



BTI7800 Series Hardware Overview and Installation Guide



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BT17800 Series Hardware Overview and Installation Guide
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Documentation and Release Notes

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Documentation Conventions

[Table 1 on page xvi](#) defines notice icons used in this guide.

Table 1: Notice Icons







Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xvi defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> show chassis alarms No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>

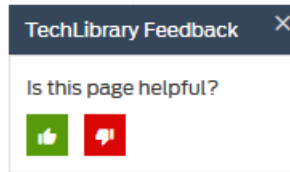
Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none">To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level.The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric <i>metric</i>>;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (<i>string1</i> <i>string2</i> <i>string3</i>)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Encloses a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	<pre>[edit] routing-options { static { route default { nexthop <i>address</i>; retain; } } }</pre>
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none">In the Logical Interfaces box, select All Interfaces.To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select Protocols>Ospf .

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- Find solutions and answer questions using our Knowledge Base: <https://kb.juniper.net/>
- Download the latest versions of software and review release notes: <https://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://kb.juniper.net/InfoCenter/>

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For international or direct-dial options in countries without toll-free numbers, see <https://support.juniper.net/support/requesting-support/>.

CHAPTER 1

BTI7800 Series Safety Information

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- [Laser Safety on page 22](#)
- [Critical Site Warnings and Requirements on page 26](#)
- [Critical Safety Warnings on page 28](#)
- [NEBS Requirements on page 28](#)

Optical Precautions

- Terminate all laser transceiver outputs properly before connecting laser inputs.
- Disconnect the input end of an optical fiber jumper cable before disconnecting the output end.
- Handle glass fiber with care. Glass fiber can be broken if mishandled.
- Protect skin from exposed glass fiber. It can penetrate the skin.
- The BTI7800 Series equipment should be used in a controlled access area. Limit the number of personnel who have access to the optical transmission systems. Personnel should be properly trained on laser safety and authorized, if access to laser emissions is required.
- Limit the use of laser test equipment to authorized, trained personnel during installation and service. This precaution includes using optical loss test (OLT) set, optical spectrum analyzer (OSA), and optical time domain reflectometer (OTDR) equipment.
- Exclude any unauthorized personnel from the immediate laser radiation area during service and installation when there is a possibility that the system might become energized. Consider the immediate service area to be a temporary laser-controlled area.
- The BTI7800 Series system functions in the 850-nm to 1620-nm wavelength window that is considered invisible radiation. Laser light being emitted by a fiber, a pigtail, or a bulkhead connector cannot be seen by the naked eye. Use appropriate eye protection during fiber-optic system installation or maintenance whenever there is potential for laser radiation exposure, as recommended by the company's health and safety procedures. Observe this precaution whether or not warning labels have been posted.
- During installation or service, a broken optical fiber or non-terminated connector should only be viewed with an indirect image converter or with a filtered optical instrument

of optical density sufficient to reduce the exposure levels below the appropriate maximum permissible exposure, unless it has been verified that all optical transmitters are turned off and will remain off during the installation or service operation.

- During all splicing operations that require viewing the end of a fiber of an SG3a, SG3b or SG4 optical-fiber communication systems, the laser source on the fiber involved shall be de-energized or viewing the systems incorporating personal protection shall be employed. A responsible person(s) shall verify that the system is de-energized before splicing proceeds. Where applicable, ensure compliance with lockout/tagout requirements of OSHA Standard 29 CFR Part 1910.147.

Laser Safety



CAUTION: USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED IN THIS GUIDE MIGHT RESULT IN HAZARDOUS RADIATION EXPOSURE.

Due to the potential safety hazard that is posed by high power outputs of optical modules, the BT17800 supports automatic power shutdown (APSD) and automatic power reduction (APR) to shut off or reduce the output powers when a fiber is cut.

Table 3: Timing of APSD and APR Operations

Laser Safety Mechanism	Activation Time	Output Level After Activation
APR	< 2.0 seconds	< 20 dBm
APSD	< 2.0 seconds	< 20 dBm

- [Laser Safety: Automatic Power Shutdown on page 22](#)
- [Laser Safety: Automatic Power Reduction on page 24](#)
- [Safety Rating and Label on page 25](#)

Laser Safety: Automatic Power Shutdown

Automatic power shutdown (APSD) applies to fiber spans between optical equipment. When a fiber is cut, APSD causes both ends to automatically shut down its high power lasers, allowing maintenance personnel to repair or reconnect the fiber safely. Once the span fibers are repaired or reconnected, the lasers are automatically turned back on and traffic is automatically restored.



WARNING: APSD is performed in software on the service module and is disabled whenever the service module undergoes a warm or cold reload. In a cold reload, the lasers are turned off and are in a safe state. In a warm reload, however, the lasers remain on while APSD is disabled.

Without being limited to the foregoing, a service module might undergo a warm reload in the following situations:

- The user issues an operator command that warm reloads the service module.
- The user issues an operator command that cold or warm reloads the Chassis Management Module (CMM) in a single CMM system.
- The user performs a software upgrade of the chassis.
- The user restores a configuration database to the chassis.
- The user replaces the CMM in the chassis. See *Chassis Management Module Replacement*.
- Any situation where a CMM fails in a single CMM system or where both CMMs fail in a dual CMM system. See *Chassis Management Module Failure or Removal*.

-
- [APSD on the 96-Channel Amplifier on page 23](#)

APSD on the 96-Channel Amplifier

The 96-Channel Amplifier is capable of emitting high output powers. To guard against accidental exposure to high-powered lasers, the 96-Channel Amplifier supports automatic power shutdown (APSD). APSD shuts down the high output lasers in both directions when a fiber cut is detected.

The output WDM signal on the line port is automatically shut down, or disabled from turn-up, if either of the following conditions occurs:

- (*Cond. 1*) A Loss of Light fault is active against the input WDM and input OSC on the same line port. This triggers the port to undertake APSD measures. The line port turns off its output WDM signal and simultaneously sends a shutdown signal on the OSC to the far end.
- (*Cond. 2*) A shutdown signal is received from the far end OSC. The far end OSC sends a shutdown signal when APSD is triggered at the far end. In response to the shutdown signal, the near end line port turns off its output WDM signal, and keeps it turned off for as long as the shutdown signal persists.

Single Fiber-Cut Example

Starting with span fibers connected, and with the WDM and OSC operationally in-service, the following sequence of events occurs after the receive fiber is cut on the line port:

1. WDM and OSC Loss of Light Receive faults are raised on the near end line port. The near end therefore meets (*Cond. 1*).
2. The near end turns off its WDM output and sends an APSD shutdown signal on the OSC to the far end.

3. When the far end receives the shutdown signal, the far end meets (*Cond. 2*) and shuts down its WDM output.
4. Both fibers are no longer illuminated by the WDM, and the safety hazard is avoided.

When the fiber cut is repaired, or when the disconnected fiber is reconnected, the recovery proceeds as follows:

1. The OSC Loss of Light Receive fault on the near end line port is cleared. The near end no longer meets (*Cond. 1*).
2. The near end turns on its WDM output and stops transmitting the APSD shutdown signal to the far end.
3. Since the far end no longer receives the APSD shutdown signal, the far end no longer meets (*Cond. 2*) and reenables the WDM output.
4. Both the near end and the far end restore traffic onto the span.

Laser Safety: Automatic Power Reduction

To guard against accidental exposure to high power lasers, some ports support automatic power reduction (APR). APR reduces the output of the laser when a fiber cut is detected.



WARNING: APR is performed in software on the service module and is disabled whenever the service module undergoes a warm or cold reload. In a cold reload, the lasers are turned off and are in a safe state. In a warm reload, however, the lasers remain on while APR is disabled.

Without being limited to the foregoing, a service module might undergo a warm reload in the following situations:

- The user issues an operator command that warm reloads the service module.
 - The user issues an operator command that cold or warm reloads the Chassis Management Module (CMM) in a single CMM system.
 - The user performs a software upgrade of the chassis.
 - The user restores a configuration database to the chassis.
 - The user replaces the CMM in the chassis. See *Chassis Management Module Replacement*.
 - Any situation where a CMM fails in a single CMM system or where both CMMs fail in a dual CMM system. See *Chassis Management Module Failure or Removal*.
-
- [APR on 96-Channel Amplifier Modules on page 25](#)

APR on 96-Channel Amplifier Modules

The 96-Channel Amplifier client and DCM ports are capable of emitting high output powers. To guard against accidental exposure to high power lasers, these ports support APR, which reduces the output of the laser when a fiber cut is detected.

The 96-Channel Amplifier supports two APRs:

- Mid-stage between the DCM Out and DCM In ports. APR is triggered when a Loss of Light Receive (LoLightRx) fault is detected at the DCM IN port of the 96-Channel Amplifier module. Once APR is triggered, the output of the laser on the DCM Out port is automatically reduced to a safe level.
- Client Out port. APR is triggered when the optical back reflection (OBR) exceeds the threshold, and the output power is larger than 5 dBm. When APR is triggered, the output of the laser on the Client Out port is automatically reduced to a safe level.

Safety Rating and Label

All BT17800 Series products meet the FDA requirements for a class 1 laser product with a Class 1M hazard rating:

**LASER RADIATION DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS CLASS 1M
LASER PRODUCT**

A caution label is located on each BT17800 Series laser circuit pack. Two different labels are used depending on the circuit pack.

Figure 1: Laser Safety Warning Label with Text



Figure 2: Laser Safety Warning Label Without Text





CAUTION: Read and understand all caution labels before working with the equipment.

BT17800 Series Laser Output Ports

The BT17800 Class 1M laser output ports are located on the following modules.

Table 4: Laser Output Ports

Module	Product Code (PEC)	Optical Wavelength	Port
96-Channel Amplifier	BT8A78AMP1	1528.77 nm to 1566.72 nm	DCM out
			Line Out
			C1 Out
96-Channel Fixed Mux/Demux	BT8A78MD03	1528.578 nm to 1566.928 nm	C1-C96 Out
			L1 Out
Wavelength Protection Switch	BT8A78WPS4	C-band: 1500 to 1570 nm	C1 Out A
		O-band: 1260 to 1350 nm	L1 Out B
		L-band: 1560 to 1620 nm	L1 Out A
			C2 Out A
			L2 Out B
			L2 Out A
			C3 Out A
			L3 Out B
			L3 Out A
			C4 Out A
			L4 Out B
			L4 Out A

Critical Site Warnings and Requirements



WARNING: You must observe the site and safety requirements in this section to ensure safe operations and proper performance of BT17800 Series equipment.



NOTE: Restricted Access refers to an inaccessible location that is normally inaccessible by the general public by means of any administrative or engineering control measure, but is accessible to authorized personnel who might not have laser safety training.

Table 5: Environmental Site Requirements

Site Criteria		Requirements
Location		<p>BT17800 equipment must be installed in a Restricted Access Location in the Central Office (CO) of Network Telecommunication Facilities.</p> <p>The chassis should be installed where personnel cannot interfere with cables and cords connected to the chassis.</p> <p>The chassis should be installed where cables and rack location do not obstruct chassis ventilation openings.</p>
Electrical	BT17814 (BT8A78CH14)	See the electrical requirements in “ BT17814 Power ” on page 40.
	BT17802 (BT8A78CH2-I02)	See the electrical requirements in “ BT17802 Power ” on page 48.
	BT17801 (BT8A78CH1)	See the electrical requirements in “ BT17801 Power ” on page 52.
Electrostatic		Always use ESD grounding devices when handling components.
Humidity		5% to 95% non-condensing
Operating temperature	BT17814 (BT8A78CH14)	15°C to +32°C; 59°F to +89.6°F
	BT17802 (BT8A78CH2-I02)	
	BT17801 (BT8A78CH1)	
Storage temperature		-40°C to +70°C; -40°F to +158°F

Be familiar with the electrical and occupational safety guidelines for your country, for example:

- In the United States, reference the latest edition of *The National Electrical Code* (NEC), and the latest guidelines of the U.S. Department of Labor, Occupational Safety & Health Administration (OSHA).
- In Canada, reference the latest edition of *The Canadian Electrical Code* (CEC), and the latest guidelines of the Canadian Centre for Occupational Health and Safety (CCOHS).

Critical Safety Warnings



WARNING: BTI7800 Series equipment is only suitable for connection to intrabuilding wiring.



WARNING: BTI7800 Series equipment is suitable for installation in a common bonding network.



WARNING: Do not install power cabling on an electrically live system. Ensure that all power is removed from the shelf before continuing with this procedure. Actual wire gauge should be determined based on local engineering standards and practices.



WARNING: Before connecting power to the BTI7800 Series chassis, remove the fuses or circuit breakers from both the A and B sides of the battery distribution bay (BDB) and power distribution panel (PDP). Failure to do so can cause serious injury or death.



WARNING: Touching electrical connectors or other exposed electrical circuitry inside the BTI7800 Series chassis or other provisioned circuit packs when they are energized can cause serious injury or death.

NEBS Requirements

The following table lists some important regulatory requirements for NEBS (Network Equipment-Building System) that you must follow when installing BTI7800 equipment.

NEBS Section	Statement
GR-1089 Section 4	An external Surge Protection Device (SPD) is to be used at the AC power service entrance.
GR-1089 Section 9	Only copper cables are to be used for grounding purposes.
	The grounding conductor AWG size should match the size of the power cable AWG.
	Bare conductors must be coated with antioxidant before crimp connections are made.
	All centralized power sources, not embedded into a BTI7800 chassis, are to be grounded to the Central Office (CO) electrical ground system (GND). The return terminal of the power source is to be connected to the CO GND.

CHAPTER 2

BTI7800 Series Chassis

- [Chassis on page 29](#)
- [Power on page 39](#)
- [Cooling on page 55](#)
- [Chassis Alarm Panel \(CAP\) on page 65](#)

Chassis

The BTI7800 Series platform provides high-density optical and transport solutions with industry-leading scale and performance. It comes in different form factors ranging from 1U for smaller remote sites to 14U for larger data centers. All chassis variants support the same universal forwarding modules that transpond and muxpond traffic on 10-Gbps and 100-Gbps interfaces including 100-Gbps coherent DWDM.

Together with its ROADM capabilities, the BTI7800 Series provides a complete end-to-end optical transport solution that can scale from 10 Gbps to nx100 Gbps and beyond.

The BTI7800 Series is available in different chassis form factors.

Table 6: BTI7800 Chassis Types

Chassis	Product Equipment Code (PEC)	Description
BTI7814	BT8A78CH14	14-slot chassis Supports all BTI7800 service modules and features.
BTI7802	BT8A78CH2-I02	2-slot chassis Supports all BTI7800 service modules and features.

Table 6: BT17800 Chassis Types (continued)

Chassis	Product Equipment Code (PEC)	Description
BT17801	BT8A78CH1	1-slot chassis Supports the following service modules: <ul style="list-style-type: none"> • UFM3 • UFM4 • UFM6 • WPS4 • AMP1



NOTE: The collective name, BT17800, is used to refer to all chassis types when distinction between chassis types is not needed.

BT17814 Chassis

The BT17814 chassis has 14 universal slots that can be individually equipped with traffic-carrying service modules. The BT17814 can be installed in 19-inch, 23-inch, and ETSI 600-mm racks.

Table 7: BT17814 Chassis Overview

Component		Access
System control	CMM Slots A and B, to support up to two Chassis Management Modules	Front
	Front panel display	Front
	Chassis Alarm Panel	Rear
Service slots	Slots 1 to 14 from left to right, to support high speed interface connections for service modules	Front
Cooling	Fan modules	Front
	Booster fan modules (Only required for chassis operation with UFM6 modules)	Rear
	Air intake grill (with access to air filter)	Front
	Fan exhaust	Rear
Power management	Power Entry Modules (AC and DC PEMs)	Rear

Figure 3: BTI7814 Chassis Front View

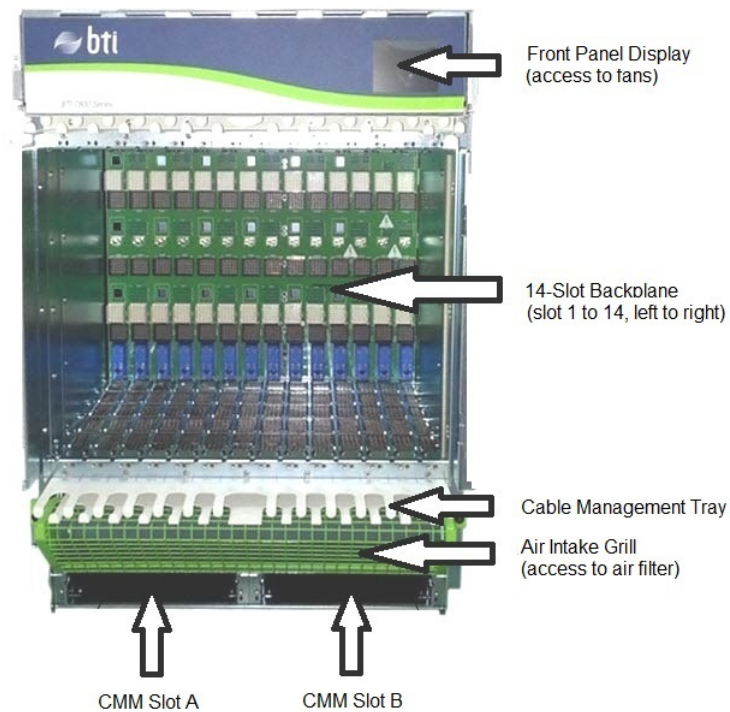


Figure 4: BTI7814 Chassis Rear View with 14-Slot Chassis DC Power Entry Modules

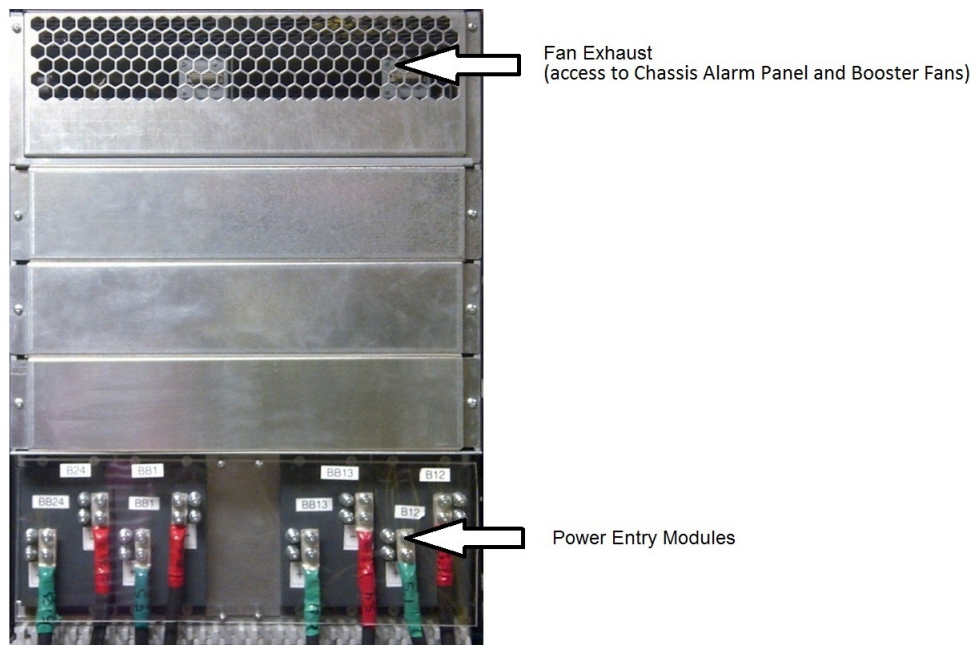


Table 8: BT17814 Major Common Equipment Components

Component	PEC	Release Introduced
14-Slot Chassis Alarm Panel	BT8A78CAP1	Release 1.1
14-Slot Chassis Front Cooling Module	BT8A78FAN3	Release 1.1
BT17814 Booster Fan	BT8A78FAN9	Release 4.1
14-Slot Chassis DC Power Entry Module	BT8A78PEM3-DC	Release 1.1
2900W (53.5V) AC Rectifier Module	BT8A78ACM1	Release 1.5
Chassis Management Module	BT8A78CMM1	Release 1.1

