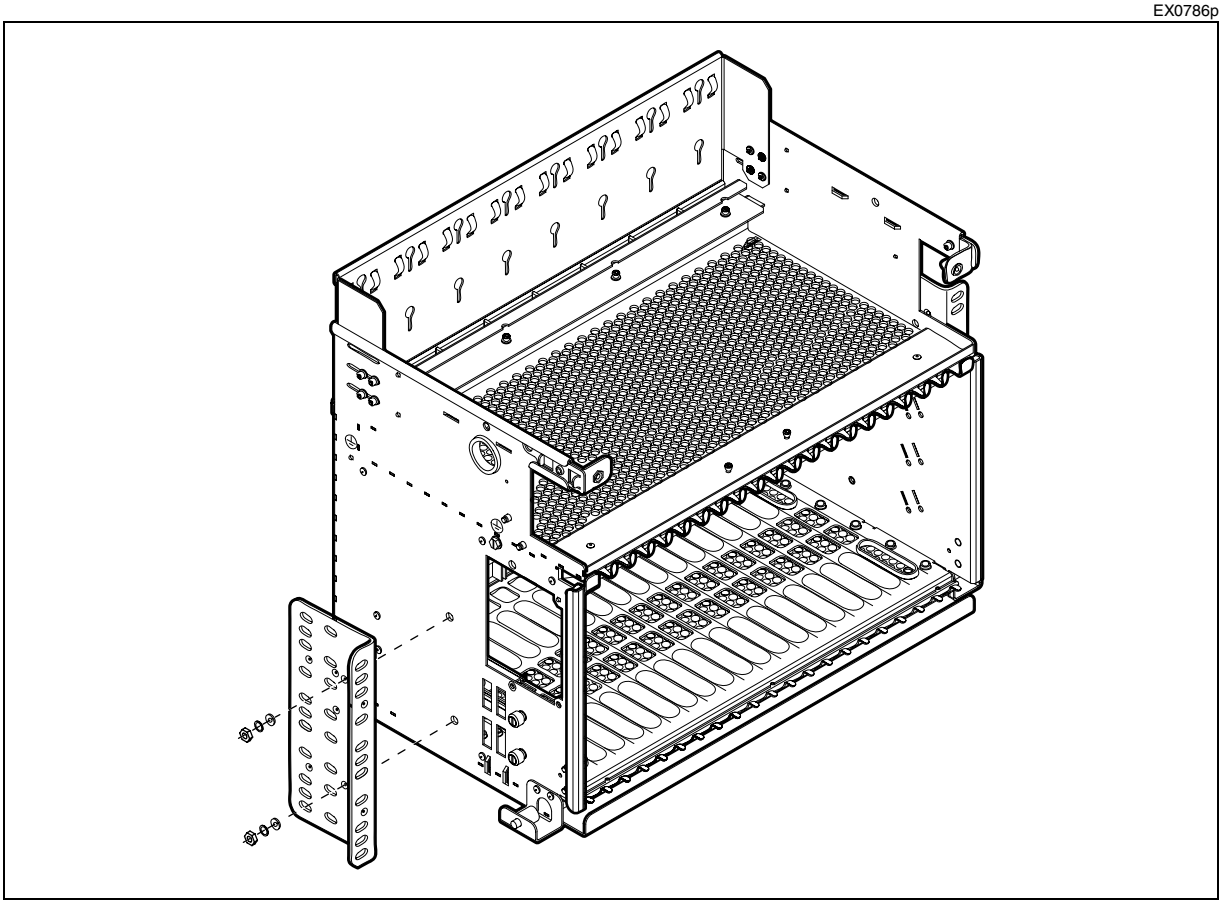


Figure 7-10
Mounting brackets–23-in. configuration

EX0785p

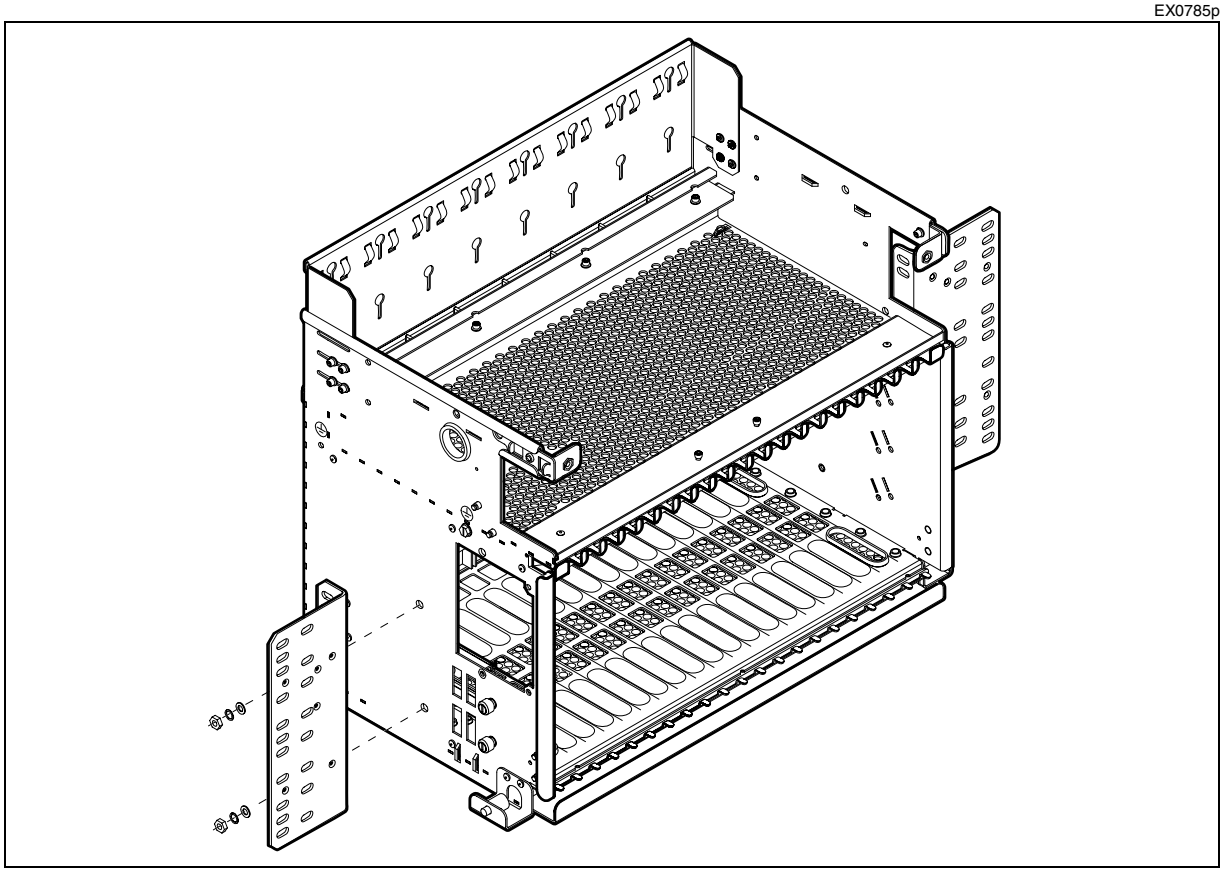


Figure 7-11
Mounting the OPTera Metro 3500 shelf on an equipment frame

EX0787p

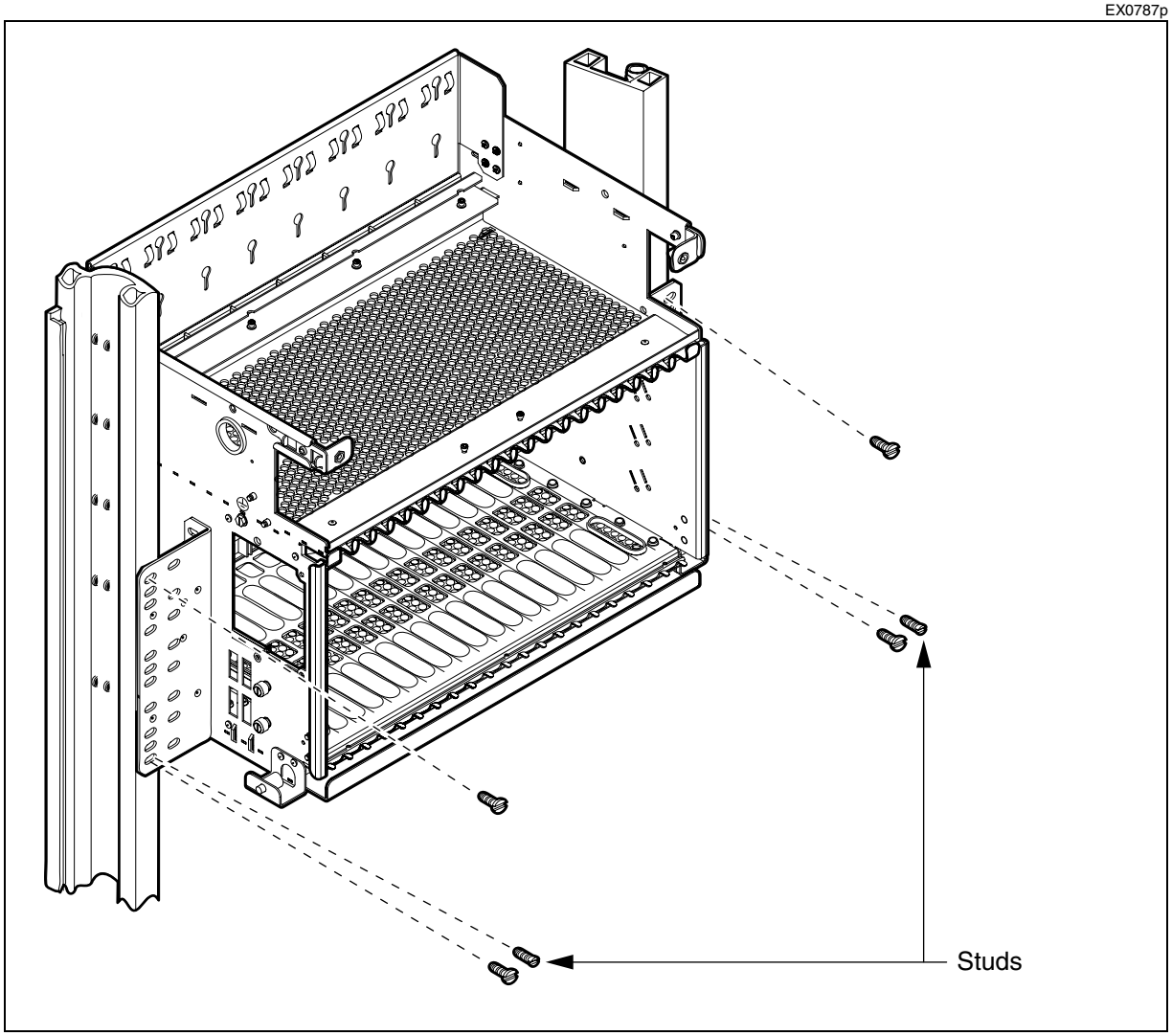


Figure 7-12
Valid mounting arrangements for an open equipment frame (23 in. frame)