BT17814 Chassis Kits

The BT17814 can be ordered as a kit that includes the bare chassis along with common equipment modules, tools, and installation hardware:

Table 9: BT17814 Kits

Main Equipment Included	Quantity	Component PEC
Equipment common to all BT17814 kits		
Chassis Management Module (CMM1)	2	BT8A78CMM1
14-Slot Chassis Alarm Panel (CAP1)	1	BT8A78CAP1
14-Slot Chassis Front Cooling Module (FAN3)	4	BT8A78FAN3
Line card filler panels (FLR7)	14	BT8A78FLR7
Chassis common tool kit (includes chassis installation kit, BIC extractor tools, adjustable wrist strap, and other hardware)	1	BT8A78TOOLS
Chassis crimp lug installation kit	1	BT8A7867
14-Slot Chassis, DC-KIT2 (BT8A78CH14-KIT2)		
14-Slot Chassis, DC, with 4 DC PEMs (BT8A78PEM3-DC)	1	BT8A78CH14
14-Slot Chassis, DC-KIT3 (BT8A78CH14-KIT3-DC)		
14-Slot Chassis, DC, with 4 DC PEMs (BT8A78PEM3-DC)	1	BT8A78CH14

Table 9: BTI7814 Kits (continued)

Main Equipment Included	Quantity	Component PEC
BTI7814 Booster Fan (FAN9)	2	BT8A78FAN9
14-Slot Chassis, AC-KIT2 (BT8A78CH14-KIT2-AC)		
14-Slot Chassis, AC	1	BT8A78CH14-AC
AC PEM	4	BT8A78ACM1
14-Slot Chassis, AC-KIT3 (BT8A78CH14-KIT3-AC)		
14-Slot Chassis, AC	1	BT8A78CH14-AC
AC PEM	4	BT8A78ACM1
BTI7814 Booster Fan (FAN9)	2	BT8A78FAN9

BTI7814 Chassis Specifications**Table 10: BTI7814 Chassis Specifications**

Shell	Specification
Height	24.5 in
	621 mm
	14 U
Width (without mounting brackets)	17.3 in
	440 mm
Width (with mounting brackets)	19 in
	482 mm
Depth	22 in
	560 mm
Weight (shell only)	76 lb
	34.3 kg
Weight (approximate fully populated)	227.7 lb
	104.86 kg
NOTE: Includes optional cover and all modules and filler panels.	
Total chassis power (fully populated)	7600 W

Table 10: BTI7814 Chassis Specifications (continued)

Shell	Specification
NEBS	GR-1089
	GR-3160 (basic temperature range)

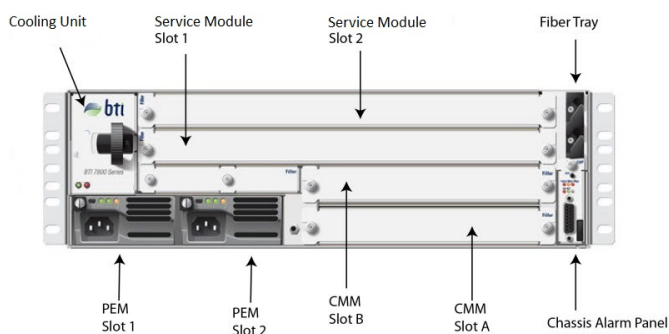
BTI7802 Chassis

The BTI7802 chassis has 2 universal slots that can be individually equipped with traffic-carrying service modules. The BTI7802 can be installed into 19-inch, 23-inch, and ETSI 600-mm racks.

The BTI7802 supports redundant management modules, AC and DC power options, and service modules for high availability.

The chassis provides front access for all components:

- One slot for the cooling module
- Two slots for service modules
- Two slots for redundant Chassis Management Modules
- Two slots for redundant PEM modules
- One slot for the Chassis Alarm Panel

Figure 5: BTI7802 Chassis Front View

The following table lists the common equipment for the BTI7802 chassis:

Table 11: BTI7802 Common Equipment Components

Component	PEC	Release Introduced
2-Slot Chassis Alarm Panel	BT8A78CAP2	Release 1.3
2-Slot Chassis Cooling Module	BT8A78FAN2	Release 1.6
1-Slot/2-Slot Chassis DC Power Entry Module	BT8A78PEM1-DC	Release 1.3
1-Slot/2-Slot Chassis AC Power Entry Module	BT8A78PEM1-AC	Release 1.3

Table 11: BTI7802 Common Equipment Components (continued)

Component	PEC	Release Introduced
Chassis Management Module (CMM)	BT8A78CMM1	Release 1.1

BTI7802 Chassis Kits

The BTI7802 can be ordered as a kit that includes the bare chassis along with common equipment modules, tools, and installation hardware. The following lists the chassis kits available for the BTI7802 chassis:

Table 12: BTI7802 Kits

Main Equipment Included	Quantity	Component PEC
Equipment common to all BTI7802 kits		
2-slot Chassis	1	BT8A78CH2-I02
2-Slot Chassis Alarm Panel (CAP2)	1	BT8A78CAP2
2-Slot Chassis Cooling Module (FAN2)	1	BT8A78FAN2
Line Card Filler Panels (FLR7)	2	BT8A78FLR7
Chassis Common Tool Kit	1	BT8A78TOOLS
2-slot Chassis, DC-KIT3 (BT8A78CH2-KIT3-DC)		
1-Slot/2-Slot Chassis DC Power Entry Module (DC PEM)	2	BT8A78PEM1-DC
DC Power Cable Assembly, 3m	2	BT8A78PWR1
Chassis Management Module (CMM)	1	BT8A78CMM1
2-slot Chassis, DC-KIT4 (BT8A78CH2-KIT4-DC)		
1-Slot/2-Slot Chassis DC Power Entry Module (DC PEM)	2	BT8A78PEM1-DC
DC Power Cable Assembly, 3m	2	BT8A78PWR1
Chassis Management Module (CMM)	2	BT8A78CMM1
2-slot Chassis, AC-KIT3 (BT8A78CH2-KIT3-AC)		
1-Slot/2-Slot Chassis AC Power Entry Module (AC PEM)	2	BT8A78PEM1-AC
Chassis Management Module (CMM)	1	BT8A78CMM1
2-slot Chassis, AC-KIT4 (BT8A78CH2-KIT4-AC)		

Table 12: BT17802 Kits (continued)

Main Equipment Included	Quantity	Component PEC
1-Slot/2-Slot Chassis AC Power Entry Module (AC PEM)	2	BT8A78PEM1-AC
Chassis Management Module (CMM)	2	BT8A78CMM1

The following BT17802 equipment changes were introduced in Release 1.6:

Manufacturing Discontinued Equipment		Replaced By	
Description	PEC	Description	PEC
2-Slot Chassis (CH2)	BT8A78CH2	2-Slot Chassis (CH2-I02)	BT8A78CH2-I02
2-Slot Chassis Cooling Module	BT8A78FAN1	2-Slot Chassis Cooling Module	BT8A78FAN2
2-Slot Chassis, DC-KIT1	BT8A78CH2-KIT1	2-slot Chassis, DC-KIT3	BT8A78CH2-KIT3-DC
2-Slot Chassis, DC-KIT2	BT8A78CH2-KIT2	2-slot Chassis, DC-KIT4	BT8A78CH2-KIT4-DC
2-Slot Chassis, AC-KIT1	BT8A78CH2-KIT1-AC	2-slot Chassis, AC-KIT3	BT8A78CH2-KIT3-AC
2-Slot Chassis, AC-KIT2	BT8A78CH2-KIT2-AC	2-slot Chassis, AC-KIT4	BT8A78CH2-KIT4-AC
Air Filter Elements (10-pack)	BT8A78AFR1	BT17802 Air Filter Elements (10-pack)	BT8A78AFR2

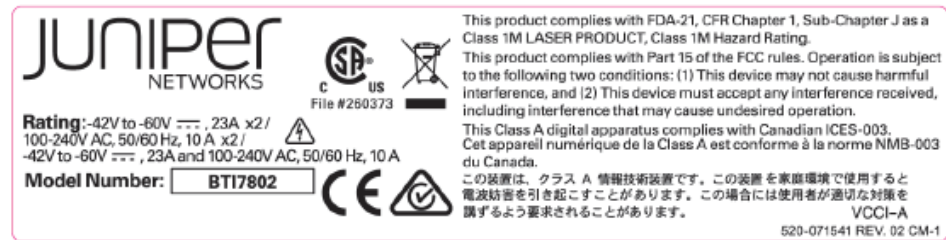
BT17802 Chassis Specifications

Table 13: BT17802 Chassis Specifications

Shell	Specification
Height	5.25 in
	133 mm
	3 U
Width (without mounting brackets)	17.3 in
	440 mm
Depth	12 in (with no modules)
	305 mm
	15 in (with modules)
	381 mm

Table 13: BTI7802 Chassis Specifications (continued)

Shell	Specification
Weight (unpopulated chassis)	15 lb 6.80 kg
Total chassis power (fully populated)	1000 W
NEBS	GR-1089 GR-3160

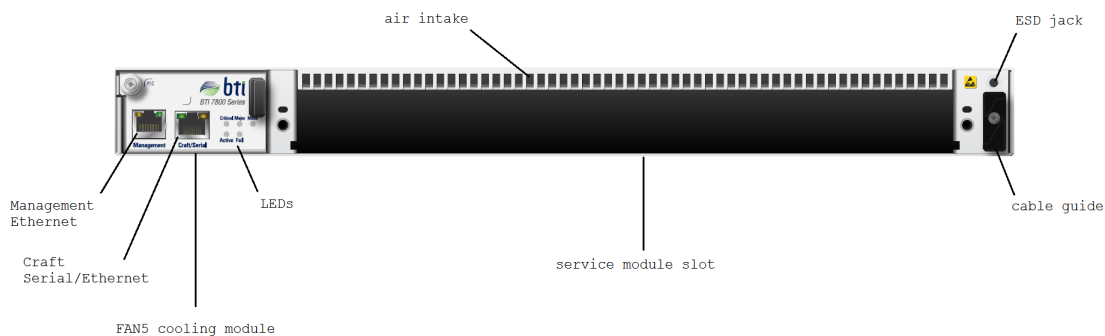


BTI7801 Chassis

The BTI7801 is a 1-slot chassis designed to extend BTI7800 reach to smaller sites that require point-to-point connectivity. The BTI7801 contains one service slot and one management slot, and can be mounted onto 19-inch, 23-inch, and ETSI 600-mm (600-mm (W) x 800-mm (D) cabinets) racks.

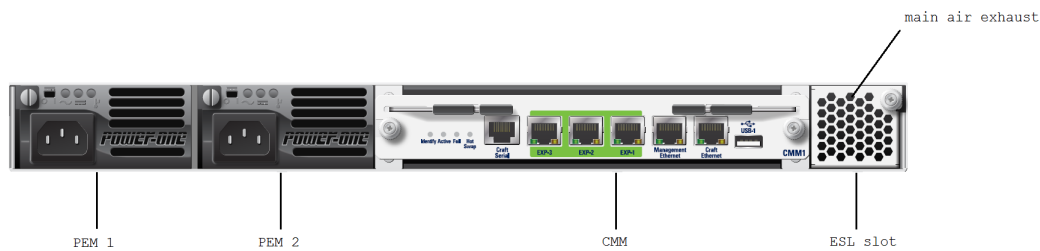
The service module and the cooling module are installed at the front of the chassis:

Figure 6: BTI7801 Chassis Front View



The Chassis Management Module, Ethernet and Serial Link module, and redundant Power Entry Modules are installed at the rear of the chassis:

Figure 7: BTI7801 Chassis Rear View



To provide front access to management ports and chassis alarm indicators, the BTI7801 cooling module is fitted with management ports and chassis status LEDs. For the management ports to be operational, the 1-Slot Chassis Front Cooling Module (FAN5) must be deployed with the optional Ethernet and Serial Link (ESL) module. The ESL module extends management connectivity from the rear of the chassis to the front. It connects to the FAN5 module from the rear and connects to the CMM using external cables.

The LEDs provide a visual indication of the chassis alarm status and do not require the ESL module.

Table 14: BTI7801 Common Equipment Components

Component	PEC	Release Introduced
Ethernet and Serial Link (ESL) module	BT8A78ESL1	Release 2.1
1-Slot Chassis Front Cooling Module	BT8A78FAN5	Release 2.1
1-Slot/2-Slot Chassis DC Power Entry Module	BT8A78PEM1-DC	Release 1.3
1-Slot/2-Slot Chassis AC Power Entry Module	BT8A78PEM1-AC	Release 1.3
Chassis Management Module (CMM)	BT8A78CMM1	Release 1.1



NOTE: The ESL module is optional and must be ordered separately.

BTI7801 Chassis Kits

The BTI7801 can be ordered as a kit that includes the bare chassis along with common equipment modules, tools, and installation hardware. The following lists the chassis kits available for the BTI7801:

Table 15: BTI7801 Kits

Main Equipment Included	Quantity	Component PEC
Equipment common to all BTI7801 kits		

Table 15: BTI7801 Kits (continued)

Main Equipment Included	Quantity	Component PEC
1-slot chassis	1	BT8A78CH1
Chassis Management Module (CMM)	1	BT8A78CMM1
1-Slot Chassis Front Cooling Module (FAN5)	1	BT8A78FAN5
Chassis Common Tool Kit	1	BT8A78TOOLS
1-slot Chassis, DC-KIT1 (BT8A78CH1-KIT1-DC)		
1-Slot/2-Slot Chassis DC Power Entry Module (DC PEM)	2	BT8A78PEM1-DC
DC Power Cable Assembly, 3m	2	BT8A78PWR1
1-slot Chassis, AC-KIT1 (BT8A78CH1-KIT1-AC)		
1-Slot/2-Slot Chassis AC Power Entry Module (AC PEM)	2	BT8A78PEM1-AC

BTI7801 Chassis Specifications

Table 16: BTI7801 Chassis Specifications

Chassis	Specification
Height	1U, 1.7 in (44 mm)
Width (without mounting brackets)	17.3 in (440 mm)
Depth	24.2 in (615 mm) Add 75 mm for cabling at the front and 75 mm for cabling at the rear.
Weight (unpopulated chassis)	20.7 lb (9.35 kg)
Total chassis power (fully populated)	400 W
NEBS	GR-1089 GR-3160 (basic temperature range)

Power

- [BTI7814 Power on page 40](#)
- [BTI7802 Power on page 48](#)

- [BTI7801 Power on page 52](#)
- [BTI7800 Series Component Power Consumption on page 53](#)

BTI7814 Power

The BTI7814 is powered by field-replaceable Power Entry Modules. Both AC and DC versions are supported.



NOTE: If your chassis has redundant PEMs, you will be able to replace a failed PEM while the redundant PEM continues to power the chassis. For more information, see [“BTI7814 Field-Replaceable Units \(FRUs\)” on page 179](#).

- [BTI7814 Power Distribution Plan on page 40](#)
- [BTI7814 DC PEM on page 41](#)
- [BTI7814 DC PEM Specifications on page 43](#)
- [BTI7814 AC PEM on page 44](#)
- [BTI7814 AC PEM Specifications on page 46](#)

BTI7814 Power Distribution Plan

The BTI7814 supports redundant power feed pairs, A1/A2 and B1/B2, that allow the chassis to survive failure in any one feed pair. Both AC and DC feeds are supported.

External power is applied to the Power Entry Modules. The DC outputs of the Power Entry Modules are connected to the internal shelf input terminals (A1, B1, A2, and B2) that, in turn, are connected to the power rails on the shelf. The internal shelf input terminals are not externally visible. The mapping from the DC PEMs and the AC PEMs to these terminals is shown in the following table:

BTI7814 Internal Shelf Input Terminals	DC PEM Slots	AC PEM Slots
A1	DC PEM 1	AC PEM Slot 1 and AC PEM Slot 2 ¹
B1	DC PEM 2	AC PEM Slot 3 and AC PEM Slot 4 ²
A2	DC PEM 3	AC PEM Slot 1 and AC PEM Slot 2 ¹
B2	DC PEM 4	AC PEM Slot 3 and AC PEM Slot 4 ²

¹ The DC outputs of the AC PEMs in these two slots are tied together to supply the A1 and A2 feeds.

² The DC outputs of the AC PEMs in these two slots are tied together to supply the B1 and B2 feeds.

The input feeds at the internal shelf input terminals power the shelf as described in the following table:

Table 17: BT17814 Backplane DC Power Distribution

Input Feeds	Channel	Slot	Modules
A1 and B1	1	Service module slots 3 and 4	Service Modules
	2	Service module slots 5 and 6	Service Modules
	3	Service module slots 7 and 8	Service Modules
	4	Service module slots 1 and 2	Service Modules
	5	Rear fans 5 and 6	BT17814 Booster Fans
	6	CMM slot A	Chassis Management Module (CMM)
A2 and B2		Front fans 1, 2, 3 and 4	Front Fan modules
	1	Service module slots 11 and 12	Service Modules
	2	Service module slots 13 and 14	Service Modules
	3	Future use	Not applicable
	4	Future use	Not applicable
	5	Service module slots 9 and 10	Service Modules
	6	CMM slot B	Chassis Management Module (CMM)
		Future use	Not applicable

Each channel has a fuse rating of 20 Amps.

BT17814 DC PEM

The BT17814 chassis can be powered by up to four DC PEMs (BT8A78PEM3-DC). Two DC PEMs are used to provide the A feeds, for a total of twelve channels on the chassis. Each DC PEM powers six channels that feed various functions. A non-redundant configuration requires two DC PEMs. A redundant configuration requires four DC PEMs. It is recommended that you configure your chassis with four DC PEMs and connect each PEM to its own (separate) power supply and return.

Each DC PEM features two dual-stud return terminals and two dual-stud feed terminals. Typically, only one dual-stud terminal is used. The extra dual-stud terminals can be used for particular applications, such as laboratory applications.

Figure 8: BT17814 14-Slot Chassis DC Power Entry Module



The DC PEMs are located on the rear of the chassis. The slots are numbered **PEM1** through **PEM4** (from right to left). **PEM1** and **PEM2** power one set of six channels, and **PEM3** and **PEM4** power the other set of six channels. For details on the power distribution plan, see [“BT17814 Power Distribution Plan” on page 40](#).

There is a direct correlation between the DC PEM slots and the internal shelf input terminals.

The external **A** feed pair consists of two individual feeds, **A1** and **A2**, which connect to the external input terminals of **PEM1** and **PEM3**. The DC outputs of **PEM1** and **PEM3** supply power to the **A1** and **A2** internal shelf input terminals respectively.

Similarly, the external **B** feed pair consists of two individual feeds, **B1** and **B2**, which connect to the external input terminals of **PEM2** and **PEM4**. The DC outputs of **PEM2** and **PEM4** supply power to the **B1** and **B2** internal shelf input terminals respectively.

This is shown in the following table along with the external breaker requirements for each individual feed:

External Feeds	DC PEM Slots	Internal Shelf Input Terminals	External Breaker Requirements
A1	PEM 1	A1	125A
B1	PEM 2	B1	125A
A2	PEM 3	A2	125A
B2	PEM 4	B2	125A

If an installed DC PEM is not connected to a power feed, but the chassis is otherwise powered (by another PEM), the following occurs:

- The unpowered DC PEM is shown in inventory.
- The red LED on the unpowered DC PEM is illuminated.
- A **powerAbsent** alarm is raised for the unpowered DC PEM.

BTI7814 DC PEM Specifications

Table 18: BTI7814 14-Slot Chassis DC Power Entry Module (BT8A78PEM3-DC) Specifications

Item	Specification
Physical Dimensions	
Height	6.25 in 159 mm
Width	3.50 in 89.0 mm
Depth	6.81 in 157.0 mm
Weight	1.6 lb 0.7 kg
Power Consumption (40°C ambient)¹	99.9% efficient (maximum 20 W)
Power Capacity	4800 W
Voltage	
Input Range ²	-42 VDC to -60 VDC
External Breaker	125 A
Power Cable	The power cord is not supplied by Juniper Networks.
Size	2 AWG
Receptacle	Not applicable
Plug	Not applicable

Table 18: BT17814 14-Slot Chassis DC Power Entry Module (BT8A78PEM3-DC) Specifications (continued)

Item	Specification				
LEDs	LED	Name	Color	State	Description
				Off	Normal operation.
				On	Fuse is blown or not present.
				Blinking	Input power is lost.
	ACT	Active	Green	On	Normal operation.
	H/S	Hot Swap	Blue	Off	Normal operation.
				Blinking	The power circuit is still active and starting to shut down.
				On	The PEM is ready to be removed.
	REV	Reverse voltage	Red	Off	Normal operation.
				On	The wiring is reversed.

¹ Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.

² Input voltages outside this range might cause the chassis to operate unpredictably.



NOTE: The REV LED indicates red to alert the installer that the chassis has been wired in reverse polarity. The installer should switch the power OFF on the chassis and rewire the positive and negative connections to the correct power terminals.

BT17814 AC PEM

The BT17814 chassis can be powered by four fan-cooled 2900W (53.5V) AC Rectifier Modules (BT8A78ACM1). The four rectifier modules and the housing are included when you order the chassis with the AC option (BT8A78CH14-KIT2-AC, BT8A78CH14-KIT3-AC). It is recommended that you install your chassis with all four rectifiers.



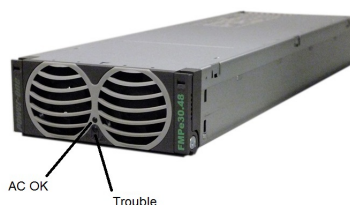
NOTE: The BT17814 chassis can also be powered by an external rectifier. For information on the external, standalone, Power-One® rack-mounted 1U rectifier, see “AC Rectifier” on page 203.

The AC PEM rectifier housing (Figure 9 on page 45) is 4RU tall, and can contain up to four AC PEMs. The rectifier housing and rectifiers come pre-installed on the chassis when you order the chassis with the AC option.

Figure 9: BT17814 AC PEM Housing



Figure 10: BT17814 AC PEM Rectifier



Each rectifier (Figure 10 on page 45) is 1RU tall, and is cooled using internal fans. The rectifier slots are numbered from **Slot 1** (top) to **Slot 4** (bottom). The top two rectifiers are for the **A** feed pair, while the bottom two rectifiers are for the **B** feed pair. For details on the power distribution plan, see “[BT17814 Power Distribution Plan](#)” on page 40.

The external fuse/breaker requirements for each feed is shown in the following table:

External Feeds	AC PEM Slots	Internal Shelf Input Terminals	External Breaker Requirements
A1	Slot 1 ¹	A1/A2	20A
A2	Slot 2 ¹	A1/A2	20A
B1	Slot 3 ²	B1/B2	20A
B2	Slot 4 ²	B1/B2	20A

¹ The DC outputs of the AC PEMs in Slot 1 and Slot 2 are tied together to supply the A1 and A2 feeds.

² The DC outputs of the AC PEMs in Slot 3 and Slot 4 are tied together to supply the B1 and B2 feeds.

Internally, the DC outputs of these rectifiers are protected through user-replaceable fuses. The fuse array for the A1/A2 feeds is located behind the rectifier in Slot 2. The fuse array for the B1/B2 feeds is located behind the rectifier in Slot 3. For instructions on replacing these fuses, see [“Replacing the Fuses on a BT17814 AC PEM” on page 185](#).

If both 2900W (53.5V) AC Rectifier Modules in the same feed pair are not powered (e.g. A1 and A2, or B1 and B2), but the chassis is otherwise powered (by the other feed pair), the following occurs:

- Both unpowered 2900W (53.5V) AC Rectifier Modules are not shown in inventory.
- The red LEDs on the unpowered 2900W (53.5V) AC Rectifier Modules are not illuminated.
- A **powerAbsent** alarm is not raised for either of these two unpowered modules.

If one 2900W (53.5V) AC Rectifier Module is powered and the other 2900W (53.5V) AC Rectifier Module in the same feed pair is seated but not powered, the following occurs:

- The unpowered 2900W (53.5V) AC Rectifier Module is shown in inventory.
- The red LED on the unpowered 2900W (53.5V) AC Rectifier Module is not illuminated.
- A **powerAbsent** alarm is raised for the unpowered module.

BT17814 AC PEM Specifications

Table 19: BT17814 AC Power Entry Module (BT8A78ACM1) Specifications

Item	Specification
Physical Dimensions	
Width	4.2 in 107 mm
Height	1.6 in 41.4 mm
Depth	13.3 in 355.1 mm
Weight	4.7 lb 2.1 kg
Power Consumption (40°C ambient) ¹	The power dissipated depends on the load. The BT8A78ACM1 is 95% efficient.
Power Capacity	<p>NOTE: The power capacity varies with the input voltage.</p> <p>1480 W @ 100 VAC input</p> <p>1640 W @ 110 VAC input</p> <p>2900 W @ 180 VAC input and above</p>
Voltage	Output (nominal) : -53.5 VDC

Table 19: BTI7814 AC Power Entry Module (BT8A78ACM1) Specifications (continued)

Item	Specification			
Input Range ²	100 to 250 VAC (50/60 Hz) NOTE: When running at input voltages below 180 VAC, the chassis must be equipped with all four AC PEMs.			
External Breaker	20 A			
Power Cable	The power cord is not supplied by Juniper Networks. NOTE: The power cord must be installed by a qualified electrician. The cord set must be certified to the following CSA/UL standards: <ul style="list-style-type: none">• CSA C22.2 No. 21 Cord Sets and Power Supply Cords ("solid green" protective earthing conductor acceptable)• UL 817 Cord Sets and Power-Supply Cords ("solid green" protective earthing conductor acceptable)			
Gauge	12 AWG SJT			
Receptacle (to chassis)	IEC C21			
Plug (to power source)	110 V supply ³ : IEC 5-20 240 V supply: IEC 6-20			
LEDs	LED	Name	State	Description
	LED (top)	AC OK	Off	AC FAIL. The input AC voltage is not in range for normal PEM operation.
			Green	AC OK. The input AC voltage is in range for normal PEM operation. ⁴
			Red	A problem has caused the rectifier to go into protection state. The DC output is shut down.
	LED (bottom)	Trouble	Off	Normal operation.
			Amber, Blinking	Internal communication is lost. ⁵
Amber			A problem with the internal PEM fan has been detected. The fan has not yet failed but requires attention.	

Table 19: BTI7814 AC Power Entry Module (BT8A78ACM1) Specifications (continued)

Item	Specification
¹	Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.
²	Running with input voltages below 180 VAC lowers the AC PEM power capacity. See the Power Capacity row above.
³	When running with a 110 V supply, ensure the chassis is equipped with all four AC PEMs.
⁴	This does not indicate that the AC input voltage is within the acceptable range needed to meet the power requirements of the chassis.
⁵	Under normal operation, the PEM provides status information to system controllers across a management bus.

BTI7802 Power

The BTI7802 is powered by field-replaceable power entry modules. Both AC and DC versions are supported.



NOTE: If your chassis has redundant PEMs, you will be able to replace a failed PEM while the redundant PEM continues to power the chassis. For more information, see “[BTI7802 Field-Replaceable Units \(FRUs\)](#)” on page 193.

BTI7802 Power Distribution Plan

The BTI7802 supports redundant power feeds, A and B, that allow the chassis to survive failure in any one feed. External power is applied to the Power Entry Modules, which, in turn, power the chassis. Each PEM can power the whole chassis.

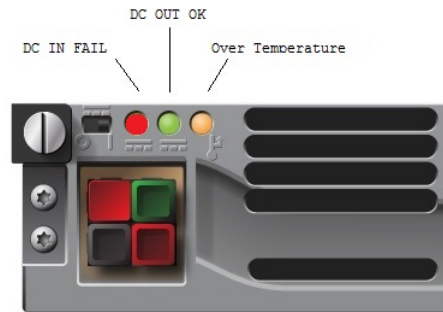
BTI7802 DC PEM

The BTI7802 chassis can be powered by up to two convection-cooled 1-Slot/2-Slot Chassis DC Power Entry Modules (BT8A78PEM1-DC). A non-redundant configuration requires one DC PEM. A redundant configuration requires two DC PEMs. It is recommended that you configure your chassis with two DC PEMs.

The PEM slots are numbered **PEM 1** (left slot) and **PEM 2** (right slot). Each DC PEM can power the full chassis.

In a redundant configuration, the A feed is applied to one DC PEM, and the B feed is applied to the other DC PEM. Each feed should be protected with a 30A breaker.

Figure 11: BT17802 1-Slot/2-Slot Chassis DC Power Entry Module



If a seated DC PEM is not connected to a power feed, but the chassis is otherwise powered (by the other PEM), the following occurs:

- The unpowered DC PEM is shown in inventory.
- The red LED on the unpowered DC PEM is illuminated.
- A **powerAbsent** alarm is raised for the unpowered DC PEM.

BT17802 DC PEM Specifications

Table 20: BT17802 1-Slot/2-Slot Chassis DC Power Entry Module (BT8A78PEM1-DC) Specifications

Item	Specification	
Physical Dimensions		
Width	3.35 in	85 mm
Height	1.59 in	40.5 mm
Depth	12.00 in	305 mm
Weight	1.60 lb	0.7 kg
Power Consumption (40° ambient)	99.9% efficient (maximum 20W)	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.		
Power Capacity	1000 W	

Table 20: BT17802 1-Slot/2-Slot Chassis DC Power Entry Module (BT8A78PEM1-DC) Specifications (continued)

Item	Specification		
Voltage	-42 V DC to -60 V DC		
Input Range	<p>NOTE: Input voltages outside this range might cause the chassis to operate unpredictably.</p>		
External Breaker	30 A		
Power Cable	Juniper Networks-supplied (BT8A78PWR1)		
LEDs	Color	State	Description
AC	Green	OFF	The AC input power is off.
		ON	The AC input power is on.
DC	Green	OFF	The DC output power is off.
		ON	The DC output power is on.
O/T	Amber	OFF	Normal operation.
		ON	An over-temperature condition or a fan fault exists.
Compliance	UL CSA ETSI		

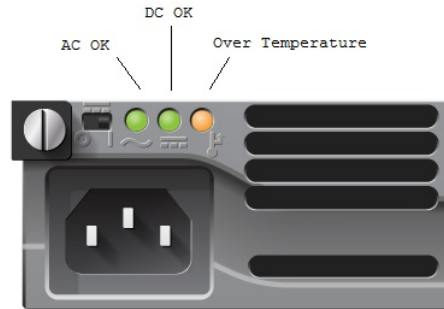
BT17802 AC PEM

The BT17802 chassis can be powered by up to two fan-cooled 1-Slot/2-Slot Chassis AC Power Entry Modules (BT8A78PEM1-AC). Each AC PEM draws air from the front of the chassis and exhausts directly out the rear. A non-redundant configuration requires one AC PEM. A redundant configuration requires two AC PEMs. It is recommended that you configure your chassis with two AC PEMs.

The PEM slots are numbered **PEM 1** (left slot) and **PEM 2** (right slot). Each AC PEM can power the full chassis.

In a redundant configuration, the A feed is applied to one AC PEM, and the B feed is applied to the other AC PEM. Each feed should be protected with a 15A breaker.

Figure 12: BT17802 1-Slot/2-Slot Chassis AC Power Entry Module



If a seated AC PEM is not connected to a power feed, but the chassis is otherwise powered (by another PEM), the following occurs:

- The unpowered AC PEM is not shown in inventory.
- The AC LED on the unpowered AC PEM is not illuminated.
- A **powerAbsent** alarm is not raised for the unpowered module.

BT17802 AC PEM Specifications

Table 21: BT17802 1-Slot/2-Slot Chassis AC Power Entry Module (BT8A78PEM1-AC) Specifications

Item	Specification
Physical Dimensions	
Width	3.35 inches 85.0 millimeters
Height	1.59 inches 40.5 millimeters
Depth	12.0 inches 305 millimeters
Weight	1.6 pounds 0.7 kilograms
Power Consumption (40°C ambient)	The power dissipated depends on the load. The BT8A78PEM1-AC is 90% efficient.
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	
Power Capacity	1000 Watts
Voltage	
Output (nominal)	-48VDC
Input	100 to 250VAC (50/60Hz)

Table 21: BTI7802 1-Slot/2-Slot Chassis AC Power Entry Module (BT8A78PEM1-AC) Specifications (continued)

Item	Specification
External Breaker	15A
Power Cable	The power cord can be ordered from Juniper Networks.
Size	18AWG (recommended for input voltages below 180VAC)
Receptacle (to chassis)	IEC C13
Plug (to power source)	IEC 5-15
LEDs	AC OK: Green (AC input normal) DC OK: Green (DC output normal) Over Temperature: Amber (Over temperature or fan fail condition)
Compliance	UL CSA ETSI

BTI7801 Power

The BTI7801 is powered by the same field-replaceable power entry modules found on the BTI7802. Both AC and DC versions are supported.



NOTE: If your chassis has redundant PEMs, you will be able to replace a failed PEM while the redundant PEM continues to power the chassis. For more information, see [“BTI7801 Field-Replaceable Units \(FRUs\)” on page 199](#).

BTI7801 Power Distribution Plan

The BTI7801 supports redundant power feeds, A and B, that allow the chassis to survive failure in any one feed. External power is applied to the Power Entry Modules, which, in turn, power the chassis. Each PEM can power the whole chassis.

BTI7801 DC PEM

The BTI7801 chassis can be powered by up to two convection-cooled 1-Slot/2-Slot Chassis DC Power Entry Modules (BT8A78PEM1-DC). This is the same PEM that powers the BTI7802. See [“BTI7802 DC PEM” on page 48](#) for more information.

BTI7801 AC PEM

The BTI7801 chassis can be powered by up to two fan-cooled 1-Slot/2-Slot Chassis AC Power Entry Modules (BT8A78PEM1-AC). This is the same PEM that powers the BTI7802. See [“BTI7802 AC PEM” on page 50](#) for more information.

BT17800 Series Component Power Consumption



NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.