EX1514p

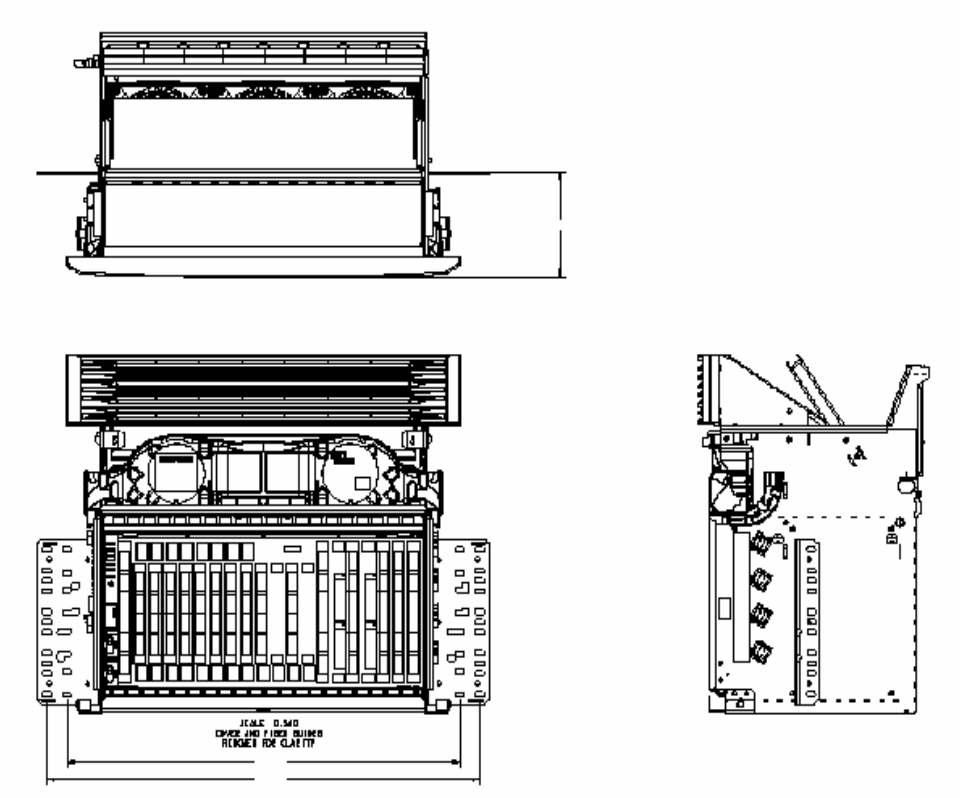
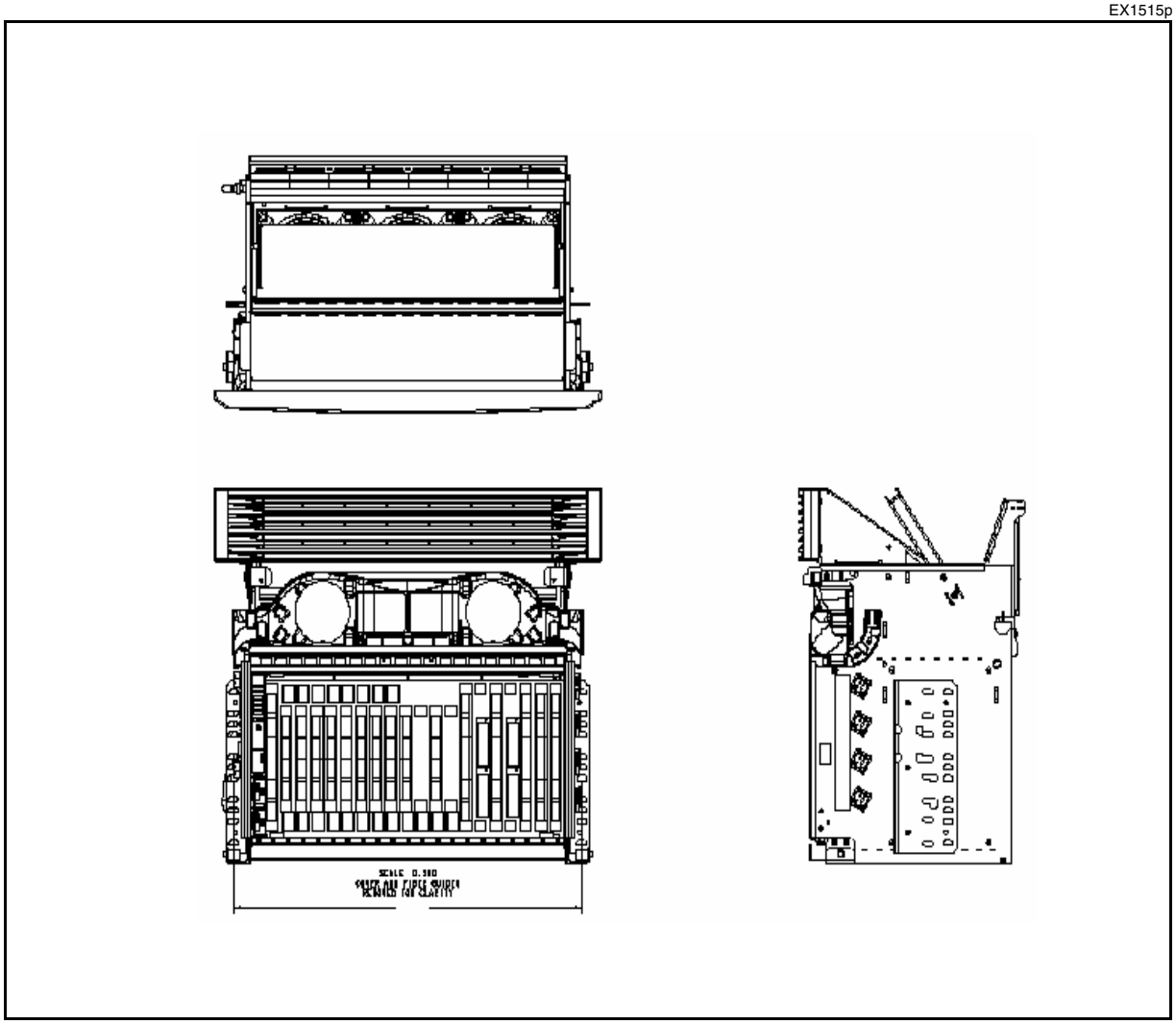


Figure 7-13
Valid mounting arrangements for an open equipment frame (19 in. frame)

EX1515p



Suggested bay manufacturers

The following tables list suggested bay manufacturers and specific frame models for mounting OPTera Metro 3500 shelves in seismic and non-seismic environments. Although the table lists suggested bay models from Nortel Networks, others may be used if the shelf mounting requirements shown in Figure 7-9 on page 7-15 and Figure 7-10 on page 7-16 for the OPTera Metro 3500 shelf are met.

Table 7-4
Suggested manufacturers and supported type bays (non-seismic)

Manufacturer	Supported Types
Nortel Networks	23 in. (486.60 mm) Seismic unequal Flange — NT7E70xx

Table 7-5
Suggested manufacturers and supported type bays (Seismic)

Manufacturer	Supported types
Nortel Networks	23 in. (584.20 mm) Seismic unequal flange — NT7E70xx

Installing an OPTera Metro 3500 shelf into a single-shelf OPTera Connect DX bay

An OPTera Metro 3500 shelf installed in an OPTera Connect DX bay can be used independently of a co-located OPTera Connect DX shelf, or as an adjunct to it, providing electrical or optical interfaces in the latter case. This efficient use of bay space effectively limits the equipment footprint in a central office. For detailed installation procedures and descriptive information, see *SONET Single-Shelf DX Bay User Guide*, NTCA69YA.

Ordering information

Use the following procedures and PEC tables to order or upgrade to Release 12 hardware and software for the OPTera Metro 3500 shelf or Universal OPTera Metro 3500 shelf. See Hardware feature descriptions on page 3-1 in Part 1 of this guide for information on OPTera Metro hardware.

Procedure 8-1
Ordering a new system installation

Use the following procedure to order the required hardware and software for a new system installation.

Note 1: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.

Note 2: If you are ordering OPE components, please refer to the *OPE Planning Guide* (NTRN10YK) for additional information.

Step	Action
1	Complete the purchase agreement prior to purchasing OPTera Metro 3500 products and/or services. See Terms and conditions on page 9-1.
2	Order the bay that best suits your needs, if required. See Table 8-31 on page 8-44.
3	Order the OPTera Metro 3500 Universal Shelf Assembly (NTN476AH). See Table 8-1 on page 8-11 for ordering information.
4	Order the breaker interface panel (BIP) that best suits your needs. See Table 8-19 on page 8-27.
5	**If** you require — **Then** go to a DSM with protected DS-1, equipped with SC, FC or ST connectors — step 6 a DSM with protected DS-1, equipped with LC connectors — step 7 a DSM with unprotected DS-1, equipped with SC, FC or ST connectors — step 8 a DSM with unprotected DS-1, equipped with LC connectors — step 9
6	For each DSM required, order one DSM interface shelf kit (NTN407AA). See Table 8-16 on page 8-24. See step 17 for information about optical connector kit requirements.

—continued—

Procedure 8-1 (continued)
Ordering a new system installation

Step	Action
	Go to step 10.
7	For each DSM required, order one DSM interface shelf kits (NTN407AC). See Table 8-16 on page 8-24. Go to step 10.
8	For each DSM required, order one DSM shelf (NTN407MA) and one DSM DS1x84 circuit pack (NTN313AA). See Table 8-16 on page 8-24. See step 17 for information about optical connector kit requirements. Go to step 10.
9	For each DSM required, order one DSM shelf (NTN407MA) and one DSM DS1x84 circuit pack (NTN313AC). See Table 8-16 on page 8-24.
10	Order OMX's, if required: • C-Band — Band 1 (NT0H32AE or NT0H32AF) — Band 2 (NT0H32BE or NT0H32BF) — Band 3 (NT0H32CE or NT0H32CF) — Band 4 (NT0H32DE or NT0H32DF) • L-Band — Band 5 (NT0H32EE or NT0H32EF) — Band 7 (NT0H32GE) or NT0H32GF) See Table 8-17 on page 8-26 or Table 8-18 on page 8-26. ***Note 1:*** For OC-192 DWDM application only Band 1 and 2 is supported. ***Note 2:*** One OMX supports 4 wavelengths in one direction.

—continued—

Procedure 8-1 (continued)
Ordering a new system installation

Step	Action
11	Order the required power cables for the network element, BIP, and DSM. For more information, see Table 8-20 on page 8-27.
12	Order the OPTera Metro 3500 Rel 12.0 extended shelf processor kit (NTN483NA). See Table 8-1 on page 8-11.
13	Depending on the type of configuration you plan to implement with your network element, order one of the following OPTera Metro 3000 right-to-use licenses: • Linear configuration right-to-use license (NTN461GB) • OC-3/OC-12/OC-48 UPSR configuration right-to-use license (NTN461GA) • OC-192 UPSR configuration right-to-use license (NTN461GG) • OC-48 BLSR configuration right-to-use license (NTN461GF) • OC-192 BLSR configuration right-to-use license (NTN461GH) See Table 8-9 on page 8-19.
14	If you will be implementing Resilient Packet Rings (RPRs) on your network, order the RPR configuration right-to-use license (NTN461GD). See Table 8-2 on page 8-12. ***Note:*** You must order one software license for each network element.
15	If you will be implementing RADIUS authentication on your network order, order the RADIUS authentication right-to-use license (NTN461GM). See Table 8-2 on page 8-12.
16	If you will be implementing Storage applications on your network order, order the Fibre Channel right-to-use license (NTN461GN). See Table 8-2 on page 8-12.
17	Order the optical connector kit: • FC Optical Connector Kit (NTN459FC) • SC Optical Connector Kit (NTN459SC) • ST Optical Connector Kit (NTN459ST) ***Note 1:*** Order one optical connector kit for each OC-3, OC-12, OC-48, and OC-48 DWDM circuit pack (not required for OC-3x4 or OC-12x4 STS circuit packs). See Table 8-9 on page 8-19. ***Note 2:*** OC-3x4 circuit packs (NTN441AA and NTN441AC) and OC-12x 4 STS (NTN446C) come pre-installed with optical connectors and do not require optical connector kits. ***Note 3:*** Order two optical connector kits for each DSM, unless the NTN313AC DS1x84TM circuit pack is ordered.
18	Order reserve optical connector kits, if required.