Table 22: BT17800 Series Component Power Consumption (at 40°C)

Module	PEC	Typical (W)	Maximum (W)
Service Modules			
Universal Forwarding Module (UFM3)	BT8A78UFM3	32	35
Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (UFM4)	BT8A78UFM4	140	154
Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (UFM6)	BT8A78UFM6-I02	Equipped with 10 QSFP+ 4x10GBASE LR or QSFP+ 4x10G Ethernet/OTN LR: 305 Equipped with 4 QSFP28 100GE LR4: 295	—
96-Channel Amplifier (AMP1)	BT8A78AMP1	68	75
96-Channel Fixed Mux/Demux (FMD96)	BT8A78MD03	0	0
Wavelength Protection Switch (WPS4)	BT8A78WPS4	22	24
BTI Interface Cards			
12x SFP+ BTI Interface Card (12x SFP+ BIC)	BT8A78SFP12G	38	43
1x CFP BTI Interface Card (1x CFP BIC)	BT8A78CFPIG	32	38
Common Equipment			
Chassis Management Module (CMM)	BT8A78CMM1	70	77
14-Slot Chassis Front Cooling Module (FAN3)	BT8A78FAN3	70	77
2-Slot Chassis Cooling Module (FAN2)	BT8A78FAN2	150	165
1-Slot Chassis Front Cooling Module (FAN5)	BT8A78FAN5	65	72
BT17814 Booster Fan (FAN9)	BT8A78FAN9	—	125

Table 22: BT17800 Series Component Power Consumption (at 40°C) (continued)

Module	PEC	Typical (W)	Maximum (W)
BT17814 Chassis Alarm Panel (CAP1)	BT8A78CAP1	2	2.4
BT17802 Chassis Alarm Panel (CAP2)	BT8A78CAP2	2	2.4
BT17814 14-Slot Chassis DC Power Entry Module (DC PEM)	BT8A78PEM3-DC	99.9% efficient	20
BT17802 1-Slot/2-Slot Chassis DC Power Entry Module (DC PEM)	BT8A78PEM1-DC	99.9% efficient	20
BT17814 AC Power Entry Module (2900W (53.5V) AC Rectifier Module)	BT8A78ACM1	95% efficient	145
BT17802 AC Power Entry Module (AC PEM)	BT8A78PEM1-AC	90% efficient	100
Ethernet and Serial Link (ESL)	BT8A78ESL1	0.25	0.25
Pluggable Transceivers			
SFP+ 850nm 200m Dual-Rate 10.3 and 10.5Gbps	BP3AD6SS	0.8	1
SFP+ 1310nm 10km Multi-Rate 9.9 to 11.1Gbps	BP3AM6MS	0.8	1
SFP+ DWDM Fixed 80km Multi-Rate 9.9 to 11.1Gbps	BP3AM6DL-xx	–	1.5
SFP+ DWDM Tunable 80km Multi-Rate 9.9 to 11.1Gbps	BP3AM6TL	1.7	2
QSFP+ 4x10GBASE LR	QSFPP-4X10GE-LR (740-054050)	–	3.5
QSFP+ 4x10G Ethernet/OTN LR	QSFPP-4X10GD-LR (740-058730)	–	3.5
QSFP+ 4x10GBASE SR	QSFPP-4X10GE-SR (740-054053)	–	1.5
QSFP+ 40GE SR4	QSFPP-40GBASE-SR4 (740-067443)	–	1.5
QSFP+ 40GE LR4	QSFPP-40GBASE-LR4 (740-073093 740-043308)	–	3.5
QSFP28 100GE AOC	JNP-100G-AOC-xx (740-06xxxx)	–	3.5

Table 22: BTI7800 Series Component Power Consumption (at 40°C) (continued)

Module	PEC	Typical (W)	Maximum (W)
QSFP28 100GE LR4	QSFP-100G-LR4-2 (740-074685)	–	3.5
QSFP28 100GE Ethernet/OTN LR4	QSFP-100G-LR4-D (740-073859)	–	3.5
QSFP28 100GE SR4	QSFP-100GBASE-SR4 (740-058734)	–	3.5
CFP 100GBASE-SR10 100m	BP3AMASS	10	12
CFP 100GBASE-LR4 10km	BP3AMDLI	20	24
100G Coherent CFP	BP3AMCTL	25	30
100G Coherent CFP-M05	CFP-100GBASE-CHRT	–	32

Cooling

- [BTI7814 Cooling System on page 55](#)
- [BTI7802 Cooling System on page 58](#)
- [BTI7801 Cooling System on page 60](#)

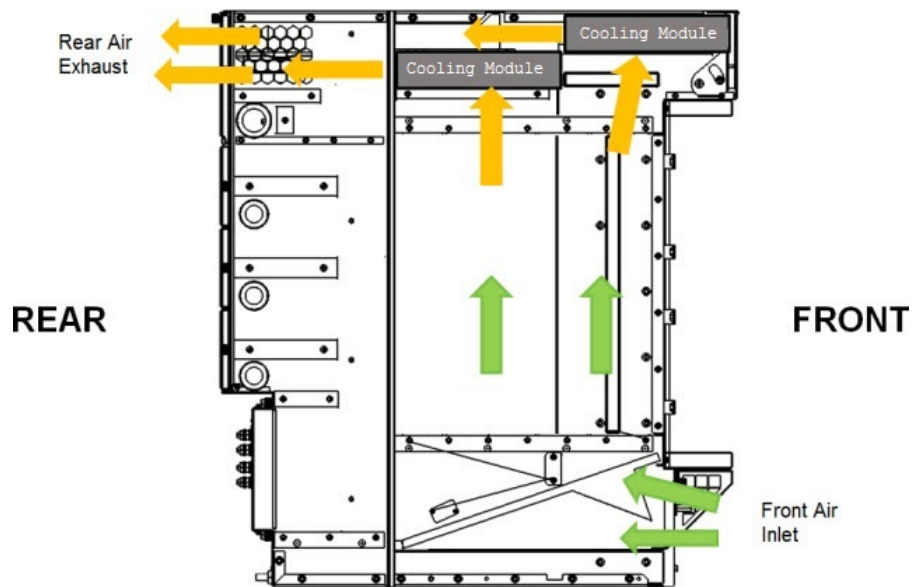
BTI7814 Cooling System

The BTI7814 system uses four 14-Slot Chassis Front Cooling Modules (FAN3) to supply front-to-back air flow through the chassis. When one or more UFM6 modules are installed in the chassis, two BTI7814 Booster Fan modules are required to provide additional cooling. For information, see [“BTI7814 Booster Fans” on page 57](#).

The figure below shows two FAN3 cooling modules on the left side of the chassis. There are two more FAN3 cooling modules on the right side of the chassis (not shown). Each cooling module is connected to the chassis independently from the other cooling modules, and each fan is controlled independently by the Chassis Management Module (CMM). The fans typically work at 60 percent of the maximum fan speed.

Cool air is drawn in from the front of the chassis and exhausts to the rear.

Figure 13: BTI7814 Cooling System Air Flow



Continuous System Operation During a Fan Failure

The BTI7814 continues to operate when a cooling module fails, as follows:

- The system is capable of cooling up to 350 Watts per slot with a single cooling module failure at 35°C indefinitely.
- The fans operate at 100 percent of maximum speed under the following conditions: when the system temperature reaches 35°C; there is a cooling module failure; the CMM is not present.
- The chassis is equipped with louver panels on the back exhaust of each cooling module to eliminate recirculating air when a cooling module fails.



NOTE: The front and rear of the chassis must remain unobstructed to ensure adequate airflow and prevent overheating. If the BTI7814 is installed in a cabinet with doors, the doors must be vented.

BTI7814 FAN3 Specifications

Table 23: 14-Slot Chassis Front Cooling Module (BT8A78FAN3) Specifications

Item	Specification	
Physical Dimensions		
Width	8.25 in	209.5 mm
Height	1.62 in	41.3 mm

Table 23: 14-Slot Chassis Front Cooling Module (BT8A78FAN3) Specifications (continued)

Item	Specification	
Depth	8.25 in	209.5 mm
Weight	3.80 lb	1.70 kg
Power Consumption (40°C ambient)	Typical: 125 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 150 W	
Air Flow	188 CFM	
LEDs	OOS (Out-of-service): Red	
	Hot Swap: Blue	

BTI7814 Booster Fans

Two BTI7814 Booster Fan (FAN9) modules are required to provide auxiliary cooling when one or more UFM6 modules are installed in the BTI7814 chassis. These booster fans are located at the rear of the chassis and are managed individually by the active CMM.



NOTE: FAN9 modules can be managed by the CMM only if the system is running Release 4.1 (or later) software and firmware.

The FAN9 modules operate simultaneously at 19 percent of their maximum fan speed, but the fan speed will increase when any of the following conditions are met:

- Either a FAN3 module or the other FAN9 module has failed.
- Either a FAN3 module or the other FAN9 module is not present in the chassis.
- There is no active CMM in the system.
- The system software and firmware have not yet been upgraded to BTI7800 Series Release 4.1 or later.



NOTE: The fan speed of the FAN3 modules is not affected by the presence and operational status of FAN9 modules. That is, FAN3 fan speed will not increase if one or both FAN9 modules are either not present in the chassis or operationally down.

BT17814 Booster Fan Specifications

Table 24: FAN9 Specifications

Item	Specification	
Physical Dimensions		
Width	8 in	203.2 mm
Height	3.5 in	88.9 mm
Depth	6 in	152.4 mm
Weight	2 lb	0.9 kg
Power Consumption (40°C ambient)	Maximum: 125 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.		
Air Flow	160 CFM	
LEDs	Active: Green	
	Fail: Red	

BT17802 Cooling System

The BT17802 chassis is shipped with the cooling module installed. The cooling module contains three fans, and only one cooling module is required per chassis. The cooling module is located at the top left of the chassis above the Power Entry Modules.

Figure 14: BT17802 Cooling Module Location

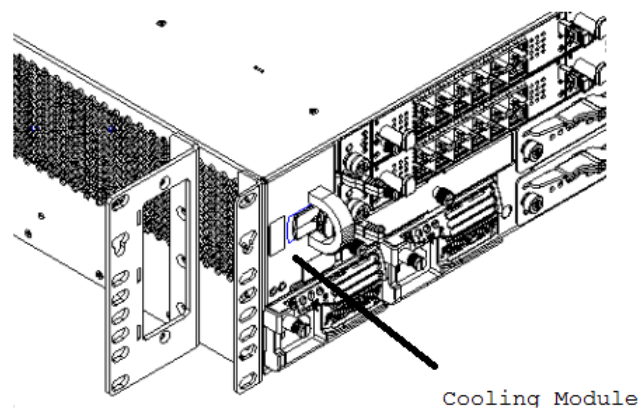
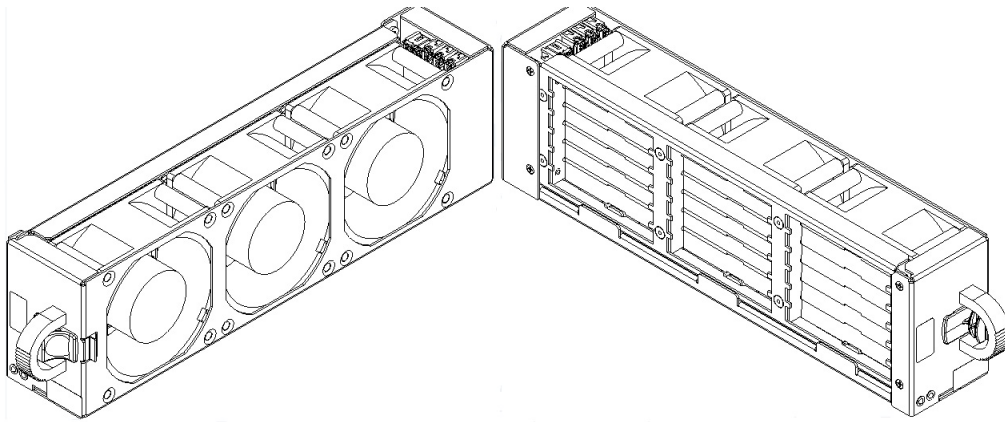


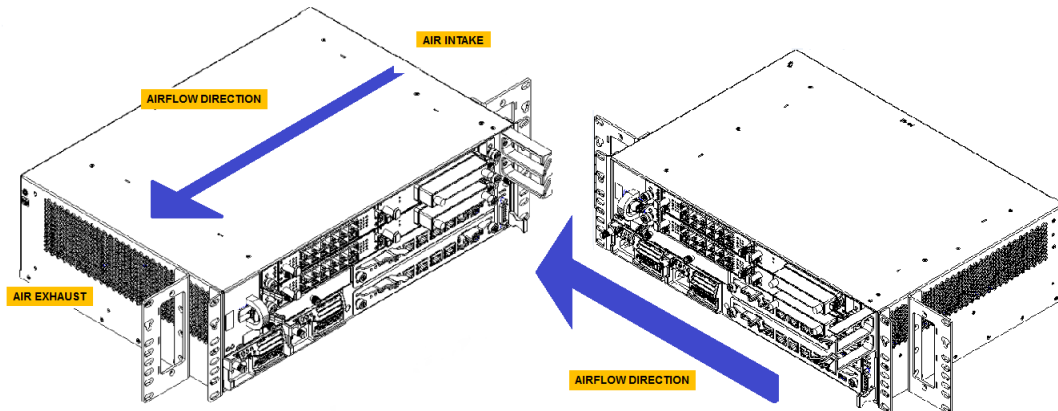
Figure 15: 2-Slot Chassis Cooling Module (BT8A78FAN2) Right and Left Side Views



NOTE: The front, rear, and both sides of the chassis must remain unobstructed to ensure adequate air flow and prevent overheating.

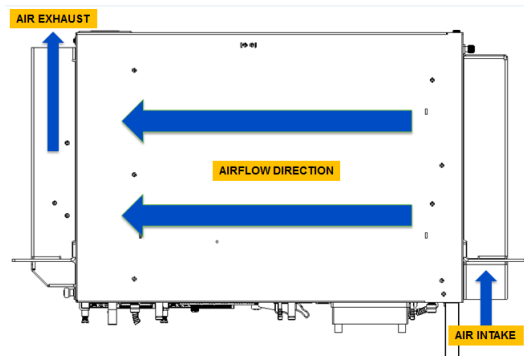
The BT17802 chassis (BT8A78CH2-I02) uses the 2-Slot Chassis Cooling Module (BT8A78FAN2) to create a side-to-side, right-to-left air flow. The air intake and exhaust are located at the sides of the chassis.

Figure 16: BT17802 Cooling System



An optional BT17802 Chassis Rear Exhaust Adapter changes the air intake and exhaust to the front and rear of the chassis respectively. The Rear Exhaust Adapter can only be used when the BT17802 chassis is mounted on a 23-inch rack.

Figure 17: BT17802 Cooling System with Rear Exhaust Adapter



NOTE: The cooling system air filter is accessible from the rear of the chassis. The BT8A78CH2-I02 chassis is shipped with the air filter installed.

BT17802 FAN2 Specifications

Table 25: 2-Slot Chassis Cooling Module (BT8A78FAN2) Specifications

Item	Specification	
Physical Dimensions		
Width	2.18 inches	55 millimeters
Height	3.28 inches	83 millimeters
Depth (excluding handle)	11.47 inches	291 millimeters
Weight	3 pounds	1.36 kilograms
Power Consumption (40°C ambient)	Typical: 150W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 180W	
Air Flow	Maximum: 220 CFM	
LEDs	Fail: Red	
	Active: Green	

BT17801 Cooling System

The BT17801 chassis is cooled by a single cooling module. The 1-Slot Chassis Front Cooling Module (FAN5) is a multi-function unit that contains five fans for cooling, along with integrated Ethernet and craft serial/Ethernet ports and chassis status LEDs. The cooling module is located at the front left of the chassis.

Figure 18: 1-Slot Chassis Front Cooling Module (BT8A78FAN5)

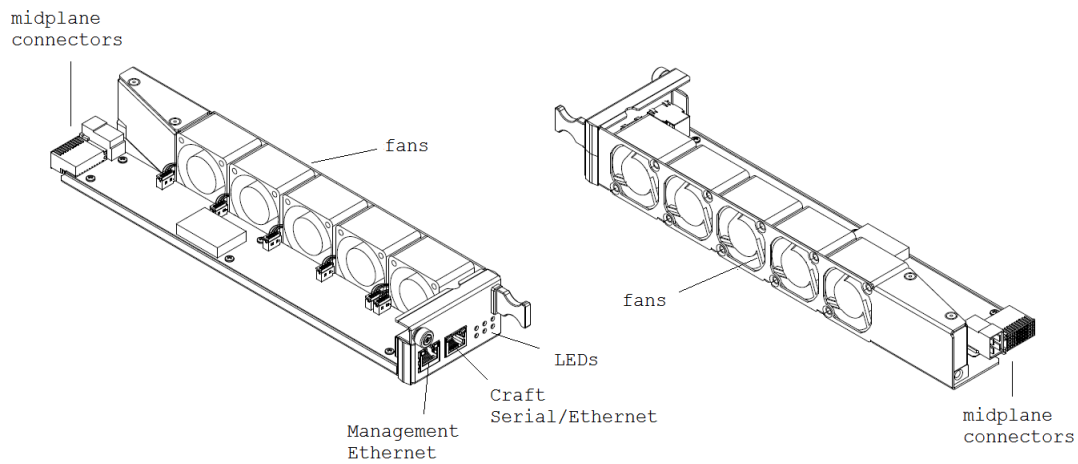
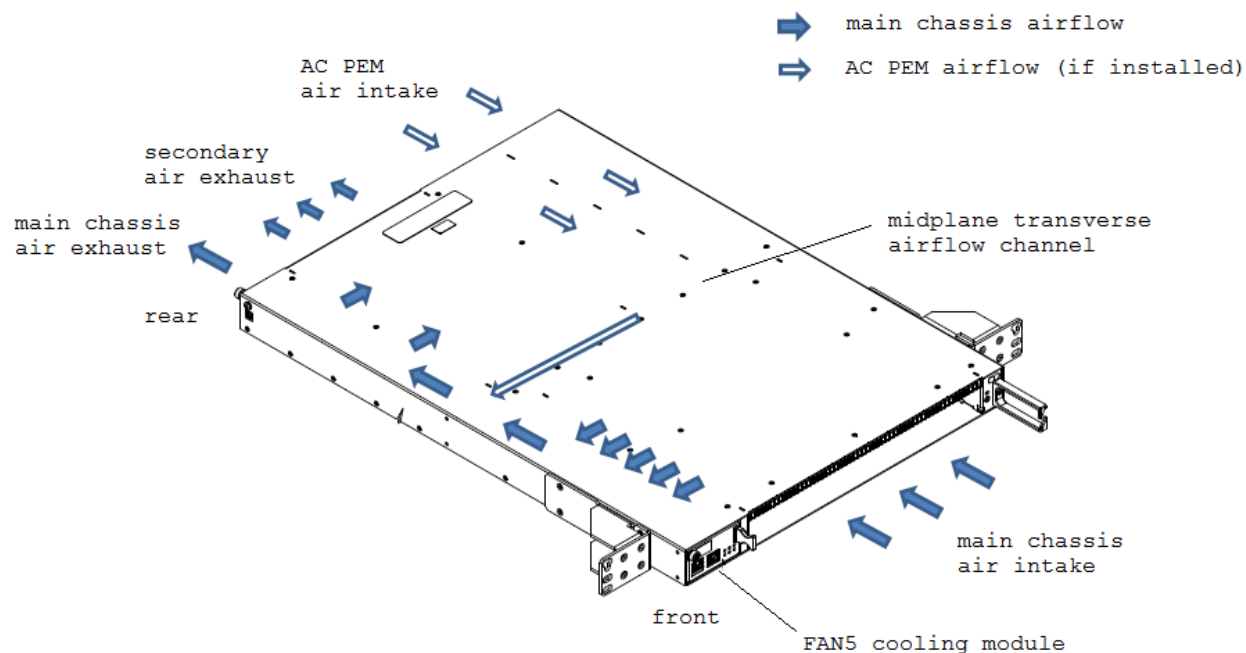


Figure 19 on page 62 shows the airflow through the chassis. Outside air enters the chassis through the air intake above the service module slot. The fans draw the air into the fan module slot and blow the air along the ESL module slot towards the main chassis air exhaust at the rear. Openings in the ESL slot allow some air to flow across the CMM and out the secondary air exhaust above the CMM.

If AC PEMs are installed, the internal AC PEM fans draw air into the module and exhaust the air out along the midplane transverse airflow channel where the air eventually mixes with the main chassis airflow. This channel is located between the front and rear backplanes.

Figure 19: BT17801 Airflow



NOTE: The front and rear of the chassis must remain unobstructed to ensure adequate airflow and prevent overheating.

BT17801 FAN5 Specifications

Table 26: 1-Slot Chassis Front Cooling Module (BT8A78FAN5) Specifications

Item	Specification	
Physical Dimensions		
Width	2.8 in	71 mm
Height	1.6 in	40 mm
Depth (excluding handle)	11.6 in	295 mm
Weight	1 lb	0.45 kg

Table 26: 1-Slot Chassis Front Cooling Module (BT8A78FAN5) Specifications (continued)

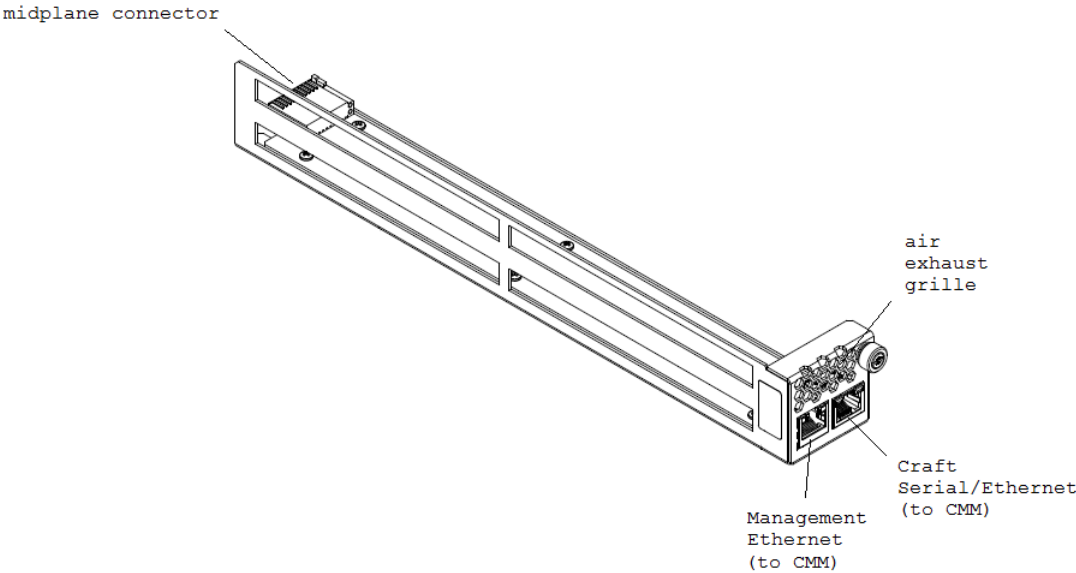
Item	Specification
Power Consumption (40°C ambient) NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Typical: 65 W Maximum: 72 W
Air Flow	Maximum: 110 CFM
LEDs	Fail: Red Active: Green
Chassis Status LEDs	Critical: Red Major: Red Minor: Amber
Port LEDs	Link (right): Green when the link is up on the corresponding CMM management port. Activity (left): Not used. This LED is green when the Link LED is lit. NOTE: The Link LED reflects the status of the link on the corresponding port of the CMM. If you connect a device to a port on the FAN5 module but leave the corresponding port on the CMM unconnected, the Link LED will not light up. Conversely, if you connect a device directly to a CMM port, the corresponding Link LED on the FAN5 module might light up even if no cable is connected to the FAN5 module.

BT17801 FAN5 Management Ports and the ESL Module

The FAN5 module can provide front access to management and craft ports. The FAN5 module works with the optional Ethernet and Serial Link (ESL) module to provide straight-through management and craft port connectivity between the front and the rear of the chassis. Ethernet and/or serial cables are run externally from the CMM at the rear of the chassis to the ESL module, which in turn connects to the FAN5 module directly through the midplane, thereby extending management and craft port connectivity from the CMM through to the front of the chassis.

The ESL module is installed from the rear of the chassis, directly behind the FAN5 module. The ESL module has a management Ethernet and craft serial/Ethernet port for connecting to the CMM, as well as a grille for fan exhaust.

Figure 20: Ethernet and Serial Link Module (BT8A78ESL1)



NOTE: The FAN5 management and craft ports are only operational if the optional ESL module is installed and connected to the CMM.

BT17801 ESL Specifications

Table 27: Ethernet and Serial Link (BT8A78ESL1) Specifications

Item	Specification	
Physical Dimensions		
Width	1.7 in	44 mm
Height	1.6 in	40 mm
Depth (excluding handle)	11.6 in	295 mm
Weight	1 lb	0.45 kg
Power Consumption (40°C ambient)	Typical: 0.25 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 0.25 W	

Table 27: Ethernet and Serial Link (BT8A78ESL1) Specifications (continued)

Item	Specification
Port LEDs	<p>Link (right): Green when the link is up on the corresponding CMM management port.</p> <p>Activity (left): Not used. This LED is green when the Link LED is lit.</p> <p>NOTE: The Link LED reflects the status of the link on the corresponding port of the CMM. If you connect a device to a port on the ESL module but leave the corresponding port on the CMM unconnected, the Link LED will not light up. Conversely, if you connect a device directly to a CMM port, the corresponding Link LED on the ESL module might light up even if no cable is connected to the ESL module.</p>

Chassis Alarm Panel (CAP)

- [BTI7814 CAP on page 65](#)
- [BTI7802 CAP on page 66](#)
- [BTI7801 CAP on page 67](#)

BTI7814 CAP

The BTI7814 Chassis Alarm Panel (CAP) provides a set of relay contacts to signal alarms to an external device, for example a breaker interface panel. The contacts are designed with shielded cable that is grounded at both the device and Front Panel Display interface. The CAP is accessible through the top rear of the chassis, and the display is located at the top right of the chassis front.

The CAP provides the following indications and functions:

- Alarm Cutoff (ACO)/Lamp test button.
- Alarm LEDs
- Telco (Office) Alarm Connector (for pin assignments and input voltages, see *Telco Alarm Connector Pin Assignments*)

Figure 21: BTI7814 Chassis Alarm Panel



BTI7814 CAP1 Specifications

Table 28: 14-Slot Chassis Alarm Panel (BT8A78CAP1) Specifications

Item	Specification	
Physical Dimensions		
Width	3.00 in	76.2 mm
Height	1.25 in	31.8 mm
Depth	4.50 in	114.3 mm
Weight	0.5 lbs	0.22 kg
Power Consumption (40°C ambient)	Typical: 2 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 2.4 W	
LEDs	Critical: Red	
	Minor: Amber	
	Major: Red	
	OOS (Out-of-service): Red	
	Power: Green	

BTI7802 CAP

The BTI7802 chassis is shipped with the Chassis Alarm Panel (CAP) module installed (BT8A78CAP2). The CAP is located on the bottom right, at the front of the chassis, and provides the following functions:

- Alarm Cutoff (ACO)/Lamp test button
- Alarm LEDs
- Telco (Office) Alarm Connector (for pin assignments and input voltages, see [“CAP Telco Alarm Connector Pin Assignments”](#) on page 218)

Figure 22: BTI7802 Chassis Alarm Panel



BTI7802 CAP2 Specifications

Table 29: 2-Slot Chassis Alarm Panel (BT8A78CAP2) Specifications

Item	Specification
Physical Dimensions	
Width	3.00 in 76.2 mm
Height	1.25 in 31.8 mm
Depth	4.50 in 114.3 mm
Weight	1.5 lbs 0.68 kg
Power Consumption (40°C ambient)	Typical: 2 W
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 2.4 W
LEDs	Critical: Red
	Minor: Amber
	Major: Red
	OOS (Out-of-service): Red
	Power: Green

BTI7801 CAP

The BTI7801 does not have a separate Chassis Alarm Panel. The chassis alarm LEDs are located on the FAN5 module. See “[BTI7801 FAN5 Specifications](#)” on page 62.

CHAPTER 3

Unpacking the BTI7800 Series Shipment

- [Unpacking the Equipment on page 69](#)
- [Verify Shipment Contents on page 70](#)
- [Lifting and Moving the BTI7814 Chassis on page 70](#)

Unpacking the Equipment

The number of packages and contents of your BTI7800 shipment is dependent on the chassis platform and configuration, and the modules and pluggable transceivers that you ordered. When unpacking the equipment, you should verify the contents against the bill of sale, and visually inspect all the equipment to verify that it is not damaged. For detailed information about the equipment, refer to the particular equipment topic. This section describes general instructions for unpacking BTI7800 Series equipment.

When unpacking the BTI7800 equipment:

- Leave equipment packed until it is needed for immediate installation.
- After unpacking the equipment, save and store the packaging material in case the equipment must be returned.
- Inspect all sides of the chassis, looking for any signs of damages while shipping.
- Store the modules in their antistatic bags until you are ready to install them.
- Handle the modules by the edges to avoid touching any pins, leads, or solder connections on the circuit board.

If the packaging is damaged and possible equipment damage is present, preserve as much of the packaging as possible and contact Juniper Networks Support.

1. Open the top of the shipping container.
2. Remove any information sheets and sub-packages.
3. Carefully remove the protective packing material from the top of the chassis.
4. Remove the packaging from the BTI7800 Series chassis.

The BTI7814 chassis ships boxed on a standard wooden pallet.

With the chassis still on the pallet, remove the plastic strapping from the box and lift the box up, over and away from the chassis. Place the box out of the way, so that it is not obstructing the area around the chassis, or obstructing the path to the chassis rack. Before moving the chassis, refer to [“Lifting and Moving the BT17814 Chassis” on page 70](#).

5. Perform a visual inspection of all equipment to verify that it is not damaged from the transport.

You have successfully completed this procedure.

Verify Shipment Contents

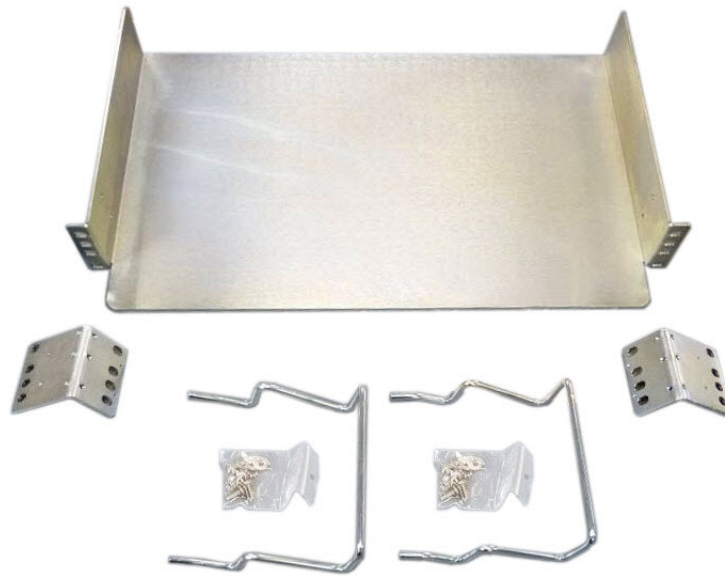
Refer to your bill of sale to verify which and how many components should be included with your shipment. For details on the contents of the different chassis kits, see [“BT17814 Chassis Kits” on page 32](#), [“BT17802 Chassis Kits” on page 35](#), or [“BT17801 Chassis Kits” on page 38](#).

Lifting and Moving the BT17814 Chassis

This section describes how to use the optional 14-Slot Chassis Shelf Installation Support Bracket Kit (BT8A78SSB1) to lift and move the BT17814 chassis to the rack for installation.

This Shelf Installation Support Bracket Kit can be used for EIA, Weco and ETSI frame types—19 inches, 21 inches, and 23 inches (482.6 mm, 533.4 mm, 584.2 mm).

Component	Description
Lift handles	Used to assist in lifting the chassis. Recommended to be used only to position the chassis in the lower rack position.
Support frame	Used to support the chassis during installation.
Brackets	Used to attach the support frame to the rack.
Two packets of nuts and bolts	Used to secure the brackets to the support frame.

Figure 23: Chassis Installation Kit

To prevent bodily injury when lifting or moving the chassis or other components, follow these guidelines.

Considerations Before You Begin

The weight of the chassis, as delivered, is approximately 80 lb (36.30 kg), which includes the Power Entry Modules (PEMs) and FAN modules. Before lifting, you might want to remove the PEMs and FAN modules to reduce the weight by approximately 10 lb (4.6 kg). See [“BT17814 Field-Replaceable Units \(FRUs\)” on page 179](#) for instructions on removing and reinstalling these modules.

Always use best practices to lift and move the chassis. We recommend the following:

- A minimum of two people.
- Four people to provide proper balance and safety—two at the front and two at the back.
- You should have a dolly on hand to move the chassis, or a mechanical lift, particularly, if you are mounting the chassis at the top of the rack. Because of the weight of the chassis, the mechanical lift provides safety and ease for lifting the chassis to a high rack position.



CAUTION: To ensure safety, follow these guidelines:

- Ensure that your footing is solid.
- Do not move suddenly or twist your body when lifting the chassis.

- When lifting the chassis, bend at your knees not your waist.
 - When moving the chassis, be sure you have an unobstructed path to the rack.
-

Mounting the Support Frame

The support frame is used, temporarily, to support the chassis during chassis rack installation. Before you move the chassis to the rack, mount the frame on the rack using the brackets, and nuts and bolts included in the bracket kit. Mount the frame in the rack where the bottom of the chassis is going to be positioned.

Figure 24: Chassis Support Frame



Moving the Chassis

After the support frame is mounted, attach one lift handle on each side of the chassis by inserting the handle tips into the pre-drilled holes on the sides of the chassis. At least, one person should be positioned on each side of the chassis to grab a handle. For proper balance, an additional person should be positioned in front of the chassis, and another in the back. At the same time, everyone should lift the chassis and carefully move the chassis to the rack and place it on the support frame.

Figure 25: Chassis Lift Handles



The lift handles must be removed before fully sliding the chassis onto the support frame. Be sure to have someone support the front of the chassis when you remove the handles. After removing the handles, slide the chassis into position on the support frame and secure the chassis with the supplied fasteners. After the chassis is securely rack mounted, you can remove the support frame for future use.



NOTE: For detailed rack mounting procedures, refer to “[Rack-Mounting the BTI7814 Chassis](#)” on page 84.

CHAPTER 4

Installing the BTI7800 Series Chassis

- Site Requirements on page 75
- Chassis Installation Kits on page 76
- Tools for Installation on page 78
- Installing the BTI7802 Chassis Rear Exhaust Adapter on page 78
- Rack-Mounting the Chassis on page 84
- Grounding the Chassis on page 89
- Powering the Chassis on page 94
- Connecting the ESD Wrist Strap Cable on page 105

Site Requirements



WARNING: You must observe these site and safety requirements to ensure safe operations and proper performance of BTI7800 Series equipment.



NOTE: Restricted Access refers to an inaccessible location that is normally inaccessible by the general public by means of any administrative or engineering control measure, but is accessible to authorized personnel who might not have laser safety training.

Table 30: Environmental Site Requirements

Site Criteria	Requirements
Location	<p>BTI7800 equipment must be installed in a Restricted Access Location in the Central Office (CO) of Network Telecommunication Facilities.</p> <p>The chassis should be installed where personnel cannot interfere with cables and cords connected to the chassis.</p> <p>The chassis should be installed where cables and rack location do not obstruct chassis ventilation openings.</p>

Table 30: Environmental Site Requirements (continued)

Site Criteria		Requirements
Electrical	BT17814 (BT8A78CH14)	See the electrical requirements in “ BT17814 Power ” on page 40.
	BT17802 (BT8A78CH2-I02)	See the electrical requirements in “ BT17802 Power ” on page 48.
	BT17801 (BT8A78CH1)	See the electrical requirements in “ BT17801 Power ” on page 52.
Electrostatic		Always use ESD grounding devices when handling components.
Humidity		5% to 95% non-condensing
Operating temperature	BT17814 (BT8A78CH14)	15°C to +32°C; 59°F to +89.6°F
	BT17802 (BT8A78CH2-I02)	
	BT17801 (BT8A78CH1)	
Storage temperature		-40°C to +70°C; -40°F to +158°F

Chassis Installation Kits

Each BT17800 Series chassis is shipped with one or more installation kits that include the hardware needed to mount, power, and ground the chassis.

The BT17800 Series Chassis Common Tool Kit (BT8A78TOOLS) includes BIC extractor tools, an adjustable wrist strap, and the following Chassis Installation Kit:

Table 31: Chassis Installation Kit (BT8A7865)

Main Components	Quantity	Function
Screw Machine, #10-32 X 0.5 inches, Pan head, Phillips, MS, SS	10	Mounting bracket screws, ground wire screws, #10-32 frame types.
Screw, #12-24 X 0.5 inches, Pan head, Phillips, MS, SS	10	Mounting bracket screws, ground wire screws, #12-24 frame types.
Washer, #10 Ext Tooth lock, SS	4	Chassis ground lugs to frame.
Washer, #10 Flat, SS	8	Washer under mounting bracket screws.
Washer, #12 Ext Tooth lock, SS	6	Chassis ground lugs to frame.
Washer, #12 Flat, SS	8	Washer under mounting bracket screws.