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Procedure 8-1 (continued)
Ordering a new system installation

Step	Action
19	Order the OPTera Metro 3500 Rel 12.0 extended network processor kit (NTN484NA), if required. See Table 8-3 on page 8-13. ***Note:*** If you do not have an NPx for your network, you must order one.
20	Order the ILAN (NTN425AA), if required. See Table 8-3 on page 8-13.
21	Order the OPTera Metro 3500 software load: • OPTera Metro 3500 Rel 12.0 CD (NTN462NA) (SN462NAB7A) • OPTera Metro 3500 Rel 12.0 DDS tape (NTN463NA) (SN463NAA6A) See Table 8-2 on page 8-12. ***Note:*** Order one software load for each network processor span of control.
22	Order the Site Manager 6.0 Application Kit (NTNM14FA). See Table 8-29 on page 8-43.
23	Order the Site Manager 6.0 OPTera Metro 3000 Series right-to-use (RTU) license (NTNM79FC). See Table 8-29 on page 8-43.
24	You must order one Site Manager 6.0 RTU for each network element.

—continued—

Procedure 8-1 (continued)
Ordering a new system installation

Step	Action
25	Order required documentation, see Table 8-30 on page 8-44.
26	**If** your shelf / **Then** go to will have at least one rear I/O module — step 27 will not have at least one rear I/O module — step 28
27	Order one of the following for your OPTera Metro 3500 shelf, depending on the width of your equipment frame: • 23 inch Rear I/O Cable Retainer (NTN450ZA), or • 19 inch Rear Cable Retainer (NTN450ZB) See Table 8-20 on page 8-27.
28	**If** your shelf / **Then** go to will support VT grooming — step 29 will not support VT grooming — step 31
29	Order the VTXe circuit pack (NTN414AH). See Table 8-4 on page 8-14. equipment.
30	Go to step 37
31	**If** the configuration you plan to implement is / **Then** go to OC-192 UPSR, BLSR or 1+1 — step 32 OC-48 BLSR — step 34 OC-3/OC-12/OC-48 UPSR or 1+1 — step 36
32	Order the STX-192 circuit pack (NTN415AA). See Table 8-4 on page 8-14.
33	Go to step 37
34	Order the VTXe circuit pack (NTN414AH). See Table 8-4 on page 8-14.
35	Go to step 37
36	Order the VTXe circuit pack (NTN414AH) or STX-192 circuit pack (NTN415AA). See Table 8-4 on page 8-14.

—continued—

Procedure 8-1 (continued)
Ordering a new system installation

Step	Action
37	Order fiber patchcords as required. Table 8-21 on page 8-29 through Table 8-26 on page 8-39 list patchcords for use with circuit packs equipped with LC connectors. ***Note 1:*** Nortel Networks recommends duplex fiber for tributary and non-DWDM line interfaces. Simplex fiber patchcords are also available. ***Note 2:*** Singlemode patchcords are used to connect 1310 nm, 1550 nm, and DWDM optics to singlemode fiber plant. ***Note 3:*** Mode conditioning patchcords are used to connect 1310 nm optics (OC3x4, OC12x4, and DS1x84 circuit packs) to multimode fiber plant. ***Note 4:*** Multimode patchcords are used to connect 850 nm optics (1000BaseSX interfaces) to multimode fiber plant.
38	Order required peripheral equipment. ***Note 1:*** Refer to Table 1-2 on page 1-16 in Part 1 of this guide for a list of supported electrical and optical interfaces by STX and VTX-series circuit packs. ***Note 2:*** If ordering 2xGigE/FC-P2P circuit pack, you must also order up to two SFP optic modules (NTTP51AA or BD). If only one module is ordered, the unequipped port should contain a dust cap (A0512434). The 2xGigE/FC-P2P circuit pack is shipped with two dust caps. See Table 8-14 on page 8-24. **—end—**

Procedure 8-2
Upgrading to Release 12.0

Use the following procedure to upgrade Release 12.0.

Note 1: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.

Note 2: If you are ordering OPE components, please refer to the *OPE Planning Guide* (NTRN10YK) for additional information.

Step	Action
1	Complete the purchase agreement prior to purchasing OPTera Metro 3500 products and/or services. See Terms and conditions on page 9-1.
2	**If** you currently have in your configuration — **Then** go to a Network Processor (NP), — step 10 an Extended Network Processor (NPx), — step 3
3	Order the OPTera Metro 3500 software load: • OPTera Metro 3500 Rel 12.0 CD (NTN462NA) (SN462NAB7A) • OPTera Metro 3500 Rel 12.0 DDS tape (NTN463NA) (SN463NAA6A) ***Note:*** Order one software load for each network processor span of control. See Table 8-2 on page 8-12.
4	Depending on the type of configuration you plan to implement, order one of the following OPTera Metro 3000 right-to-use licenses: • Linear configuration right-to-use license (NTN461GB) • OC-3/OC-12/OC-48 UPSR configuration right-to-use license (NTN461GA) • OC-192 UPSR configuration right-to-use license (NTN461GG) • OC-48 BLSR configuration right-to-use license (NTN461GF) • OC-192 BLSR configuration right-to-use license (NTN461GH) See Table 8-2 on page 8-12.
5	If you will be implementing Resilient Packet Rings (RPRs) on your network, order the RPR configuration right-to-use license (NTN461GD). See Table 8-2 on page 8-12.
6	If you will be implementing RADIUS authentication on your network order, order the RADIUS authentication right-to-use license (NTN461GM). See Table 8-2 on page 8-12.

—continued—

Procedure 8-2 (continued)
Upgrading to Release 12.0

Step	Action
7	If you will be implementing Storage applications on your network order, order the Fibre Channel right-to-use license (NTN461GN). See Table 8-2 on page 8-12.
8	Order the OPTera Metro 3500 Rel 12.0 software upgrade right-to-use license (NTN461NA). See Table 8-2 on page 8-12. ***Note:*** Order one software license for each software load you purchased in step 3.
9	Go to step 11.
10	Order the OPTera Metro 3500 Rel 12.0 extended network processor kit (NTN484NA). See Table 8-3 on page 8-13.
11	Order the power module and cooling unit upgrade kit, as required. See Table 8-27 on page 8-41.
12	Order the Site Manager 6.0 Application Kit (NTNM14FA). See Table 8-29 on page 8-43.
13	Order the Site Manager 6.0 Upgrade right-to-use (RTU) license (NTNM79FA). See Table 8-29 on page 8-43. ***Note:*** You must order one Site Manager 6.0 RTU for each network element.
14	Order the Rel 12.0 Network-Based Upgrade CAP (NTRN21AL) or the Rel 12.0 Nodal-Based Upgrade CAP (NTRN23AL), as required.Table 8-30 on page 8-44.
15	Order required documentation. See Table 8-30 on page 8-44.
16	**If** — **Then** go to you will order at least one rear I/O module and your shelf currently does not have a rear cable retaining bar — step 17 your shelf has at least one rear I/O module but does not have a rear cable retaining bar — step 17 your shelf does not and will not have rear I/O modules — step 18 your shelf already has a rear cable retaining bar — step 18
17	Order one of the following for your OPTera Metro 3500 shelf, depending on the width of your equipment frame: • 23 inch Rear I/O Cable Retainer (NTN450ZA), or • 19 inch Rear Cable Retainer (NTN450ZB) See Table 8-20 on page 8-27.

—continued—

Procedure 8-2 (continued)
Upgrading to Release 12.0

Step	Action
18	Order fiber patchcords as required. Table 8-21 on page 8-29 through Table 8-26 on page 8-39 list patchcords for use with circuit packs equipped with LC connectors. ***Note 1:*** Nortel Networks recommends duplex fiber for tributary and non-DWDM line interfaces. Simplex fiber patchcords are also available. ***Note 2:*** Singlemode patchcords are used to connect 1310 nm, 1550 nm, and DWDM optics to singlemode fiber plant. ***Note 3:*** Mode conditioning patchcords are used to connect 1310 nm optics (OC3x4, OC12x4, and DS1x84 circuit packs) to multimode fiber plant. ***Note 4:*** Multimode patchcords are used to connect 850 nm optics (1000BaseSX interfaces) to multimode fiber plant.
19	Order required peripheral equipment. ***Note 1:*** Refer to Table 1-2 on page 1-16 in Part 1 of this guide for a list of supported electrical and optical interfaces by STX and VTX-series circuit packs. ***Note 2:*** If ordering 2xGigE/FC-P2P circuit pack, you must also order up to two SFP optic modules (NTTP51AA or BD). If only one module is ordered, the unequipped port should contain a dust cap (A0512434). The 2xGigE/FC-P2P circuit pack is shipped with two dust caps. See Table 8-14 on page 8-24 **—end—**

PEC tables

Use the PEC tables to prepare for an OPTera Metro 3500 Rel 12.0 order. Quantity boxes are not included for kit sub-assemblies which may be orderable separately. All shaded areas signify the components included in the kit.

Note: If you are ordering OPE equipment, please refer to the *OPE Planning Guide* (NTRN10YK) for additional information.

Table 8-1
OPTera Metro 3500 Universal Shelf Assembly (NTN476AH) and accessories

PEC	Description	Quantity
NTN476AH	OPTera Metro 3500 Universal Shelf Assembly • extended temperature	
NTN45065	Installation kit	
NTN450CH	Universal shelf assembly	
NTN45033	OPTera Metro 3500 front cover	
NTN45014	OPTera Metro 3500 BP	
NTN45047	OPTera Metro 3500 Universal shelf air deflector	
NTN45052	OPTera Metro 3500 fiber tray	
NTN451BH	LIF interface • extended temperature	
NTN451MH	LOAM interface • extended temperature	
NTN451HA	Power module (2) • extended temperature	
NTN458QH	Universal shelf cooling unit assembly • extended temperature	
NTN458HH	Universal shelf cooling unit fan module (3) • extended temperature	
NTN45061	Frame ground cable	
NTN45852	Universal shelf fan cable	
NTN458MM	Universal shelf fan power cable assembly	
NTN458KE	OPTera Metro 3500 air filter	

Table 8-1 (continued)
OPTera Metro 3500 Universal Shelf Assembly (NTN476AH) and accessories

PEC	Description	Quantity
NTN45840	OPTera Metro 3500 Universal shelf plenum assembly	
NT0H57BB	Fiber Manager	
Note 1: You must order power cabling separately from the Shelf Assembly. See Table 8-20 on page 8-27. ***Note 2:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-2
OPTera Metro 3500 extended shelf processor kits, software, and licenses

PEC	Description	Quantity
NTN483NA	OPTera Metro 3500 Rel 12.0 extended shelf processor kit • extended temperature	
NTN423BH	OPTera Metro 3500 extended shelf processor • extended temperature	
NTN460C1	OPTera Metro 3500 Rel 12.0 software code	
NTNM23CA	Multiservice Managed Object Agent (MOA) 12.0 CD package	
NTNM2302	Multiservice MOA 12.0 software	
NTNM2352	Multiservice MOA 12.0 Documentation	
NTNM2382	Multiservice MOA 12.0 operational Considerations	
NTNM43CA	Multiservice Managed Object Agent (MOA) 12.0 Documentation package	
	Multiservice MOA 12.0 Planning Guide	
	Multiservice MOA 12.0 User Guide)	
	Multiservice MOA 12.0 Operational Considerations	
NTN461GF	OPTera Metro 3500 OC-48 BLSR configuration right-to-use license	
NTN461GH	OPTera Metro 3500 OC-192 BLSR configuration right-to-use license	
NTN461GA	OPTera Metro 3500 OC-3/OC-12/OC-48 UPSR configuration right-to-use license	
NTN461GG	OPTera Metro 3500 OC-192 UPSR configuration right-to-use license	

Table 8-2 (continued)
OPTera Metro 3500 extended shelf processor kits, software, and licenses

PEC	Description	Quantity
NTN461GB	OPTera Metro 3500 linear configuration right-to-use license	
NTN461GD	Resilient packet ring (RPR) configuration right-to-use license	
NTN461GM	OPTera Metro 3000 RADIUS authentication right-to-use license	
NTN461GN	Fibre Channel right-to-use license	
NTN461NA	OPTera Metro 3500 Rel 12.0 software upgrade right-to-use license	
NTN462NA (SN462NAB7A)	OPTera Metro 3500 Rel 12.0 CD	
NTN463NA (SN463NAA6A) See Note 1:	OPTera Metro 3500 Rel 12.0 DDS Tape	
Note 1: This item includes a Release 12.0 and a Release 11.02 tape. The Release 11.02 tape is required as an intermediate upgrade step when upgrading from Release 10.3 or 11.01. Please refer to NTRN21AL "Site Manager network software upgrade to Rel. 12.00" or NTRN23AL "Site Manager nodal software upgrade to Rel. 12.00" for more details. ***Note 2:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-3
OPTera Metro 3500 extended network processor kit and ILAN circuit pack

PEC	Description	Quantity
NTN484NA	OPTera Metro 3500 Rel 12.0 extended network processor kit • extended temperature	
NTN424BH	OPTera Metro 3000 extended network processor • extended temperature	
NTN460C1	OPTera Metro 3500 Rel 12.0 software code	
NTN425AA	ILAN circuit pack	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-4
Transport common equipment

PEC	Description	Quantity
NTN414AH	VTX-48e enhanced cross-connect circuit pack • supports either OC-12 or OC-48 in slots 11 and 12 • extended temperature	
NTN415AA	STX-192 cross-connect circuit pack • supports either OC-48 STS or OC-192 in slots 11 and 12 • supports OC-192 BLSR, UPSR and 1+1	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-5
OC-3 circuit packs

PEC	Description	Quantity
NTN401DA	OC-3 Interconnect • extended temperature	
NTN401AA	OC-3 LR Interface • extended temperature	
NTN441AA	OC-3x4 IR Interface • extended temperature	
NTN441AC	OC-3x4 IR Interface • extended temperature • supports multimode interworking	
Note 1: One optical connector kit (see Table 8-9 on page 8-19) is required for each optical interface except the OC-3x4 IR interface circuit packs which come equipped with connectors ***Note 2:*** OC-3x4 IR (NTN441AA) circuit packs are equipped with pre-installed SC connectors. OC-3x4 IR (NTN441AC) circuit packs are equipped with pre-installed LC connectors. ***Note 3:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-6
OC-12 circuit packs

PEC	Description	Quantity
NTN404AA	OC-12 LR 1310 STS-3c Interface • extended temperature	
NTN404BA	OC-12 IR 1310 STS-3c Interface • extended temperature	
NTN404CA	OC-12 ER 1550 STS-3c Interface • extended temperature	
NTN404DA	OC-12 1310 STS-3c Interconnect • extended temperature	
NTN404JA	OC-12 LR 1310 STS-12c Interface • extended temperature	
NTN404KA	OC-12 IR 1310 STS-12c Interface • extended temperature	
NTN404LA	OC-12 ER 1550 STS-12c Interface • extended temperature	
NTN404MA	OC-12 IC 1310 STS-12c Interconnect • extended temperature	
NTN446CA	OC-12x4 STS IR interface	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-7
OC-48 non-DWDM circuit packs

PEC	Description	Quantity
NTN440BA	OC-48 1310 IR interface circuit pack	
NTN440DA	OC-48 1550 LR interface circuit pack	
NTN440FA	OC-48 1550 ELR interface circuit pack	
NTN440EA	OC-48 1310 SR interface circuit pack	
NTN440HA	OC-48 STS SR interface circuit pack	
NTN440KA	OC-48 STS IR interface circuit pack	
NTN440LA	OC-48 STS LR interface circuit pack	

Table 8-7 (continued)
OC-48 non-DWDM circuit packs

PEC	Description	Quantity
NTN440EH	OC-48 1310 SR interface circuit pack • extended temperature	
NTN440BH	OC-48 1310 IR interface circuit pack • extended temperature	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-8
OC-48 DWDM circuit packs

PEC	Description	Quantity
NTN442EA	OC-48 LR DWDM circuit pack (1535.04 nm) • See Note 1	
NTN442FB	OC-48 LR DWDM circuit pack (1555.75 nm) • See Note 1	
NTN408AS	OC-48 ER DWDM circuit pack (1535.04 nm) • See Note 1	
NTN408CW	OC-48 ER DWDM circuit pack (1555.75 nm) • See Note 1	
C-Band		
NTN442AA	OC-48 LR DWDM circuit pack (1528.77nm) • band 1 channel 1 (C-Band)	
NTN442AB	OC-48 LR DWDM circuit pack (1533.47nm) • band 1 channel 2 (C-Band)	
NTN442AC	OC-48 LR DWDM circuit pack (1530.33nm) • band 1 channel 3 (C-Band)	
NTN442AD	OC-48 LR DWDM circuit pack (1531.90nm) • band 1 channel 4 (C-Band)	
NTN442BA	OC-48 LR DWDM circuit pack (1538.19nm) • band 2 channel 1 (C-Band)	
NTN442BB	OC-48 LR DWDM circuit pack (1542.94nm) • band 2 channel 2 (C-Band)	

Table 8-8 (continued)
OC-48 DWDM circuit packs

PEC	Description	Quantity
NTN442BC	OC-48 LR DWDM circuit pack (1539.77nm) • band 2 channel 3 (C-Band)	
NTN442BD	OC-48 LR DWDM circuit pack (1541.35nm) • band 2 channel 4 (C-Band)	
NTN442CA	OC-48 LR DWDM circuit pack (1547.72nm) • band 3 channel 1 (C-Band)	
NTN442CB	OC-48 LR DWDM circuit pack (1552.52nm) • band 3 channel 2 (C-Band)	
NTN442CC	OC-48 LR DWDM circuit pack (1549.32nm) • band 3 channel 3 (C-Band)	
NTN442CD	OC-48 LR DWDM circuit pack (1550.92nm) • band 3 channel 4 (C-Band)	
NTN442DA	OC-48 LR DWDM circuit pack (1557.36nm) • band 4 channel 1 (C-Band)	
NTN442DB	OC-48 LR DWDM circuit pack (1562.23nm) • band 4 channel 2 (C-Band)	
NTN442DC	OC-48 LR DWDM circuit pack (1558.98nm) • band 4 channel 3 (C-Band)	
NTN442DD	OC-48 LR DWDM circuit pack (1560.61nm) • band 4 channel 4 (C-Band)	
NTN408AA	OC-48 ER DWDM circuit pack (1528.77nm) • band 1 channel 1 (C-Band) • See Note 3	
NTN408AN	OC-48 ER DWDM circuit pack (1533.47nm) • band 1 channel 2 (C-Band) • See Note 3	
NTN408AE	OC-48 ER DWDM circuit pack (1530.33nm) • band 1 channel 3 (C-Band) • See Note 3	
NTN408AJ	OC-48 ER DWDM circuit pack (1531.90nm) • band 1 channel 4 (C-Band) • See Note 3	

Table 8-8 (continued)
OC-48 DWDM circuit packs

PEC	Description	Quantity
NTN408CN	OC-48 ER DWDM circuit pack (1552.52nm) • band 3 channel 2 (C-Band) • See Note 3	
NTN408CJ	OC-48 ER DWDM circuit pack (1550.92nm) • band 3 channel 4 (C-Band) • See Note 3	
NTN408DA	OC-48 ER DWDM circuit pack (1557.36nm) • band 4 channel 1 (C-Band) • See Note 3	
L-Band		
NTN442JA	OC-48 LR DWDM circuit pack (1570.42nm) • band 5 channel 1 (L-Band) • See Note 4	
NTN442JB	OC-48 LR DWDM circuit pack (1575.37nm) • band 5 channel 2 (L-Band) • See Note 4	
NTN442JC	OC-48 LR DWDM circuit pack (1572.06nm) • band 5 channel 3 (L-Band) • See Note 4	
NTN442JD	OC-48 LR DWDM circuit pack (1573.71nm) • band 5 channel 4 (L-Band) • See Note 4	
NTN442LA	OC-48 LR DWDM circuit pack (1590.41nm) • band 7 channel 1 (L-Band) • See Note 4	
NTN442LB	OC-48 LR DWDM circuit pack (1595.49nm) • band 7 channel 2 (L-Band) • See Note 4	

Table 8-8 (continued)
OC-48 DWDM circuit packs

PEC	Description	Quantity
NTN442LC	OC-48 LR DWDM circuit pack (1592.10nm) • band 7 channel 3 (L-Band) • See Note 4	
NTN442LD	OC-48 LR DWDM circuit pack (1593.80nm) • band 7 channel 4 (L-Band) • See Note 4	
Note 1: Not supported by OMX. ***Note 2:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility. ***Note 3:*** Additional wavelengths for extended reach DWDM circuit packs may be introduced in the future. ***Note 4:*** Additional wavelengths for DWDM L-Band circuit packs may be introduced in the future.		

Table 8-9
Optical connector kits

PEC	Description	Quantity
NTN459FC	FC Optical Connector Kit	
NTN459SC	SC Optical Connector Kit	
NTN459ST	ST Optical Connector Kit	

Table 8-10
OC-192 non-DWDM circuit packs

PEC	Description	Quantity
NTN445CB	OC-192 IR circuit pack	
NTN445DA	OC-192 LR G.709 FEC circuit pack	

Table 8-11
OC-192 DWDM G.709 FEC circuit packs

PEC	Description	Quantity
NTN445JA	OC-192 DWDM G.709 FEC circuit pack (1535.04nm) • See Note 1	
C-Band		
NTN445EA	OC-192 DWDM G.709 FEC circuit pack (1528.77nm) • band 1 channel 1 (C-Band) • See Note 2	
NTN445EB	OC-192 DWDM G.709 FEC circuit pack (1533.47nm) • band 1 channel 2 (C-Band) • See Note 2	
NTN445EC	OC-192 DWDM G.709 FEC circuit pack (1530.33nm) • band 1 channel 3 (C-Band) • See Note 2	
NTN445ED	OC-192 DWDM G.709 FEC circuit pack (1531.90nm) • band 1 channel 4 (C-Band) • See Note 2	
NTN445FA	OC-192 DWDM G.709 FEC circuit pack (1538.19nm) • band 2 channel 1 (C-Band) • See Note 2	
NTN445FB	OC-192 DWDM G.709 FEC circuit pack (1542.94nm) • band 2 channel 2 (C-Band) • See Note 2	
NTN445FC	OC-192 DWDM G.709 FEC circuit pack (1539.77nm) • band 2 channel 3 (C-Band) • See Note 2	
NTN445FD	OC-192 DWDM G.709 FEC circuit pack (1541.35nm) • band 2 channel 4 (C-Band) • See Note 2	

Note 1: Not supported by OMX.
Note 2: Additional wavelengths for DWDM C-Band circuit packs may be introduced in the future.

Table 8-12
Tributary and protection switching circuit packs

PEC	Description	Quantity
NTN437AA	DS3x3 mapper (OPTera Metro 3500)	
NTN435AA	DS3x12 mapper	
NTN435AH	DS3x12 mapper • extended temperature	
NTN435BA	DS3x12e mapper (enhanced) • extended temperature	
NTN435FA	DS3VTx12 mapper	
NTN430AA	DS1 mapper	
NTN430BA	DS1 enhanced mapper	
NTN412AA	Protection switch controller (PSC) • extended temperature	
NTN413AA	Protection switch extender (PSX) • extended temperature	
NTN436AA	EC-1x3 circuit pack (OPTera Metro 3500)	
NTN436DA	EC-1x12 circuit pack • extended temperature	
NTN433AA	2x100BT-P2P circuit pack	
NTN433BB	OPTera Packet Edge System - Ethernet, 4x100BT circuit pack	
NTN433EA	OPTera Packet Edge System - Ethernet, 4x100FX-MM circuit pack • See Note 1	
NTN433FA	OPTera Packet Edge System - Ethernet, 4x100FX-SM circuit pack • See Note 1	
NTN438AA	OPTera Packet Edge System - Ethernet, 2x1000SX circuit pack • See Note 2	
NTN438BA	OPTera Packet Edge System - Ethernet, 2x1000LX circuit pack • See Note 2	

Table 8-12 (continued)
Tributary and protection switching circuit packs

PEC	Description	Quantity
NTN438DA	2xGigE/FC-P2P • See Note 5	
Note 1: The Universal fiber tool (NTN458TC) for removal of MT-RJ is included in the shelf kit. ***Note 2:*** The SC/FC/ST tool kit (NTN458TA) is included in the shelf kit. ***Note 3:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility. ***Note 4:*** If you are ordering OPE equipment, please refer to the OPE Planning Guide (NTRN10YK) for additional information. ***Note 5:*** The 2xGigE/FC card is shipped with 2 dust caps (A0512434), dust caps are required for SFP cages (A0512434) not equipped with actual SFP modules.		