Table 31: Chassis Installation Kit (BT8A7865) (continued)

Main Components	Quantity	Function
Screw M6 X 12 mm, Hex head steel	2	BTI7814 ground lugs to chassis.
Screw, M4 X 6 mm, Pan head, Phillips, with Ext lock washer, SS	2	BTI7802 ground lugs to chassis.
Lug, 10-12AWG #12 Stud insulated	2	BTI7802 chassis ground lugs.
Lug, 10-12AWG #10 Stud insulated	2	BTI7802 chassis ground lugs.
Packing bag for installation kit	1	Installation hardware plastic shipping bag.

The BTI7814 Chassis Crimp Lug Installation Kit (BT8A7867) is shipped with every BTI7814 chassis:

Table 32: BTI7814 Chassis Crimp Lug Installation Kit (BT8A7867)

Main Components	Quantity	Function
Dual stud crimp lug #2 AWG Wire, 5/8" Stud pitch, 1/4" Stud diameter	10	8 power cable lugs plus 2 chassis ground lugs, same part.
Packing bag for installation kit	1	Installation hardware plastic shipping bag.

The following kits and cables are optional and must be ordered separately:

Table 33: Miscellaneous Kits and Accessories

Name	PEC	Description
BTI7814 Chassis Shelf Installation Support Bracket Kit	BT8A78SSB1	For use when rack-mounting the BTI7814 chassis.
BTI7814 Air Filter Elements (10-pack)	BT8A78AFR3	Replacement air filter elements for the BTI7814.
BTI7802 Chassis Rear Exhaust Adapter	BT8A78REX	Air deflectors for the BTI7802 to accommodate front to rear airflow in a 23-inch rack.
BTI7802 AC PEM Cable	North America: BP1A58GA Europe: BP1A58HA United Kingdom: BP1A58JA Australia: BP1A58KA	AC PEM cable for BTI7802 chassis, 1.5m.
BTI7802 Air Filter Elements (10-pack)	BT8A78AFR2	Replacement air filter elements for the BTI7802.

Table 33: Miscellaneous Kits and Accessories (continued)

Name	PEC	Description
BT17801 Chassis Support Bracket Kit	BT8A78SSB3	Additional bracket for use when mounting the BT17801 chassis into a 4-post 19-inch or ETSI 600-mm cabinet.

Tools for Installation

Tools to have on-hand when you are ready to install the BT17800 Series chassis:

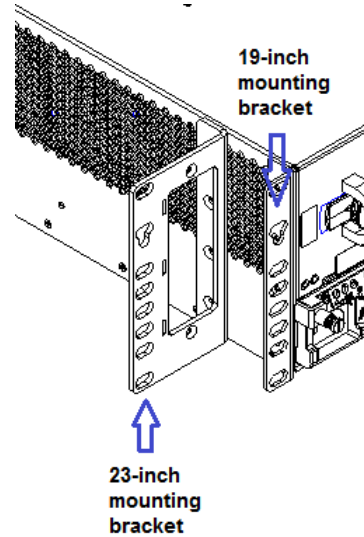
- Number 1 Phillips screwdriver
- Number 2 Phillips screwdriver
- 10 mm socket or wrench
- T15 Torx[®] screwdriver (for fastening mounting brackets onto a BT17814 chassis)
- Grounded antistatic mat to place modules
- ESD grounding strap to prevent electrostatic discharge damage
- Wire stripping and crimping tool
- Multimeter
- Tape measure, to verify adequate spacing around the rack, and between chassis in a multi-chassis rack configuration

Installing the BT17802 Chassis Rear Exhaust Adapter

Use this procedure to install the Rear Exhaust Adapter onto a BT17802 chassis to accommodate front-to-rear airflow when the chassis is mounted onto a 23-inch rack.

Prerequisites:

- Ensure the 19-inch mounting brackets are removed and the 23-inch mounting brackets



are securely attached to the chassis.

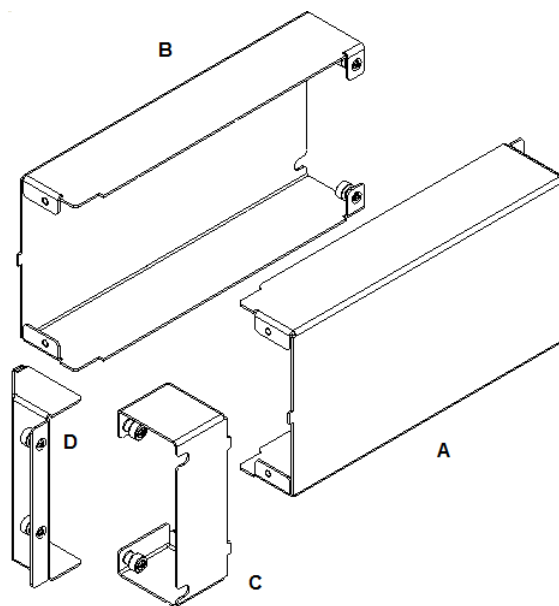


WARNING:

- This equipment is intended to be installed and serviced by qualified personnel.
- Make sure you are familiar with the site and safety guidelines.
- Use an ESD wrist strap whenever you handle equipment.

Install the Rear Exhaust Adapter before mounting the chassis onto the rack. The Rear Exhaust Adapter kit is comprised of four brackets and all required fasteners.

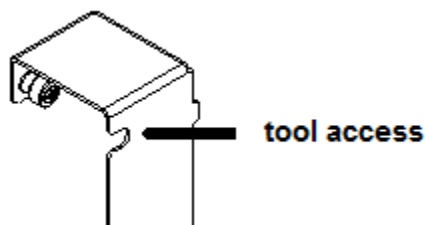
Figure 26: Rear Exhaust Adapter Kit (BT8A78REX)



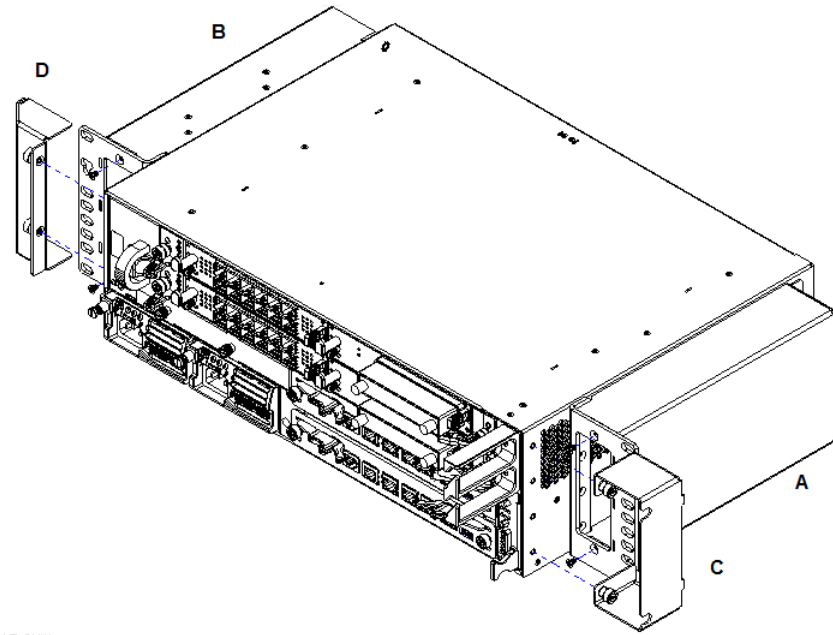
Item	Bracket Description	Fastener
A	Right rear air deflector (open front, closed rear)	2 captive screws fasten to chassis 2 M3.5x5mm screws (supplied) fasten to 23 inch bracket
B	Left rear air deflector with rear exhaust	2 captive screws fasten to chassis 2 M3.5x5mm screws (supplied) fasten to 23 inch bracket
C	Right front air intake	2 captive screws fasten to chassis
D	Left front cover	2 captive screws fasten to chassis

Tools required

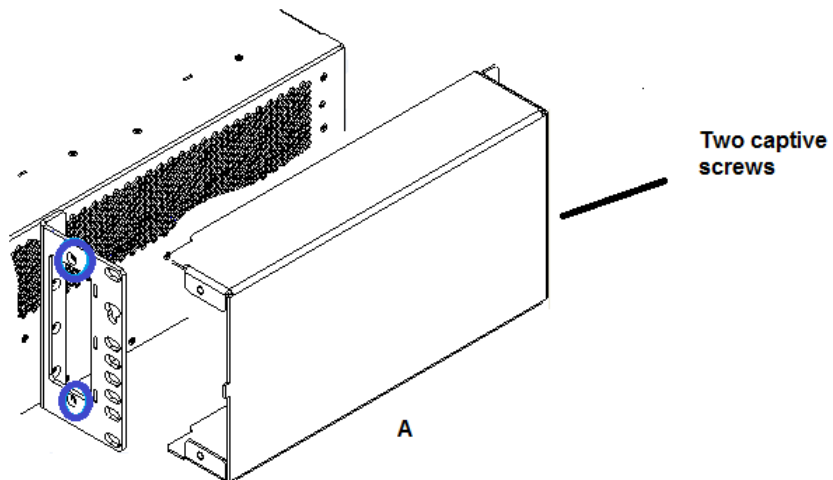
- Number 1 Phillips screwdriver - the shaft of the screwdriver should be longer than 3 inches in order to reach the screw through the tool access opening



Install the rear brackets A and B to the mounting bracket before you attach the front brackets C and D to the chassis.

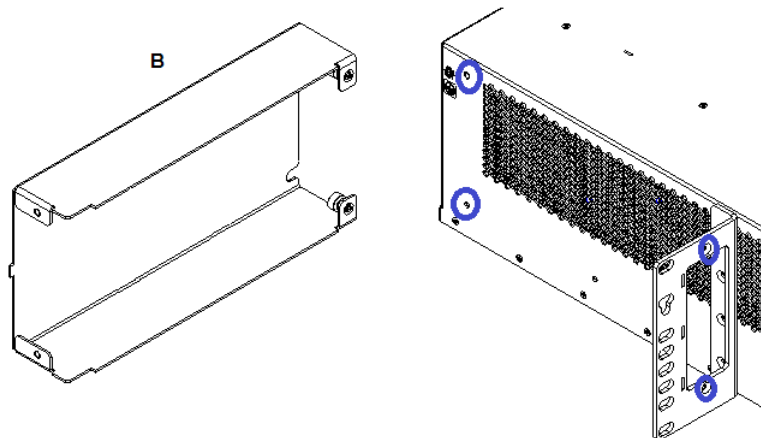


1. Install the right rear air deflector.
 - a. Place the air deflector behind the 23-inch mounting bracket.

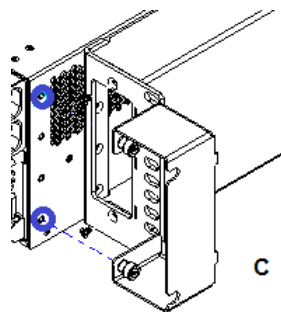


- b. Insert the metal tab into the slot of the 23-inch mounting bracket.
 - c. Align the bracket drill holes with the mounting bracket screw inserts. Fasten the bracket to the mounting bracket using the two M3.5 screws.
 - d. Align the captive screws on the rear of the bracket to the chassis screw inserts. Fasten the captive screws.
 - e. Ensure all surfaces are flush.
2. Install the left rear air deflector.

- a. Place the air deflector behind the 23-inch mounting bracket.

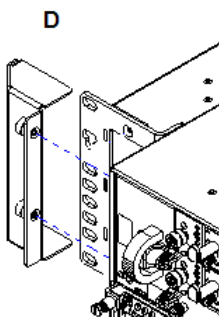


- b. Insert the metal tab into the slot of the 23-inch mounting bracket.
 - c. Align the bracket drill holes with the mounting bracket screw inserts. Fasten the bracket to the mounting bracket using the two M3.5 screws.
 - d. Align the captive screws on the rear of the bracket to the chassis screw inserts. Fasten the captive screws.
 - e. Ensure all surfaces are flush.
3. Install the right front air intake.
 - a. Place the air intake in front of the 23-inch mounting bracket.

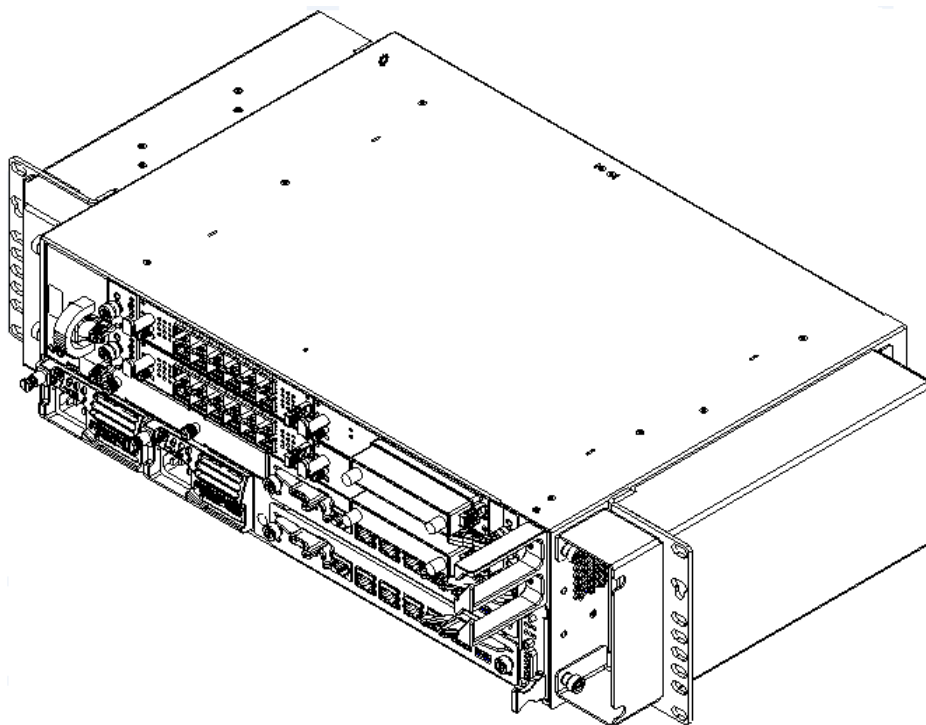


- b. Insert the metal tab into the slot of the 23-inch mounting bracket.
 - c. Align the captive screws on the bracket to the chassis screw inserts. Fasten the captive screws.
 - d. Ensure all surfaces are flush.
4. Install the left front cover.

- a. Place the cover in front of the 23-inch mounting bracket.



- b. Insert the metal tab into the slot of the 23-inch mounting bracket.
- c. Align the captive screws on the bracket to the chassis screw inserts. Fasten the captive screws.
- d. Ensure all surfaces are flush.



You have successfully completed this procedure.

Rack-Mounting the Chassis



CAUTION: Before you proceed, ensure that you are familiar with the safety information described in the *BT17800 Series Hardware Overview and Installation Guide*.



NOTE: Be familiar with the electrical and occupational safety guidelines for your country, for example:

- In the United States, refer to the latest edition of *The National Electrical Code* (NEC), and the latest guidelines of the U.S. Department of Labor, Occupational Safety & Health Administration (OSHA).
- In Canada, refer to the latest edition of *The Canadian Electrical Code* (CEC), and the latest guidelines of the Canadian Centre for Occupational Health and Safety (CCOHS).
- [Rack-Mounting the BT17814 Chassis on page 84](#)
- [Rack-Mounting the BT17802 Chassis on page 86](#)
- [Rack-Mounting the BT17801 Chassis on page 87](#)

Rack-Mounting the BT17814 Chassis

Use this procedure to mount the BT17814 onto a rack.

Table 34: Rack-Mounting Considerations

Issue	Description
Rack size	ANSI 19 in ETSI 600 mm ANSI 23 in
Cabinet size	ETSI 600 mm x 600 mm - for DC chassis kits only NEBS 24 in (depth) - for DC chassis kits only NOTE: For the BT17814 with the AC chassis kit, ensure the selected cabinet has sufficient depth.
Chassis placement in rack	For rack stabilization, load the rack from the bottom up with the heaviest chassis at the bottom.
Number of chassis in a rack	Up to three chassis can be installed in a rack. There are no spacing requirements for the amount of space between chassis.

Installation Tools and Kits

- Number 1 and Number 2 Phillips screwdrivers
- 10 mm socket wrench
- T15 Torx[®] screwdriver (for fastening mounting brackets onto the chassis)
- Chassis Installation Kit (BT8A7865)
- 14-Slot Chassis Shelf Installation Support Bracket Kit (BT8A78SSB1) - optional

If you are using the optional 14-Slot Chassis Shelf Installation Support Bracket Kit (BT8A78SSB1), see also [“Lifting and Moving the BTI7814 Chassis” on page 70](#).

1. Install the correct mounting brackets for the desired rack width.
Mounting brackets for 19-inch, 600-mm, and 23-inch racks are supplied.
2. Get into chassis lifting position.
 - If using a mechanical lift aid, at least two people are required. The chassis should be center balanced.
 - Three people: Two in the front, and one positioned center chassis back.
 - Four people: Two in the front and two in the back, each positioned at a corner of the chassis.
3. With the chassis front facing, grasp the chassis from the bottom, with all personnel positioning their hands on the chassis in the positions stated in Step 1, to ensure proper chassis balance.
4. At the same time, each person slowly lift the chassis and slide it onto the rack until the chassis mounting brackets meet the rack posts.
5. Align the chassis mounting bracket holes with the rack post holes.
6. Insert each screw, loosely, through the lock washer then the flat washer, through the bracket, and finally into the rack post hole. Insert one screw in the top bracket hole on each side, and one screw in the bottom bracket hole on each side. When all the screws are in place, tighten the screws into the rack post.
7. Verify that the chassis is properly placed in the rack, and check each screw to ensure it is securely tightened.

You have successfully completed this procedure.

Rack-Mounting the BT17802 Chassis

Table 35: Rack-Mounting Considerations

Issue	Description
Rack size	ANSI 19 in ETSI 600 mm ANSI 23 in
Cabinet size	ETSI 600 mm x 600 mm NEBS 24 in (depth)
Chassis placement in rack	For rack stabilization, load the rack from the bottom up with the heaviest chassis at the bottom.
Number of chassis in a rack	Up to 14 BT17802 chassis can be installed in a standard 42U server rack. There are no spacing requirements for the amount of space between chassis.