Table 8-13
I/O modules

PEC	Description	Quantity
NTN452AA	DS1 1-28 Front I/O module • only for use with NTN476AA or NTN476DA shelves	
NTN452CA	DS1 29-56 Front I/O module • only for use with NTN476AA or NTN476DA shelves	
NTN452EA	DS1 29-84 Front I/O module • only for use with NTN476AA or NTN476DA shelves	
NTN452JA	BNC 12-Port Front I/O module • only for use with NTN476AA or NTN476DA shelves	
NTN452NA	8xRJ-45 Front I/O module • only for use with NTN476AA or NTN476DA shelves	
NTN312AA	DSM DS1 I/O module • only for use with DSM shelf • extended temperature	
NTN452AH	DS1 1-28 Front Enhanced I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452CH	DS1 29-56 Front Enhanced I/O module • only for use with NTN476AH Universal Shelf • extended temperature	

Table 8-13 (continued)
I/O modules

PEC	Description	Quantity
NTN452EH	DS1 29-84 Front Enhanced I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452JH	BNC 12-Port Front Enhanced I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452NH	8xRJ-45 Front Enhanced I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452BA	DS1 1-28 Rear I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452DA	DS1 29-56 Rear I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452FA	DS1 29-84 Rear I/O module • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452KA	BNC 12-Port Rear I/O • only for use with NTN476AH Universal Shelf • extended temperature	
NTN452HB	8xRJ-45 Rear I/O • only for use with NTN476AH Universal Shelf • extended temperature	
Note 1: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility. ***Note 2:*** You are recommended to use 'straight' cables for front-facing DS1 I/O modules. ***Note 3:*** You are recommended to use 'right-angle' cables for rear-facing DS1 I/O modules.		

Table 8-14
Small Form factor Pluggable (SFP modules)

PEC	Description	Quantity
NTTP51AA	1000-BaseSX 850 nm SFP module	
NTTP51BD	1000-BaseLX 1310 nm SFP module	
A0512434	Dust covers for SFP cage • See Note	
Note: Dust covers are required for SFP cages (A0512434) not equipped with actual SFP modules.		

Table 8-15
Fiber tools

PEC	Description	Quantity
NTN458TC	Universal fiber tool • for SC, ST, FC, MT-RJ, and LC connectors • See Note	
Note: The Universal fiber tool is included in the Shelf kit and DSM Shelf kit.		

Table 8-16
DSM shelf and accessories

PEC	Description	Quantity
NTN407AA	DSM shelf kit (adapterless interface) • extended temperature • See Note 1	
NTN313AA	DSM DS1x84 TM circuit pack (2) • extended temperature • See Note 2	
NTN407MA	DSM shelf • extended temperature • See Note 1	
NTN407AC	DSM shelf kit (LC interface) • extended temperature • See Note 1	
NTN313AC	DSM DS1x84 TM circuit pack (2) • extended temperature • LC connector pre-installed	

Table 8-16 (continued)
DSM shelf and accessories

PEC	Description	Quantity
NTN407MA	DSM shelf • extended temperature • See Note1	
NTN313AA	DSM DS1x84 TM circuit pack • extended temperature • See Note 2	
NTN313AC	DSM DS1x84 TM circuit pack • extended temperature • LC connector pre-installed	
NTN407MA	DSM shelf • extended temperature • See Note 1	
NTN355AA	DSM Fan module • extended temperature	
NTN31112	DSM Extender Pack for the OAM Adapter Module • extended temperature	
NTN356AA	DSM OAM Adapter Module • extended temperature	
NTN312AA	DSM DS1 I/O module (three included in each DSM shelf) • extended temperature	
NTN45060	DSM ground cable	
NTN356AA	DSM OAM Adapter Module • extended temperature	

Note 1: The DSM shelf (NTN407MA) does not include the DSM DS1x84 TM circuit packs.

Note 2: One optical connector kit (see Table 8-9 on page 8-19) is required for each of the DSM DS1x84 TM (NTN313AA) circuit packs.

Note 3: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.

Table 8-17
OMX equipment drawers

PEC	Description	Quantity
NT0H32AE	OMX + Fiber Manager 4CH (Band 1)	
NT0H32BE	OMX + Fiber Manager 4CH (Band 2)	
NT0H32CE	OMX + Fiber Manager 4CH (Band 3)	
NT0H32DE	OMX + Fiber Manager 4CH (Band 4)	
NT0H32EE	OMX + Fiber Manager 4CH (Band 5)	
NT0H32FE	OMX + Fiber Manager 4CH (Band 6)	
NT0H32GE	OMX + Fiber Manager 4CH (Band 7)	
NT0H32HE	OMX + Fiber Manager 4CH (Band 8)	
Note 1: The OMX does not support 1535.04nm and 1555.75nm wavelengths. ***Note 2:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-18
Enhanced OMX equipment drawers

PEC	Description	Quantity
NT0H32AF	Enhanced OMX + Fiber Manager 4CH (Band 1)	
NT0H32BF	Enhanced OMX + Fiber Manager 4CH (Band 2)	
NT0H32CF	Enhanced OMX + Fiber Manager 4CH (Band 3)	
NT0H32DF	Enhanced OMX + Fiber Manager 4CH (Band 4)	
NT0H32EF	Enhanced OMX + Fiber Manager 4CH (Band 5)	
NT0H32FF	Enhanced OMX + Fiber Manager 4CH (Band 6)	
NT0H32GF	Enhanced OMX + Fiber Manager 4CH (Band 7)	
NT0H32HF	Enhanced OMX + Fiber Manager 4CH (Band 8)	
Note 1: The OMX does not support 1535.04nm or 1555.75nm wavelengths. ***Note 2:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-19
Breaker Interface Panels (BIPs)

PEC	Description	Quantity
NTN458RA	OPTera Metro 3000 Breaker Interface Panel (BIP) 20A	
NTFW56BA	Breaker interface panel (BIP) 15A (for European deployment only)	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-20
Patch panel, cables, and cable accessories

PEC	Description	Quantity
NT0H43CA	SC to SC patch panel	
NTN458ZB	OPTera Metro 3000 BIP cable harness • See Note 1	
NTN458ZD	OPTera Metro 3000 BIP cable harness • See Note 2	
NTN458MU	OPTera Metro 3000 Universal shelf BIP cable harness • See Note 3	
NTN458ND	DS1 straight connector kit • no cable	
NTN458NE	DS1 right angle connector kit • no cable	
NTN458MD	DS1 straight cable assembly, 50 ft. (15.24 m) • See Note 4	
NTN458ME	DS1 straight cable assembly, 100 ft. (30.48 m) • See Note 4	
NTN458MR	DS1 right angle cable assembly, 100 ft. (30.48 m) • See Note 4	
	DS1 right angle connectors (2) 100 ft. (30.48 m), cable brackets (2), cable ties (2), and screws (2)	
NTN458MQ	DS1 right angle cable assembly, 50 ft. (15.24 m) • See Note 4	
	DS1 right angle connectors (2) 50 ft. (15.24 m), cable brackets (2), cable ties (2), and screws (2)	
NTN458MT	DS1 right angle I/O cable bracket kit (2)	

Table 8-20 (continued)
Patch panel, cables, and cable accessories

PEC	Description	Quantity
	cable brackets (2), cable ties (2), and screws (2)	
NTN458ND	DS1 straight cable connector kit	
NTN458NE	DS1 right angle cable connector kit	
NTN458AJ	Ethernet CAT5 MDI cable (straight), 10 ft. (3.05 m)	
NTN458BJ	Ethernet CAT5 MDI cable (straight), 35 ft. (10.67 m)	
NTN458CJ	Ethernet CAT5 MDI cable (straight), 100 ft. (30.48 m)	
NTN458DJ	Ethernet CAT5 MDI-X (cross-over), 9.84 ft. (3 m)	
NTN458EJ	Ethernet CAT5 MDI-X (cross-over), 32.81 ft. (10 m)	
NTN458FJ	Ethernet CAT5 MDI cable-X (cross-over), 98.42 ft. (30 m)	
NTN458AC	MT-RJ to SC 2-fiber Duplex multi mode, 13.12 ft. (4 m)	
NTN458BC	MT-RJ to SC 2-fiber Duplex multi mode, 32.81 ft. (10 m)	
NTN458CC	MT-RJ to SC 2-fiber Duplex single mode, 13.12 ft. (4 m)	
NTN458DC	MT-RJ to SC 2-fiber Duplex single mode, 32.81 ft. (10 m)	
NTN450ZA	23 inch Rear I/O Cable Retainer • See Note 5	

Table 8-20 (continued)
Patch panel, cables, and cable accessories

PEC	Description	Quantity
NTN450ZB	19 inch Rear I/O Cable Retainer • See Note 5	
NTN458AB	RS-232 (50 ft / 15.24 m) (DSUB/DSUB) cable assembly • See Note 7	
A0790559	DB-9 Female to DB-9 Female adapter • See Note 8	

Note 1: One NTN458ZB BIP cable harness supports A and B feeds for four OPTera Metro 3500 shelves and one DSM, or five DSMs, or five OPTera Metro 3400 shelves connected to BIP NTN458RA.

Note 2: One NTN458ZD BIP cable harness supports A and B feeds for eight DSM shelves connected to BIP NTN458RA.

Note 3: One NTN458MU BIP cable harness supports A and B feeds for a single network element or a single DSM shelf connected to BIP NTN458RA.

Note 4: When using DS1 29-84 I/Os (NTN452EA), order two DS1 cable assemblies.

Note 5: Each OPTera Metro 3500 Universal Shelf Assembly (NTN476AH) equipped with at least one rear I/O module must have one Rear I/O Cable Retainer. See Ordering a new system installation on page 8-2 and Upgrading to Release 12.0 on page 8-8.

Note 6: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.

Note 7: Use the NTN458AB cable in conjunction with the A0790559 adapter to provide an RS-232 interface from a laptop computer to the shelf processor for temporary craft access. To close the OPTera Metro 3500 front cover, the cable and adaptor must be disconnected from the shelf processor.

Note 8: Use the A0790559 adapter in conjunction with NTN458AB cable to provide an RS-232 interface from a laptop computer to the shelf processor for temporary craft access. To close the OPTera Metro 3500 front cover, the cable and adaptor must be disconnected from the shelf processor.

Table 8-21
Optical patch cords Single Mode (SM) Simplex

PEC	Description	Quantity
NTTC50AA	Optical patchcord, LC-LC, SM, Simplex 3.28 ft. (1 m)	
NTTC50AB	Optical patchcord, LC-LC, SM, Simplex 6.56 ft. (2 m)	
NTTC50AC	Optical patchcord, LC-LC, SM, Simplex 9.84 ft. (3 m)	
NTTC50AD	Optical patchcord, LC-LC, SM, Simplex 16.40 ft. (5 m)	
NTTC50AE	Optical patchcord, LC-LC, SM, Simplex 22.97 ft. (7 m)	
NTTC50AF	Optical patchcord, LC-LC, SM, Simplex 32.80 (10 m)	
NTTC50AG	Optical patchcord, LC-LC, SM, Simplex 42.65 ft. (13 m)	
NTTC50AH	Optical patchcord, LC-LC, SM, Simplex 49.21 ft. (15 m)	

Table 8-21 (continued)
Optical patch cords Single Mode (SM) Simplex

PEC	Description	Quantity
NTTC50AJ	Optical patchcord, LC-LC, SM, Simplex 65.62 ft. (20 m)	
NTTC50AK	Optical patchcord, LC-LC, SM, Simplex 82.02 ft. (25 m)	
NTTC50AL	Optical patchcord, LC-LC, SM, Simplex 98.42 ft. (30 m)	
NTTC50BA	Optical patchcord, LC-SC, SM, Simplex 3.28 ft. (1 m)	
NTTC50BB	Optical patchcord, LC-SC, SM, Simplex 6.56 ft. (2 m)	
NTTC50BC	Optical patchcord, LC-SC, SM, Simplex 9.84 ft. (3 m)	
NTTC50BD	Optical patchcord, LC-SC, SM, Simplex 16.40 ft. (5 m)	
NTTC50BE	Optical patchcord, LC-SC, SM, Simplex 22.97 ft. (7 m)	
NTTC50BF	Optical patchcord, LC-SC, SM, Simplex 32.80 (10 m)	
NTTC50BG	Optical patchcord, LC-SC, SM, Simplex 42.65 ft. (13 m)	
NTTC50BH	Optical patchcord, LC-SC, SM, Simplex 49.21 ft. (15 m)	
NTTC50BJ	Optical patchcord, LC-SC, SM, Simplex 65.62 ft. (20 m)	
NTTC50BK	Optical patchcord, LC-SC, SM, Simplex 82.02 ft. (25 m)	
NTTC50BL	Optical patchcord, LC-SC, SM, Simplex 98.42 ft. (30 m)	
NTTC50CA	Optical patchcord, LC-FC, SM, Simplex 3.28 ft. (1 m)	
NTTC50CB	Optical patchcord, LC-FC, SM, Simplex 6.56 ft. (2 m)	
NTTC50CC	Optical patchcord, LC-FC, SM, Simplex 9.84 ft. (3 m)	
NTTC50CD	Optical patchcord, LC-FC, SM, Simplex 16.40 ft. (5 m)	
NTTC50CE	Optical patchcord, LC-FC, SM, Simplex 22.97 ft. (7 m)	
NTTC50CF	Optical patchcord, LC-FC, SM, Simplex 32.80 (10 m)	
NTTC50CG	Optical patchcord, LC-FC, SM, Simplex 42.65 ft. (13 m)	
NTTC50CH	Optical patchcord, LC-FC, SM, Simplex 49.21 ft. (15 m)	
NTTC50CJ	Optical patchcord, LC-FC, SM, Simplex 65.62 ft. (20 m)	
NTTC50CK	Optical patchcord, LC-FC, SM, Simplex 82.02 ft. (25 m)	
NTTC50CL	Optical patchcord, LC-FC, SM, Simplex 98.42 ft. (30 m)	
NTTC50DA	Optical patchcord, LC-ST, SM, Simplex 3.28 ft. (1 m)	
NTTC50DB	Optical patchcord, LC-ST, SM, Simplex 6.56 ft. (2 m)	
NTTC50DC	Optical patchcord, LC-ST, SM, Simplex 9.84 ft. (3 m)	

Table 8-21 (continued)
Optical patch cords Single Mode (SM) Simplex

PEC	Description	Quantity
NTTC50DD	Optical patchcord, LC-ST, SM, Simplex 16.40 ft. (5 m)	
NTTC50DE	Optical patchcord, LC-ST, SM, Simplex 22.97 ft. (7 m)	
NTTC50DF	Optical patchcord, LC-ST, SM, Simplex 32.80 (10 m)	
NTTC50DG	Optical patchcord, LC-ST, SM, Simplex 42.65 ft. (13 m)	
NTTC50DH	Optical patchcord, LC-ST, SM, Simplex 49.21 ft. (15 m)	
NTTC50DJ	Optical patchcord, LC-ST, SM, Simplex 65.62 ft. (20 m)	
NTTC50DK	Optical patchcord, LC-ST, SM, Simplex 82.02 ft. (25 m)	
NTTC50DL	Optical patchcord, LC-ST, SM, Simplex 98.42 ft. (30 m)	

Table 8-22
Optical patch cords Single Mode (SM) Duplex

PEC	Description	Quantity
NTTC53AA	Optical patchcord, LC-LC, SM, Duplex 3.28 ft. (1 m)	
NTTC53AB	Optical patchcord, LC-LC, SM, Duplex 6.56 ft. (2 m)	
NTTC53AC	Optical patchcord, LC-LC, SM, Duplex 9.84 ft. (3 m)	
NTTC53AD	Optical patchcord, LC-LC, SM, Duplex 16.40 ft. (5 m)	
NTTC53AE	Optical patchcord, LC-LC, SM, Duplex 22.97 ft. (7 m)	
NTTC53AF	Optical patchcord, LC-LC, SM, Duplex 32.80 (10 m)	
NTTC53AG	Optical patchcord, LC-LC, SM, Duplex 42.65 ft. (13 m)	
NTTC53AH	Optical patchcord, LC-LC, SM, Duplex 49.21 ft. (15 m)	
NTTC53AJ	Optical patchcord, LC-LC, SM, Duplex 65.62 ft. (20 m)	
NTTC53AK	Optical patchcord, LC-LC, SM, Duplex 82.02 ft. (25 m)	
NTTC53AL	Optical patchcord, LC-LC, SM, Duplex 98.42 ft. (30 m)	
NTTC53BA	Optical patchcord, LC-SC, SM, Duplex 3.28 ft. (1 m)	
NTTC53BB	Optical patchcord, LC-SC, SM, Duplex 6.56 ft. (2 m)	
NTTC53BC	Optical patchcord, LC-SC, SM, Duplex 9.84 ft. (3 m)	
NTTC53BD	Optical patchcord, LC-SC, SM, Duplex 16.40 ft. (5 m)	
NTTC53BE	Optical patchcord, LC-SC, SM, Duplex 22.97 ft. (7 m)	
NTTC53BF	Optical patchcord, LC-SC, SM, Duplex 32.80 (10 m)	

Table 8-22 (continued)
Optical patch cords Single Mode (SM) Duplex

PEC	Description	Quantity
NTTC53BG	Optical patchcord, LC-SC, SM, Duplex 42.65 ft. (13 m)	
NTTC53BH	Optical patchcord, LC-SC, SM, Duplex 49.21 ft. (15 m)	
NTTC53BJ	Optical patchcord, LC-SC, SM, Duplex 65.62 ft. (20 m)	
NTTC53BK	Optical patchcord, LC-SC, SM, Duplex 82.02 ft. (25 m)	
NTTC53BL	Optical patchcord, LC-SC, SM, Duplex 98.42 ft. (30 m)	
NTTC53CA	Optical patchcord, LC-FC, SM, Duplex 3.28 ft. (1 m)	
NTTC53CB	Optical patchcord, LC-FC, SM, Duplex 6.56 ft. (2 m)	
NTTC53CC	Optical patchcord, LC-FC, SM, Duplex 9.84 ft. (3 m)	
NTTC53CD	Optical patchcord, LC-FC, SM, Duplex 16.40 ft. (5 m)	
NTTC53CE	Optical patchcord, LC-FC, SM, Duplex 22.97 ft. (7 m)	
NTTC53CF	Optical patchcord, LC-FC, SM, Duplex 32.80 (10 m)	
NTTC53CG	Optical patchcord, LC-FC, SM, Duplex 42.65 ft. (13 m)	
NTTC53CH	Optical patchcord, LC-FC, SM, Duplex 49.21 ft. (15 m)	
NTTC53CJ	Optical patchcord, LC-FC, SM, Duplex 65.62 ft. (20 m)	
NTTC53CK	Optical patchcord, LC-FC, SM, Duplex 82.02 ft. (25 m)	
NTTC53CL	Optical patchcord, LC-FC, SM, Duplex 98.42 ft. (30 m)	
NTTC53DA	Optical patchcord, LC-ST, SM, Duplex 3.28 ft. (1 m)	
NTTC53DB	Optical patchcord, LC-ST, SM, Duplex 6.56 ft. (2 m)	
NTTC53DC	Optical patchcord, LC-ST, SM, Duplex 9.84 ft. (3 m)	
NTTC53DD	Optical patchcord, LC-ST, SM, Duplex 16.40 ft. (5 m)	
NTTC53DE	Optical patchcord, LC-ST, SM, Duplex 22.97 ft. (7 m)	
NTTC53DF	Optical patchcord, LC-ST, SM, Duplex 32.80 (10 m)	
NTTC53DG	Optical patchcord, LC-ST, SM, Duplex 42.65 ft. (13 m)	
NTTC53DH	Optical patchcord, LC-ST, SM, Duplex 49.21 ft. (15 m)	
NTTC53DJ	Optical patchcord, LC-ST, SM, Duplex 65.62 ft. (20 m)	
NTTC53DK	Optical patchcord, LC-ST, SM, Duplex 82.02 ft. (25 m)	
NTTC53DL	Optical patchcord, LC-ST, SM, Duplex 98.42 ft. (30 m)	

Table 8-23
Optical patch cords Multi Mode (MM) 50 micron Simplex

PEC	Description	Quantity
NTTC56AA	Optical patchcord, LC-LC, MM, Simplex 3.28 ft. (1 m)	
NTTC56AB	Optical patchcord, LC-LC, MM, Simplex 6.56 ft. (2 m)	
NTTC56AC	Optical patchcord, LC-LC, MM, Simplex 9.84 ft. (3 m)	
NTTC56AD	Optical patchcord, LC-LC, MM, Simplex 16.40 ft. (5 m)	
NTTC56AE	Optical patchcord, LC-LC, MM, Simplex 22.97 ft. (7 m)	
NTTC56AF	Optical patchcord, LC-LC, MM, Simplex 32.80 (10 m)	
NTTC56AG	Optical patchcord, LC-LC, MM, Simplex 42.65 ft. (13 m)	
NTTC56AH	Optical patchcord, LC-LC, MM, Simplex 49.21 ft. (15 m)	
NTTC56AJ	Optical patchcord, LC-LC, MM, Simplex 65.62 ft. (20 m)	
NTTC56AK	Optical patchcord, LC-LC, MM, Simplex 82.02 ft. (25 m)	
NTTC56AL	Optical patchcord, LC-LC, MM, Simplex 98.42 ft. (30 m)	
NTTC56BA	Optical patchcord, LC-SC, MM, Simplex 3.28 ft. (1 m)	
NTTC56BB	Optical patchcord, LC-SC, MM, Simplex 6.56 ft. (2 m)	
NTTC56BC	Optical patchcord, LC-SC, MM, Simplex 9.84 ft. (3 m)	
NTTC56BD	Optical patchcord, LC-SC, MM, Simplex 16.40 ft. (5 m)	
NTTC56BE	Optical patchcord, LC-SC, MM, Simplex 22.97 ft. (7 m)	
NTTC56BF	Optical patchcord, LC-SC, MM, Simplex 32.80 (10 m)	
NTTC56BG	Optical patchcord, LC-SC, MM, Simplex 42.65 ft. (13 m)	
NTTC56BH	Optical patchcord, LC-SC, MM, Simplex 49.21 ft. (15 m)	
NTTC56BJ	Optical patchcord, LC-SC, MM, Simplex 65.62 ft. (20 m)	
NTTC56BK	Optical patchcord, LC-SC, MM, Simplex 82.02 ft. (25 m)	
NTTC56BL	Optical patchcord, LC-SC, MM, Simplex 98.42 ft. (30 m)	
NTTC56CA	Optical patchcord, LC-FC, MM, Simplex 3.28 ft. (1 m)	
NTTC56CB	Optical patchcord, LC-FC, MM, Simplex 6.56 ft. (2 m)	
NTTC56CC	Optical patchcord, LC-FC, MM, Simplex 9.84 ft. (3 m)	
NTTC56CD	Optical patchcord, LC-FC, MM, Simplex 16.40 ft. (5 m)	
NTTC56CE	Optical patchcord, LC-FC, MM, Simplex 22.97 ft. (7 m)	
NTTC56CF	Optical patchcord, LC-FC, MM, Simplex 32.80 (10 m)	