Installation Tools and Kits

- Number 1 and Number 2 Phillips screwdrivers
- Chassis Installation Kit (BT8A7865)



NOTE: 23-inch and 19-inch mounting brackets are assembled on every shipped BT17802 chassis. 21-inch mounting brackets are packaged as a separate item and are shipped with the chassis. Before you begin this procedure you should remove unnecessary mounting brackets by unfastening and removing the screws that attach the brackets to the chassis. Re-use previously mounted bracket screws should you require to attach the 21 inch mounting brackets.

1. Place the BT17802 on a flat surface with the front facing you.
Verify if you need to remove or install the mounting brackets.
2. If you are mounting the chassis in a 23-inch rack or frame, verify if you need to install the BT17802 Chassis Rear Exhaust Adapter.
See [“Installing the BT17802 Chassis Rear Exhaust Adapter” on page 78.](#)
3. Get into rack-mounting position. Choose one of the following options:
 - One person is needed if the chassis is being seated on a rack shelf.

- For balance, two people are needed if the chassis is not being seated on a rack shelf. One person should be positioned at the center front of the chassis and the other at the center back.
4. Align the chassis mounting bracket holes with the rack post holes.
 5. Insert each screw, loosely, through the lock washer then the flat washer, through the bracket, and finally into the rack post hole. One screw in the top bracket hole on each side, and one screw in the bottom bracket hole on each side. When all the screws are in place, tighten the screws into the rack post.
 6. Verify that the chassis is properly placed in the rack, and check each screw to ensure it is securely tightened.

You have successfully completed this procedure.

Rack-Mounting the BTI7801 Chassis

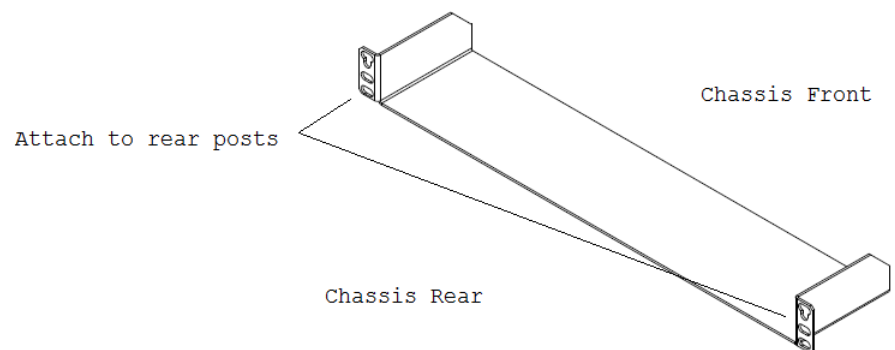
Table 36: Rack-Mounting Considerations

Measurement	Support
Rack size	ANSI 19 in ETSI 600 mm ANSI 23 in
Cabinet size	ANSI 19 in ETSI 600 mm x 800 mm NOTE: Ensure the selected cabinet has sufficient depth to accommodate the BTI7801.
Chassis placement in rack	For rack stabilization, load the rack from the bottom up with the heaviest chassis at the bottom.
Number of chassis in a rack	Up to 42 BTI7801 chassis can be installed in a standard 42U server rack. There are no vertical spacing requirements for the amount of space between chassis.

Installation Tools and Kits

- Number 2 Phillips screwdriver
- 10-mm socket wrench
- Chassis Installation Kit (BT8A7865)
- BTI7801 Chassis Support Bracket Kit (BT8A78SSB3) - for use in 4-post 19-inch and ETSI 600-mm cabinets

1. Place the BT17801 on a flat surface with the front facing you.
2. Install the correct mounting brackets for the desired rack width.
Mounting brackets for 19-inch, 600-mm, and 23-inch racks are supplied.
3. Get into rack-mounting position. Choose one of the following options:
 - One person is needed if the chassis is being seated on a rack shelf.
 - For balance, two people are needed if the chassis is not being seated on a rack shelf. One person should be positioned at the center front of the chassis and the other at the center back.
4. Align the chassis mounting bracket holes with the rack post holes.
5. Insert each screw, loosely, through the lock washer then the flat washer, through the bracket, and finally into the rack post hole one screw in the top bracket hole on each side, and one screw in the bottom bracket hole on each side. When all the screws are in place, tighten the screws into the rack post.
6. If you are mounting the BT17801 into a 4-post 19-inch or ETSI 600-mm cabinet, and if there is no other equipment immediately below the BT17801 to provide support, attach the BT17801 Chassis Support Bracket (BT8A78SSB3) onto the rear posts to support the rear of the chassis.



Working from the rear of the rack, insert each screw, loosely, through the lock washer then the flat washer, through the bracket, and finally into the rack post hole. The support bracket requires four sets of screws, two for each rear post. All screws and washers are included in the BT8A78SSB3 kit. When all the screws are in place, tighten the screws into the rack post.

If you are mounting multiple BTI7801 chassis, one on top of the other, only the bottom BTI7801 chassis requires the support bracket. The support bracket should not be used if you are mounting the BTI7801 directly on top of other equipment.

7. Verify that the chassis is properly placed in the rack, and check each screw to ensure it is securely tightened.

You have successfully completed this procedure.

Grounding the Chassis

- [Frame-Grounding a BTI7814 Chassis on page 89](#)
- [Frame-Grounding a BTI7802 Chassis on page 90](#)
- [Frame-Grounding a BTI7801 Chassis on page 92](#)

Frame-Grounding a BTI7814 Chassis

The BTI7814 uses DC-I grounding configuration with the return ground isolated from the frame ground.



WARNING: You must complete this procedure before connecting power and powering on the chassis. The chassis voltage is considered hazardous.



NOTE: NEBS Compliance Statements for GR-1089:

- Only copper cables are to be used for grounding purposes.
- The grounding conductor AWG size should match the size of the power cable AWG.
- Bare conductors must be coated with antioxidant before crimp connections are made.

Installation Tools and Kits

- Number 1 and Number 2 Phillips screwdrivers
- 10 mm nut-driver
- Wire stripping and crimping tool
- Multimeter
- Chassis Installation Kit (BT8A7865)
- Chassis Crimp Lug Installation Kit (BT8A7867)
- A grounding cable that is at least the same size as the power cable. The dual stud lugs supplied in the Chassis Crimp Lug Installation Kit are for use with 2 AWG cables. The 2 AWG lugs can crimp down to 4AWG.

Location of Ground Connections

There are two grounding locations on the rear of the chassis, one on each bottom corner beneath the PEMs.

Procedure

To frame ground the chassis, use the following procedure:

1. Use a wire stripper tool to strip the end of the ground wire to the correct length (5.0 mm, 0.2 in) for crimping onto the supplied (dual stud) ring lugs.
2. Insert the stripped end of the grounding wire into the open end of the lug.
3. Use a ring lug crimping tool (do not use pliers) to secure the grounding wire in place in the lug.
4. Use the two supplied hex screws and four lock washers (one on each side of each lug hole) to attach the lug to a grounding location on the chassis.

Do not overtighten.

5. Prepare the other end of the grounding wire with a dual stud lug, and connect it to the frame with the two screws and four lock washers (one on each side of each lug hole) supplied in the installation kit.
6. Check the connectivity of the grounding by using a multimeter to measure the resistance between the shelf and the frame. Put one test lead in contact with an unpainted zone of the chassis and the other test lead in contact with the equipment frame. The measured resistance should be less than 1 Ohm.

You have successfully completed this procedure.

Frame-Grounding a BT17802 Chassis

The BT17802 uses DC-I grounding configuration with the return ground isolated from the frame ground.



WARNING: You must complete this procedure before connecting power and powering on the chassis. The chassis voltage is considered hazardous.



NOTE: NEBS Compliance Statements for GR-1089:

- Only copper cables are to be used for grounding purposes.
 - The grounding conductor AWG size should match the size of the power cable AWG.
 - Bare conductors must be coated with antioxidant before crimp connections are made.
-

Installation Tools and Kits

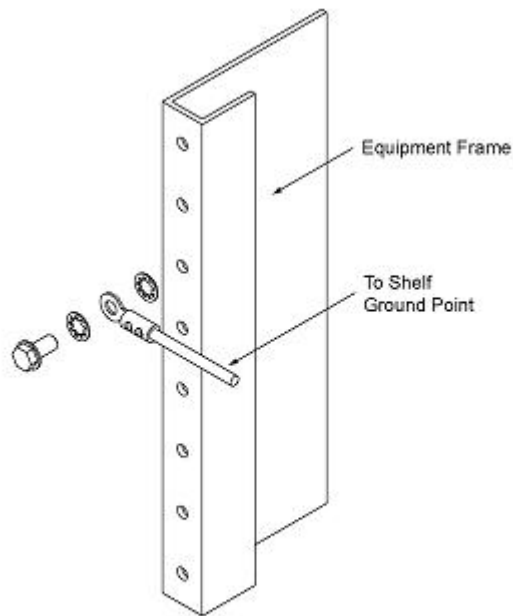
- Number 1 and Number 2 Phillips screwdrivers
- Wire stripping and crimping tool
- Multimeter
- Chassis Installation Kit (BT8A7865)
- A grounding cable that is at least the same size as the power cable. The single stud lugs supplied in the Chassis Installation Kit are for use with 10-12 AWG cables.

Location of Ground Screw

The ground screw is located on the left side of the chassis and is accessible from the rear. It is identified by a grounding label.

1. Use a wire stripper tool to strip the end of the ground wire to the correct length (5.0 mm, 0.2 in) for crimping the supplied ring lugs.
2. Insert the stripped end of the grounding wire into the open end of the lug.
3. Use a ring lug crimping tool (do not use pliers) to secure the grounding wire in place in the lug.
4. Use the supplied screw and two lock washers (one on the top side and one on the bottom side of the lug) to attach the lug to a grounding position on the chassis. Tighten to 20 in-lb.
5. Prepare the other end of the grounding wire with a lug, and connect it to the equipment frame with the screw and two lock washers (one on the top side and one on the bottom side of the lug) supplied in the installation kit.

Do not overtighten.



6. Check the connectivity of the grounding by using a multimeter to measure the resistance between the shelf and the frame. Put one test lead in contact with an unpainted zone of the chassis and the other test lead in contact with the equipment frame. The measured resistance should be less than 1 Ohm.

You have successfully completed this procedure.

Frame-Grounding a BT17801 Chassis

The BT17801 uses DC-I grounding configuration with the return ground isolated from the frame ground.



WARNING: You must complete this procedure before connecting power and powering on the chassis. The chassis voltage is considered hazardous.



NOTE: NEBS Compliance Statements for GR-1089:

- Only copper cables are to be used for grounding purposes.
- The grounding conductor AWG size should match the size of the power cable AWG.
- Bare conductors must be coated with antioxidant before crimp connections are made.

Installation Tools and Kits

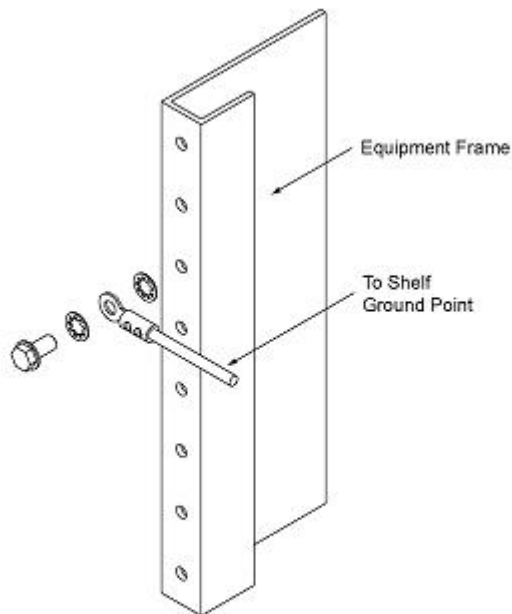
- Number 1 and Number 2 Phillips screwdrivers
- Wire stripping and crimping tool
- Multimeter
- Chassis Installation Kit (BT8A7865)
- A grounding cable that is at least the same size as the power cable. The single stud lugs supplied in the Chassis Installation Kit are for use with 10-12 AWG cables.

Location of Ground Screw

The ground screw is located on the left side of the chassis and is accessible from the rear. It is identified by a grounding label.

1. Use a wire stripper tool to strip the end of the ground wire to the correct length (5.0 mm, 0.2 in) for crimping the supplied ring lugs.
2. Insert the stripped end of the grounding wire into the open end of the lug.
3. Use a ring lug crimping tool (do not use pliers) to secure the grounding wire in place in the lug.
4. Use the supplied screw and two lock washers (one on the top side and one on the bottom side of the lug) to attach the lug to a grounding position on the chassis. Tighten to 20 in-lb.
5. Prepare the other end of the grounding wire with a lug, and connect it to the equipment frame with the screw and two lock washers (one on the top side and one on the bottom side of the lug) supplied in the installation kit.

Do not overtighten.



6. Check the connectivity of the grounding by using a multimeter to measure the resistance between the shelf and the frame. Put one test lead in contact with an unpainted zone of the chassis and the other test lead in contact with the equipment frame. The measured resistance should be less than 1 Ohm.

You have successfully completed this procedure.

Powering the Chassis

- [Powering the BT17814 Chassis on page 94](#)
- [Powering the BT17802 Chassis on page 100](#)
- [Powering the BT17801 Chassis on page 105](#)

Powering the BT17814 Chassis

- [Connecting the DC Power Feeds to a BT17814 DC PEM on page 94](#)
- [Connecting the AC Power Feeds to a BT17814 AC PEM on page 97](#)

Connecting the DC Power Feeds to a BT17814 DC PEM

If you order the BT17814 chassis with the DC option, the chassis is shipped with the 14-Slot Chassis DC Power Entry Modules DC PEM installed. This topic describes how to connect the power feeds to the DC PEMs.



NOTE: BTI7800 equipment should be powered in accordance with DC-I (isolated DC return) equipment installation criteria; the DC return terminal is not connected to the equipment frame or the equipment grounding means.

To understand how the power is distributed throughout the chassis, refer to “[BTI7814 Power Distribution Plan](#)” on page 40. For procedures to replace a DC PEM, refer to “[Replacing the BTI7814 DC PEM](#)” on page 180.



WARNING:

- This equipment is intended to be installed and serviced by qualified personnel.
- To avoid personal injury or damage to chassis components, ensure there is no power going to the chassis.
- Make sure you are familiar with the site and safety guidelines described in the *BTI7800 Series Hardware Overview and Installation Guide*.



WARNING: Before you proceed:

- Do not work alone.
- The chassis must be grounded to the frame in which it is mounted.
- The power source to which you are connecting the chassis must be powered off.
- The circuit breaker switch, to which the power source is wired, must be shut off.
- Locate the emergency power-off switch for the location in which you are working.
- Do not overload the power source to which you are connecting the chassis.
- Check your work area for possible hazards, such as ungrounded power extension cables and moist floors.
- Remove all jewelry, neckties, and scarves.
- Use appropriate caution. This documentation does not cover every potential hazardous condition.

Installation Tools and Kits

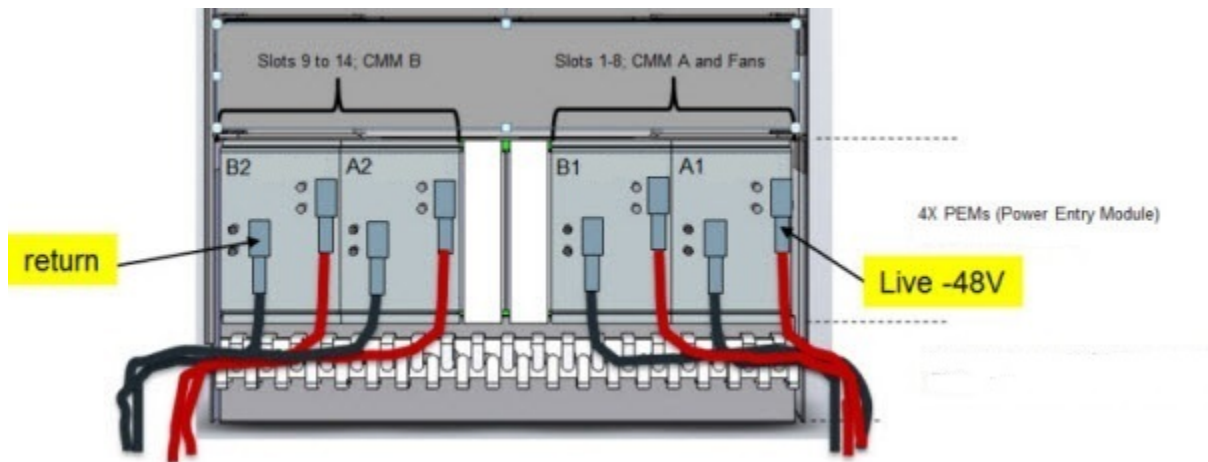
- Number 1 and Number 2 Phillips screwdrivers
- 10 mm nut-driver
- Wire stripping and crimping tool

- Multimeter
 - Chassis Installation Kit (BT8A7865)
 - Chassis Crimp Lug Installation Kit (BT8A7867). The dual stud lugs supplied in the Chassis Crimp Lug Installation Kit are for use with 2 AWG cables. The 2 AWG lugs can crimp down to 4 AWG.
 - A set of power cables that meets the requirements specified in [“BT17814 DC PEM Specifications” on page 43](#)
1. Verify that there is no power going to the chassis.
 2. Verify that the chassis is properly grounded. For information on frame-grounding the chassis, refer to [“Frame-Grounding a BT17814 Chassis” on page 89](#).
 3. Prepare the power cables as needed for attachment to the chassis.
 - a. Use a wire stripper tool to strip one end of the power cable to the correct length (5.0 mm, 0.2 inch) for crimping on the supplied (dual stud) ring lugs.
 - b. Insert the stripped end of the power cable into the open end of the lug.
 - c. Use a ring lug crimping tool (do not use pliers) to secure the power cable to the lug.
 4. Remove the protective shields covering the DC PEMs (if applicable).
 5. Connect the power feeds as follows.



NOTE: All four feeds must be connected for proper operation.

Figure 27: DC PEM Power Feed Connections



- a. Connect the first set of Feed and Return cables to the first DC PEM.



NOTE: The other end of these two cables will be connected to the plant power source. Place this end of the cables out of the way until you are ready to connect them to the power source.

- b. Repeat for the other DC PEMs.
6. Reinstall the protective shields on the DC PEMs.
The shields should be oriented such that the instrument access holes are aligned with the DC terminals.
7. Follow the appropriate procedures in your plant to prepare and connect the other end of the power cables to the DC power source.
8. Power on the DC power distribution unit in your plant to power on the chassis.
9. Perform a voltage checklist. You can check the voltage through the instrument access holes in the protective shields on the DC PEMs.