Table 8-23 (continued)
Optical patch cords Multi Mode (MM) 50 micron Simplex

PEC	Description	Quantity
NTTC56CG	Optical patchcord, LC-FC, MM, Simplex 42.65 ft. (13 m)	
NTTC56CH	Optical patchcord, LC-FC, MM, Simplex 49.21 ft. (15 m)	
NTTC56CJ	Optical patchcord, LC-FC, MM, Simplex 65.62 ft. (20 m)	
NTTC56CK	Optical patchcord, LC-FC, MM, Simplex 82.02 ft. (25 m)	
NTTC56CL	Optical patchcord, LC-FC, MM, Simplex 98.42 ft. (30 m)	
NTTC56DA	Optical patchcord, LC-ST, MM, Simplex 3.28 ft. (1 m)	
NTTC56DB	Optical patchcord, LC-ST, MM, Simplex 6.56 ft. (2 m)	
NTTC56DC	Optical patchcord, LC-ST, MM, Simplex 9.84 ft. (3 m)	
NTTC56DD	Optical patchcord, LC-ST, MM, Simplex 16.40 ft. (5 m)	
NTTC56DE	Optical patchcord, LC-ST, MM, Simplex 22.97 ft. (7 m)	
NTTC56DF	Optical patchcord, LC-ST, MM, Simplex 32.80 (10 m)	
NTTC56DG	Optical patchcord, LC-ST, MM, Simplex 42.65 ft. (13 m)	
NTTC56DH	Optical patchcord, LC-ST, MM, Simplex 49.21 ft. (15 m)	
NTTC56DJ	Optical patchcord, LC-ST, MM, Simplex 65.62 ft. (20 m)	
NTTC56DK	Optical patchcord, LC-ST, MM, Simplex 82.02 ft. (25 m)	
NTTC56DL	Optical patchcord, LC-ST, MM, Simplex 98.42 ft. (30 m)	

Table 8-24
Optical patch cords Multi Mode (MM) 50 micron Duplex

PEC	Description	Quantity
NTTC59AA	Optical patchcord, LC-LC, MM, Duplex 3.28 ft. (1 m)	
NTTC59AB	Optical patchcord, LC-LC, MM, Duplex 6.56 ft. (2 m)	
NTTC59AC	Optical patchcord, LC-LC, MM, Duplex 9.84 ft. (3 m)	
NTTC59AD	Optical patchcord, LC-LC, MM, Duplex 16.40 ft. (5 m)	
NTTC59AE	Optical patchcord, LC-LC, MM, Duplex 22.97 ft. (7 m)	
NTTC59AF	Optical patchcord, LC-LC, MM, Duplex 32.80 (10 m)	
NTTC59AG	Optical patchcord, LC-LC, MM, Duplex 42.65 ft. (13 m)	
NTTC59AH	Optical patchcord, LC-LC, MM, Duplex 49.21 ft. (15 m)	
NTTC59AJ	Optical patchcord, LC-LC, MM, Duplex 65.62 ft. (20 m)	

Table 8-24 (continued)
Optical patch cords Multi Mode (MM) 50 micron Duplex

PEC	Description	Quantity
NTTC59AK	Optical patchcord, LC-LC, MM, Duplex 82.02 ft. (25 m)	
NTTC59AL	Optical patchcord, LC-LC, MM, Duplex 98.42 ft. (30 m)	
NTTC59BA	Optical patchcord, LC-SC, MM, Duplex 3.28 ft. (1 m)	
NTTC59BB	Optical patchcord, LC-SC, MM, Duplex 6.56 ft. (2 m)	
NTTC59BC	Optical patchcord, LC-SC, MM, Duplex 9.84 ft. (3 m)	
NTTC59BD	Optical patchcord, LC-SC, MM, Duplex 16.40 ft. (5 m)	
NTTC59BE	Optical patchcord, LC-SC, MM, Duplex 22.97 ft. (7 m)	
NTTC59BF	Optical patchcord, LC-SC, MM, Duplex 32.80 (10 m)	
NTTC59BG	Optical patchcord, LC-SC, MM, Duplex 42.65 ft. (13 m)	
NTTC59BH	Optical patchcord, LC-SC, MM, Duplex 49.21 ft. (15 m)	
NTTC59BJ	Optical patchcord, LC-SC, MM, Duplex 65.62 ft. (20 m)	
NTTC59BK	Optical patchcord, LC-SC, MM, Duplex 82.02 ft. (25 m)	
NTTC59BL	Optical patchcord, LC-SC, MM, Duplex 98.42 ft. (30 m)	
NTTC59CA	Optical patchcord, LC-FC, MM, Duplex 3.28 ft. (1 m)	
NTTC59CB	Optical patchcord, LC-FC, MM, Duplex 6.56 ft. (2 m)	
NTTC59CC	Optical patchcord, LC-FC, MM, Duplex 9.84 ft. (3 m)	
NTTC59CD	Optical patchcord, LC-FC, MM, Duplex 16.40 ft. (5 m)	
NTTC59CE	Optical patchcord, LC-FC, MM, Duplex 22.97 ft. (7 m)	
NTTC59CF	Optical patchcord, LC-FC, MM, Duplex 32.80 (10 m)	
NTTC59CG	Optical patchcord, LC-FC, MM, Duplex 42.65 ft. (13 m)	
NTTC59CH	Optical patchcord, LC-FC, MM, Duplex 49.21 ft. (15 m)	
NTTC59CJ	Optical patchcord, LC-FC, MM, Duplex 65.62 ft. (20 m)	
NTTC59CK	Optical patchcord, LC-FC, MM, Duplex 82.02 ft. (25 m)	
NTTC59CL	Optical patchcord, LC-FC, MM, Duplex 98.42 ft. (30 m)	
NTTC59DA	Optical patchcord, LC-ST, MM, Duplex 3.28 ft. (1 m)	
NTTC59DB	Optical patchcord, LC-ST, MM, Duplex 6.56 ft. (2 m)	
NTTC59DC	Optical patchcord, LC-ST, MM, Duplex 9.84 ft. (3 m)	
NTTC59DD	Optical patchcord, LC-ST, MM, Duplex 16.40 ft. (5 m)	

Table 8-24 (continued)
Optical patch cords Multi Mode (MM) 50 micron Duplex

PEC	Description	Quantity
NTTC59DE	Optical patchcord, LC-ST, MM, Duplex 22.97 ft. (7 m)	
NTTC59DF	Optical patchcord, LC-ST, MM, Duplex 32.80 (10 m)	
NTTC59DG	Optical patchcord, LC-ST, MM, Duplex 42.65 ft. (13 m)	
NTTC59DH	Optical patchcord, LC-ST, MM, Duplex 49.21 ft. (15 m)	
NTTC59DJ	Optical patchcord, LC-ST, MM, Duplex 65.62 ft. (20 m)	
NTTC59DK	Optical patchcord, LC-ST, MM, Duplex 82.02 ft. (25 m)	
NTTC59DL	Optical patchcord, LC-ST, MM, Duplex 98.42 ft. (30 m)	

Table 8-25
Optical patchcords Mode Conditioning 50 micron Duplex

PEC	Description	Quantity
NTTC71AA	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 3.28 ft. (1 m)	
NTTC71AB	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 6.56 ft. (2 m)	
NTTC71AC	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 9.84 ft. (3 m)	
NTTC71AD	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 16.40 ft. (5 m)	
NTTC71AE	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 22.97 ft. (7 m)	
NTTC71AF	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 32.80 (10 m)	
NTTC71AG	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 42.65 ft. (13 m)	
NTTC71AH	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 49.21 ft. (15 m)	
NTTC71AJ	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 65.62 ft. (20 m)	
NTTC71AK	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 82.02 ft. (25 m)	
NTTC71AL	Optical patchcord, LC-LC, Mode Conditioning 50 micron, Duplex 98.42 ft. (30 m)	

Table 8-25 (continued)
Optical patchcords Mode Conditioning 50 micron Duplex

PEC	Description	Quantity
NTTC71BA	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 3.28 ft. (1 m)	
NTTC71BB	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 6.56 ft. (2 m)	
NTTC71BC	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 9.84 ft. (3 m)	
NTTC71BD	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 16.40 ft. (5 m)	
NTTC71BE	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 22.97 ft. (7 m)	
NTTC71BF	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 32.80 (10 m)	
NTTC71BG	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 42.65 ft. (13 m)	
NTTC71BH	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 49.21 ft. (15 m)	
NTTC71BJ	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 65.62 ft. (20 m)	
NTTC71BK	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 82.02 ft. (25 m)	
NTTC71BL	Optical patchcord, LC-SC, Mode Conditioning 50 micron, Duplex 98.42 ft. (30 m)	
NTTC71CA	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 3.28 ft. (1 m)	
NTTC71CB	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 6.56 ft. (2 m)	
NTTC71CC	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 9.84 ft. (3 m)	
NTTC71CD	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 16.40 ft. (5 m)	
NTTC71CE	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 22.97 ft. (7 m)	
NTTC71CF	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 32.80 (10 m)	

Table 8-25 (continued)
Optical patchcords Mode Conditioning 50 micron Duplex

PEC	Description	Quantity
NTTC71CG	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 42.65 ft. (13 m)	
NTTC71CH	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 49.21 ft. (15 m)	
NTTC71CJ	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 65.62 ft. (20 m)	
NTTC71CK	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 82.02 ft. (25 m)	
NTTC71CL	Optical patchcord, LC-FC, Mode Conditioning 50 micron, Duplex 98.42 ft. (30 m)	
NTTC71DA	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 3.28 ft. (1 m)	
NTTC71DB	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 6.56 ft. (2 m)	
NTTC71DC	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 9.84 ft. (3 m)	
NTTC71DD	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 16.40 ft. (5 m)	
NTTC71DE	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 22.97 ft. (7 m)	
NTTC71DF	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 32.80 (10 m)	
NTTC71DG	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 42.65 ft. (13 m)	
NTTC71DH	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 49.21 ft. (15 m)	
NTTC71DJ	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 65.62 ft. (20 m)	
NTTC71DK	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 82.02 ft. (25 m)	
NTTC71DL	Optical patchcord, LC-ST, Mode Conditioning 50 micron, Duplex 98.42 ft. (30 m)	

Table 8-26
Optical Patchcords Mode Conditioning 62.5 micron Duplex

PEC	Description	Quantity
NTTC77AA	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 3.28 ft. (1 m)	
NTTC77AB	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 6.56 ft. (2 m)	
NTTC77AC	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 9.84 ft. (3 m)	
NTTC77AD	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 16.40 ft. (5 m)	
NTTC77AE	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 22.97 ft. (7 m)	
NTTC77AF	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 32.80 (10 m)	
NTTC77AG	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 42.65 ft. (13 m)	
NTTC77AH	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 49.21 ft. (15 m)	
NTTC77AJ	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 65.62 ft. (20 m)	
NTTC77AK	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 82.02 ft. (25 m)	
NTTC77AL	Optical patchcord, LC-LC, Mode Conditioning 62.5 micron, Duplex 98.42 ft. (30 m)	
NTTC77BA	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 3.28 ft. (1 m)	
NTTC77BB	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 6.56 ft. (2 m)	
NTTC77BC	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 9.84 ft. (3 m)	
NTTC77BD	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 16.40 ft. (5 m)	
NTTC77BE	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 22.97 ft. (7 m)	
NTTC77BF	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 32.80 (10 m)	

Table 8-26 (continued)
Optical Patchcords Mode Conditioning 62.5 micron Duplex

PEC	Description	Quantity
NTTC77BG	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 42.65 ft. (13 m)	
NTTC77BH	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 49.21 ft. (15 m)	
NTTC77BJ	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 65.62 ft. (20 m)	
NTTC77BK	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 82.02 ft. (25 m)	
NTTC77BL	Optical patchcord, LC-SC, Mode Conditioning 62.5 micron, Duplex 98.42 ft. (30 m)	
NTTC77CA	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 3.28 ft. (1 m)	
NTTC77CB	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 6.56 ft. (2 m)	
NTTC77CC	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 9.84 ft. (3 m)	
NTTC77CD	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 16.40 ft. (5 m)	
NTTC77CE	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 22.97 ft. (7 m)	
NTTC77CF	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 32.80 (10 m)	
NTTC77CG	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 42.65 ft. (13 m)	
NTTC77CH	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 49.21 ft. (15 m)	
NTTC77CJ	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 65.62 ft. (20 m)	
NTTC77CK	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 82.02 ft. (25 m)	
NTTC77CL	Optical patchcord, LC-FC, Mode Conditioning 62.5 micron, Duplex 98.42 ft. (30 m)	
NTTC77DA	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 3.28 ft. (1 m)	

Table 8-26 (continued)
Optical Patchcords Mode Conditioning 62.5 micron Duplex

PEC	Description	Quantity
NTTC77DB	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 6.56 ft. (2 m)	
NTTC77DC	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 9.84 ft. (3 m)	
NTTC77DD	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 16.40 ft. (5 m)	
NTTC77DE	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 22.97 ft. (7 m)	
NTTC77DF	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 32.80 (10 m)	
NTTC77DG	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 42.65 ft. (13 m)	
NTTC77DH	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 49.21 ft. (15 m)	
NTTC77DJ	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 65.62 ft. (20 m)	
NTTC77DK	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 82.02 ft. (25 m)	
NTTC77DL	Optical patchcord, LC-ST, Mode Conditioning 62.5 micron, Duplex 98.42 ft. (30 m)	

Table 8-27
Replacement parts

PEC	Description	Quantity
NTN458MW	Power module and cooling unit upgrade kit (for NTN476AA Shelf Assembly only) • See Note 1	
NTN451HA	20 A power card (2)	
NTN458MJ	Fan power cable	
NTN458QA	Cooling unit assembly	
NTN45043	Air deflector	
NTN451HA	20 A power module • extended temperature • rated at 12.5 Amp at extended temperatures	

Table 8-27 (continued)
Replacement parts

PEC	Description	Quantity
NTN451GA	12.5 A power module	
NTN458QH	Universal shelf cooling unit assembly • extended temperature • See Note 3	
NTN458HH	Universal shelf cooling unit fan module (for NTN458QH) • extended temperature • See Note 3	
NTN458QA	Cooling unit assembly (contains 3 cooling unit fan modules) • See Note 2	
NTN458HC	Cooling unit fan module (for NTN458QA) • See Note 2	
NTN458GA	Fan kit (contains 3 cooling unit fan modules) • See Note 1	
NTN458HB	Cooling unit fan module (for NTN458GA) • See Note 1	
NTN451BA	Left interface (LIF) • Only for use with NTN476DA and NTN476AA shelves	
NTN451MA	Left OAM (LOAM)	
NTN451BH	Left interface (LIF) • extended temperature	
NTN451MH	Left OAM (LOAM) • extended temperature	
NTN355AA	DSM fan module • extended temperature • See Note 4	
NTN312AA	DSM DS1 I/O module • extended temperature • See Note 4	

Table 8-27 (continued)
Replacement parts

PEC	Description	Quantity
NTN356AA	DSM OAM Adapter Module • extended temperature • See Note 4	
NTN31112	DSM Extender Pack • extended temperature • See Note 4	
Note 1: When replacing the Cooling Unit Assembly for the NTN476AA shelf, you can upgrade to the NTN458QA by ordering the NTN458MW kit, or you can order the NTN458GA. ***Note 2:*** When replacing the Cooling Unit Assembly for the NTN476DA shelf, you must order the NTN458QA. ***Note 3:*** When replacing the Cooling Unit Assembly for the NTN476AH Universal Shelf, you must order the NTN458QH. ***Note 4:*** All DSM components must be used on the DSM Shelf Assembly. ***Note 5:*** Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-28
Replacement modules

PEC	Description	Quantity
NTN407MA	DS1 service module (DSM) shelf • extended temperature	
Note: Consult Table 3-3 on page 3-9 in Part 1 of this guide for equipment operational temperature ranges and shelf compatibility.		

Table 8-29
Graphical User Interface

PEC	Description	Quantity
NTNM14FA	Site Manager 6.0 Application Kit	
NTNM1402	Site Manager 6.0 Software	
NTNM1452	Site Manager 6.0 Planning and Installation Guide (electronic version on CD)	
NTNM35FA	Site Manager 6.0 Planning and Installation Guide (paper version)	
NTNM79FA	Site Manager 6.0 Upgrade RTU	
NTNM79FC	Site Manager 6.0 OPTera Metro 3000 Series RTU	

Table 8-30
Documentation

PEC	Description	Quantity
NTN465GF	Rel 12.0 OPTera Metro 3500 Documentation Suite	
NTN464GF	Rel 12.0 OPTera Metro 3500 Interactive CD	
NTN464ZG	Rel 12.0 OPTera Metro 3500 Helmsman CD NTPs	
NTN469GF	Rel 12.0 OPTera Metro 3500 Shelf Setup Guide	
NTRN10AM	Rel 12.0 OPTera Metro 3500 Planning Guide	
NTRN10YK	OPTera Packet Edge System Planning Guide	
NTN465YG	OPTera Packet Edge System User Guide	
NTRN11YK	OPTera Packet Edge System Network Application and Management Guide	
NTRN21AL	Site Manager network software upgrade to Rel. 12.00	
NTRN23AL	Site Manager nodal software upgrade to Rel. 12.00	
NTRN60AA	OPTera Metro 3500-Replacing Universal LIF card CAP	
NTNM51FAGA	Preside Applications Platform Documentation Package (Rel 9.2)	
NTNM43CA	Multiservice Managed Object Agent (MOA) Documentation Package (Rel 12.0)	
NTNM26DA	Preside Software Upgrade Management 3.0 Documentation Package	

Table 8-31
Suggested bays

PEC	Description
NT7E70AA	7.0 ft. (2.13 m)
NT7E70BA	7.5 ft. (2.29 m)
NT7E70CA	8.0 ft. (2.44 m)
NT7E70DA	9.0 ft. (2.74 m)
NT7E70EA	11.5 ft. (3.50 m)
NTN450ZW	Drip tray
Note: You can also install the OPTera Metro 3500 shelf in a single-shelf OPTera Connect DX bay. Refer to the SONET Single-Shelf DX Bay User Guide (NTCA69YA) for supplementary information.	

Table 8-32
Bay frame accessories

PEC	Description	Quantity
NT7E6020	Frame Insulating Kit	
NT7E6040	Frame Levelling Kit	
NTN450ZW	Drip Tray	
Note: Order one drip tray (NTN450ZW) for each bay.		

Terms and conditions

Completion of a purchase agreement is required prior to purchasing OPTera Metro 3500 products and/or services. Contact one of the following:

- your Nortel Networks sales person
- telephone: Suzanne Calton (972) 685-2888
- email CONTMGNT@nortelnetworks.com

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Glossary

ADM

add/drop multiplexer

AID

access identifier

AINS

automatic in-service

AIS

alarm indication signal

APD

avalanche photo diode

BCC

Bay command console

BGP

border gateway protocol

BITS

building-integrated timing supply

BLSR

bidirectional line-switched ring

CAP

change application procedure

CC

composite clock

CRC

cyclic redundancy check

CSA

carrier-serving area

dB

decibel

dBm

decibels above one milliwatt

dc

direct current

DCC

data communications channel

DFB

distributed feedback

DS1

digital signal level 1 (1.544 Mbit/s)

DS3

digital signal level 3 (44.736 Mbit/s)

DSM

distributed service module

DWDM

dense wavelength division multiplexing

EC-1

electrical carrier level 1 (51.84 Mbit/s)

ECT

equalizer coupler tray

EIM

Ethernet inverse multiplexer

EoL

end of life

ESWD

electronic software delivery

FAD

facility access digroup

FFP

facility protection group

FP

Fabry-Perot

Gbit/s

gigabits per second

GFP

generic framing protocol

GX

gigamux shelf

HBA

host bus adapter

HDLC

high-level data link control

HX

high density shelf

ID

identifier

I/F

interface

ILAN

intershelf LAN

iPT

interWAN packet transport

IR

intermediate reach

IS

in-service

ISTR

in-service traffic rollover

ITU-T

International Telecommunication Union - Telecommunication Standardization Bureau

LAN

local area network

LBO

line buildout

LED

light-emitting diode

LEX

left extender

LIF

left interface

LLI

leased line interface

LOA

loss of association

LOAM

left operations, administration, and maintenance

Mbit/s

megabits per second

MLM

multi longitudinal mode

MOA

managed object agent

MONE

monitor signal from equipment side

MONEF

monitor signals from equipment and facility side

MONF

monitor signal from facility side

MX

medium density shelf

NE

network element

NMA

network management application

NP

network processor

NTP

Nortel Networks technical publication or

network timing protocol

OADM

optical add/drop multiplexer

OAM

operations, administration, and maintenance

OAM&P

operations, administration, maintenance, and provisioning

OC-n

optical carrier level n

OC-3

optical carrier level 3 (155.52 Mbit/s)

OC-12

optical carrier level 12 (622.08 Mbit/s)

OC-48

optical carrier level 48 (2488.32 Mbit/s)

OC-192

optical carrier level 192 (9.6 Gbit/s)

OFA

optical fiber amplifier

OMX

optical multiplexer

OOS

out-of-service

OPC

operations controller

OPE

OPTera Packet Edge

OPR

optical power received un-normalized

OPRN

optical power received normalized

OPTera Metro 3100

formerly Express CX

OPTera Metro 3300

formerly Express MX

OPTera Metro 3400

formerly Express HX

OPTera Metro 3500

formerly Express GX

OS

operations system

OSI

Open Systems Interconnection

OSMINE

Operations System Modifications for the Integration of Network Elements

PEC

product engineering code

PG

planning guide

PIN

p-intrinsic-n

PM

performance monitoring

POP

point of presence

PPP

point-to-point protocol

PSC

protection switch controller

PSX

protection switch extender

PTE

path-terminating equipment

REX

right extender

RFI

remote fault indicator

RPR

resilient packet ring

SDCC

section data communications channel

SDH

synchronous digital hierarchy

SDTH

signal degrade threshold

SF

signal failure

SLM

single longitudinal mode

SNMP

simple network management protocol

SOC

span of control

SFP

Small Form Factor Pluggables

SoL

start of life

SONET

synchronous optical network

SP

shelf processor

SPE

synchronous payload envelope

SPLTA

split signal from path A

SPLTE

split signal from equipment side

SPLTEF

split signal from equipment side and facility side

SPLTF

split signal from facility side

SR

short reach

STM-1

synchronous transport module, level 1

STS-n

synchronous transport signal level n

STS-nc

STS-n concatenated structure

TAP

test access port

TARP

target identifier address resolution protocol

TBOS

telemetry byte-oriented serial protocol

TCP/IP

transmission control protocol/Internet protocol

TCS

test controller system

TDM

time division multiplexer

TID

target identifier

TIRKS

Trunks Integrated Record Keeping System

TL1

Transaction Language 1

TOD

time of day

TOS

test operations system

TSA

time slot assignment

TSI

time slot interchange

UPSR

unidirectional path-switched ring

VOA

variable optical attenuator

VCAT

virtual concatenation

VT

virtual tributary

VTX

virtual tributary cross-connect

WAN

wide area network

OPTera Metro 3500 Multiservice Platform

Planning and Ordering Guide—Part 2 of 2

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