With a portable multimeter, measure the voltage at each DC PEM as follows:

- **- Minus Feed:** -42VDC to -60VDC as measured from the Feed to the Return.
- **+ Positive Return:** Within less than 2V of the frame or chassis ground.

You have successfully completed this procedure.

Connecting the AC Power Feeds to a BTI7814 AC PEM

If you order the BTI7814 chassis with the AC option, the chassis is shipped with the 2900W (53.5V) AC Rectifier Modules installed. This topic describes how to connect power to the BTI7814 2900W (53.5V) AC Rectifier Module.

To understand how the power is distributed throughout the chassis, refer to "[BTI7814 Power Distribution Plan](#)" on page 40. For procedures to replace an AC PEM, refer to "[Replacing the BTI7814 AC PEM](#)" on page 182.



WARNING:

- This equipment is intended to be installed and serviced by qualified personnel.
- To avoid personal injury or damage to chassis components, ensure there is no power going to the chassis.
- Make sure you are familiar with the site and safety guidelines described in the *BTI7800 Series Hardware Overview and Installation Guide*.



WARNING: Before you proceed:

- Do not work alone.
- The chassis must be grounded to the frame in which it is mounted.
- The power source to which you are connecting the chassis must be powered off.
- The circuit breaker switch, to which the power source is wired, must be shut off.
- Locate the emergency power-off switch for the location in which you are working.
- Do not overload the power source to which you are connecting the chassis.
- Check your work area for possible hazards, such as ungrounded power extension cables and moist floors.
- Remove all jewelry, neckties, and scarves.
- Use appropriate caution. This documentation does not cover every potential hazardous condition.

Installation Tools and Kits

- Multimeter
- A set of power cables that meets the requirements specified in [“BT17814 AC PEM Specifications” on page 46](#)

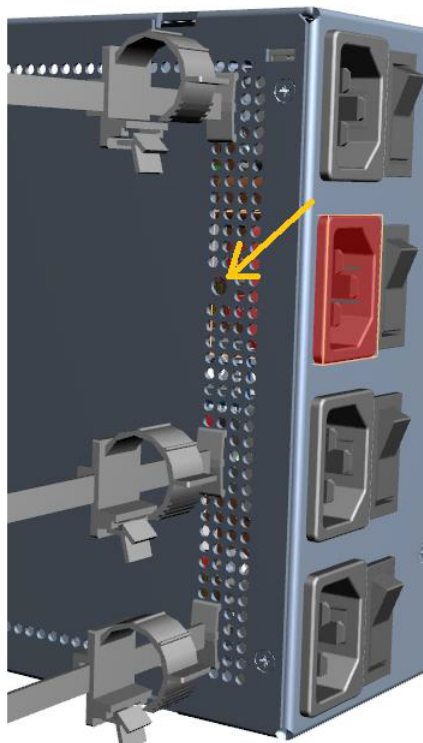
Procedure

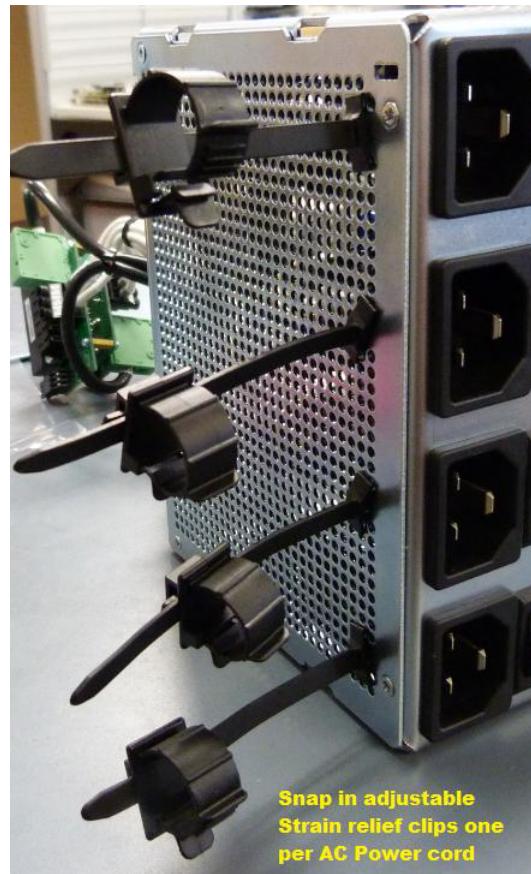
1. Verify that there is no power going to the chassis.
2. Verify that the chassis is properly grounded. For information on frame-grounding the chassis, refer to [“Frame-Grounding a BT17814 Chassis” on page 89](#).
3. Ensure the power switch on the AC PEM housing for each rectifier is off.
4. Attach the AC power cables to the AC receptacles on the housing.
5. To prevent the power cables from being accidentally disconnected, attach the power cables to the cable strain relief clips.

The AC PEM housing is shipped with individual cable strain relief clips that hold the power cables firmly in place. These clips can be used for both straight and right-angle connectors.

- a. Attach the cable strain relief clips to the AC PEM housing.

The housing has four holes designed to hold the four clips in place.





- b. Attach the AC power cables to the respective clips.
6. Follow the appropriate steps to connect the other end of the cables to the power source in your plant. Ensure the power source to which you are connecting the cables is powered off.
7. Turn on the main power source.
8. Switch on one rectifier at a time.

The AC PEM LED starts to light up. The AC OK light turns solid green when the module is ready. Wait for the AC OK light before proceeding to power the next rectifier.

You have successfully completed this procedure.

Powering the BT17802 Chassis

- [Installing and Cabling the BT17802 DC PEM on page 101](#)
- [Installing and Cabling the BT17802 AC PEM on page 103](#)

Installing and Cabling the BTI7802 DC PEM

This topic describes how to install, cable and connect power to the BTI7802 1-Slot/2-Slot Chassis DC Power Entry Modules (BT8A78PEM1-DC).



NOTE: BTI7800 equipment should be powered in accordance with DC-I (isolated DC return) equipment installation criteria; the DC return terminal is not connected to the equipment frame or the equipment grounding means.

For procedures to replace a DC PEM, refer to [“Replacing the BTI7802 PEM” on page 193](#).



WARNING:

- This equipment is intended to be installed and serviced by qualified personnel.
- To avoid personal injury or damage to chassis components, ensure there is no power going to the chassis.
- Make sure you are familiar with the site and safety guidelines described in the *BTI7800 Series Hardware Overview and Installation Guide*.



WARNING: Before you proceed:

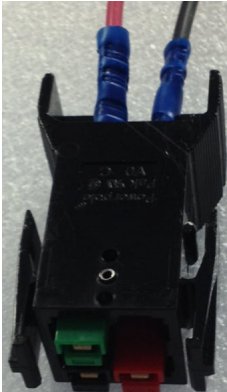

- Do not work alone.
- The chassis must be grounded to the frame in which it is mounted.
- The power source to which you are connecting the chassis must be powered off.
- The circuit breaker switch, to which the power source is wired, must be shut off.
- Locate the emergency power-off switch for the location in which you are working.
- Do not overload the power source to which you are connecting the chassis.
- Check your work area for possible hazards, such as ungrounded power extension cables and moist floors.
- Remove all jewelry, neckties, and scarves.
- Use appropriate caution. This documentation does not cover every potential hazardous condition.

Installation Tools and Kits

- Wire stripping and crimping tool

- Multimeter
- DC Power Cable Assembly (BT8A78PWR1)

Table 37: BT17802 DC Power Cable Assembly (BT8A78PWR1)

DC PEM Cable Connector	DC PEM Cable
	

Procedure

1. Verify there is no power going to the chassis.
2. Verify the chassis is properly grounded. For information on frame-grounding the chassis, refer to [“Frame-Grounding a BT17802 Chassis” on page 90](#).
3. Using a wire stripper tool, strip the other end of the DC PEM connector and cable and prepare it, as needed, for connection to the DC power distribution unit in your plant.

4. Install the DC PEM.

Loosen the latch thumbscrew and pull the latch to the open position.



5. Position the module edges onto the slot guides, and gently slide the module along the guides until the DC PEM connects to the backplane.
6. Push in the latch to lock the module in place. Carefully tighten the thumbscrew.



NOTE: You will not be able to plug in the DC cable connector if the latch is not locked in place.

7. Attach the DC PEM connector to the DC PEM module.
8. Follow the appropriate steps to connect the other end of the cable to the DC power distribution unit in your plant. Ensure that the power source to which you are connecting the cable is powered off.
9. Power on the chassis from the main power source.
The DC PEM LEDs start to light up. The DC OK light turns solid green when the module is ready.
10. Perform a voltage checklist. The voltage can be checked only at the breaker/fuse panel end where the DC power cable is terminated.
With a portable multimeter, measure the voltage as follows:
 - **- Minus Feed:** -42VDC to -60VDC as measured from the Feed to the Return.
 - **+ Positive Return:** Within less than 2V of the frame or chassis ground.
11. Repeat this procedure for the second DC PEM.

You have successfully completed this procedure.

Installing and Cabling the BTI7802 AC PEM

If you order the BTI7802 chassis with the AC option, the chassis is shipped with the 1-Slot/2-Slot Chassis AC Power Entry Modules (AC PEMs). This topic describes how to install, cable and connect power to the BTI7802 AC PEM (BT8A78PEM1-AC).

For procedures to replace a AC PEM, refer to [“Replacing the BTI7802 PEM” on page 193](#).



WARNING:

- This equipment is intended to be installed and serviced by qualified personnel.
- To avoid personal injury or damage to chassis components, ensure there is no power going to the chassis.
- Make sure you are familiar with the site and safety guidelines described in the *BTI7800 Series Hardware Overview and Installation Guide*.



WARNING: Before you proceed:

- Do not work alone.
- The chassis must be grounded to the frame in which it is mounted.
- The power source to which you are connecting the chassis must be powered off.

- The circuit breaker switch, to which the power source is wired, must be shut off.
- Locate the emergency power-off switch for the location in which you are working.
- Do not overload the power source to which you are connecting the chassis.
- Check your work area for possible hazards, such as ungrounded power extension cables and moist floors.
- Remove all jewelry, neckties, and scarves.
- Use appropriate caution. This documentation does not cover every potential hazardous condition.

Installation Tools and Kits

- Multimeter
- Power cables that meet the requirements specified in [“BT17802 AC PEM Specifications” on page 51](#)

1. Verify that there is no power going to the chassis.
2. Verify that the chassis is properly grounded. For information on frame-grounding the chassis reference [“Frame-Grounding a BT17802 Chassis” on page 90](#).
3. Install the AC PEM.

Loosen the latch thumbscrew and pull the latch to the open position.



4. Position the module edges onto the slot guides, and gently slide the module along the guides until the AC PEM connects to the backplane.
Push-in the latch to lock the module in place. Carefully tighten the thumbscrew.
5. Attach the AC cable to the AC receptacle on the AC PEM module.
6. Follow the appropriate steps to connect the other end of the cable to the power source in your plant. Ensure the power source to which you are connecting the cable is powered off.
7. Power on the chassis from the main power source.

The AC PEM LEDs start to light up. The AC OK light turns solid green when the module is ready.

8. Perform a voltage checklist. The voltage can be checked only at the breaker/fuse panel end where the AC power cable is terminated.

See [“BTI7802 AC PEM Specifications” on page 51](#) for the recommended AC PEM voltage values.

9. Repeat this procedure for the second AC PEM.

You have successfully completed this procedure.

Powering the BTI7801 Chassis

- [Installing and Cabling the BTI7801 DC PEM on page 105](#)
- [Installing and Cabling the BTI7801 AC PEM on page 105](#)

Installing and Cabling the BTI7801 DC PEM

The BTI7801 uses the same DC PEM as the BTI7802. See [“Installing and Cabling the BTI7802 DC PEM” on page 101](#) for installation and cabling instructions.

Installing and Cabling the BTI7801 AC PEM

The BTI7801 uses the same AC PEM as the BTI7802. See [“Installing and Cabling the BTI7802 AC PEM” on page 103](#) for installation and cabling instructions.

Connecting the ESD Wrist Strap Cable

Plug in the supplied ESD wrist strap cable to the ESD jack on the chassis.



CAUTION: Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent operational failures. ESD can occur when a module is improperly handled. Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

- [BTI7814 ESD Jack Locations on page 105](#)
- [BTI7802 ESD Jack Location on page 106](#)
- [BTI7801 ESD Jack Location on page 106](#)

BTI7814 ESD Jack Locations

There are two ESD jacks on the BTI7814 chassis:

- At the front of the chassis, to the left of the air intake grill
- At the rear of the chassis, below the Power Entry Modules

BTI7802 ESD Jack Location

There is one ESD jack on the BTI7802 chassis:

- At the front of the chassis, between the lower Chassis Management Module slot and the Power Entry Module

BTI7801 ESD Jack Location

There is one ESD jack on the BTI7801 chassis:

- At the front of the chassis, top right corner above the cable guide.

CHAPTER 5

BTI7800 Series Modules

- [List Of Modules on page 107](#)
- [Module Installation and Removal Guidelines on page 108](#)
- [Chassis Management Module \(CMM\) on page 110](#)
- [Universal Forwarding Module \(UFM\) on page 115](#)
- [BTI Interface Card \(BIC\) on page 122](#)
- [96-Channel Amplifier \(AMP1\) on page 130](#)
- [Wavelength Protection Switch \(WPS4\) on page 135](#)
- [96-Channel Fixed Mux/Demux \(FMD96\) on page 142](#)
- [Service Module LEDs on page 151](#)
- [Port LEDs on page 152](#)

List Of Modules

The following table lists the management and traffic modules for the BTI7800. Traffic modules refer to all modules that carry user traffic, and include service modules, BTI Interface Cards, and passive rack-mounted modules.

Table 38: BTI7800 Series Management and Traffic Modules

Module	Description	PEC	Introduced
Management modules			
Chassis Management Module 1 (CMM1)	Provides management and control of the system.	BT8A78CMM1	Release 1.1
Service modules			
Universal Forwarding Module (UFM3)	Supports two BICs.	BT8A78UFM3	Release 1.1
Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (UFM4)	Contains one 100G Coherent MSA XCVR and supports one BTI Interface Card (BIC).	BT8A78UFM4	Release 1.1
Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (UFM6)	Contains a total of ten client ports and one 400G Coherent MSA XCVR. ¹	BT8A78UFM6-I02	Release 4.1

Table 38: BT17800 Series Management and Traffic Modules (continued)

Module	Description	PEC	Introduced
96-Channel Amplifier (AMP1)	Provides DWDM composite signal amplification in point-to-point applications. NOTE: This module is not supported on the BT17801.	BT8A78AMP1	Release 1.1
Wavelength Protection Switch (WPS4)	Provides revertive or non-revertive wavelength protection switching.	BT8A78WPS4	Release 1.6
BIC modules			
12x SFP+ BTI Interface Card (12x SFP+ BIC)	For up to 12 SFP+ transceivers.	BT8A78SFP12G	Release 1.1
1x CFP BTI Interface Card (1x CFP BIC)	For 1 CFP transceiver.	BT8A78CFPIG	Release 1.1
Passive modules			
96-Channel Fixed Mux/Demux (FMD96)	Provides local fixed grid access to all 96 wavelengths in the DWDM 50-GHz channel plan.	BT8A78MD03	Release 2.0

¹ Client ports 1 to 10 support QSFP+ transceivers and client ports 1, 2, 6, 7 support both QSFP+ and QSFP28 transceivers.

Module Installation and Removal Guidelines

All management and traffic modules are hot-swappable. You can install or remove these modules while the chassis is powered.



WARNING: Use proper caution when working with the equipment. This chapter might not cover every possible hazardous condition.



NOTE: After installing a module or a BIC into a slot, you must wait a minimum of 60 seconds before you can remove that module or BIC from the slot. This allows time for the CMM to recognize that the module or BIC has been inserted.



NOTE: After removing a module or a BIC from a slot, you must wait a minimum of 60 seconds before you can install another module or BIC (or that same module or BIC) into the same slot. This allows time for the CMM to recognize that the module or BIC has been removed.

- Before installing or removing any module, ensure that the installation or the removal does not violate the rules specified in [“Installation Rules for the 100G Coherent CFP” on page 177](#). This applies even if the module you are installing or removing does not contain a 100G Coherent CFP transceiver.
- Before installing a module, ensure that the slot is free from dust and other debris.
- All empty slots should be covered with filler panels. This prevents debris from getting into the slot, and helps maintain the required system temperature.
- Module installation is independent of module configuration. You can configure a module and then install it, or you can install a module and then configure it. For details on configuring modules (including pre-provisioning and autoprovisioning), see the *BT17800 Series Software Configuration Guide*.
- Visually inspect the module, including the pins and connectors that attach to the backplane, for signs of damage before installation.
- Always install one module at a time. If the module is correctly installed, the faceplate will be in line with other installed modules and the latches will be secured correctly.
- The thumbscrews used to secure the module can be operated by hand or with a screwdriver.
- Ensure protective covers are placed on all unused ports.
- Be familiar with the module LED indicators described in [“Service Module LEDs” on page 151](#).

Safety Warnings

- This equipment is intended to be installed and serviced by qualified personnel.
- Be familiar with the safety guidelines described in the *BT17800 Series Hardware Overview and Installation Guide*.
- Ensure the chassis is installed properly and secured onto the rack.
- Ensure you have an unobstructed path to the chassis.
- Avoid contact with rotating fan blades.

Electrical Warnings



CAUTION: Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures. ESD can occur when a module is improperly handled.

To prevent ESD damage to a module, follow these guidelines:

- Always wear an ESD grounding device, such as an ESD wrist strap, when handling a module.
- Do not remove a module from its antistatic bag until installation. Store removed modules in antistatic packaging.

- If you need to set a module down, place it back into its antistatic packaging or on a properly-grounded antistatic mat.
- Handle the module by its edges and/or its faceplate and avoid touching any pins, leads, or solder connections on the circuit board.

Chassis Management Module (CMM)

The Chassis Management Module (CMM) provides management and control of the chassis, and is responsible for the following functions:

- Monitors, controls, and assures proper operation of the modules and other chassis components.
- Watches over the basic health of the system, reports anomalies, and takes corrective action when needed.
- Retrieves inventory information and sensor readings, as well as, receive event reports and failure notifications from the modules and field-replaceable units (FRUs).
- Performs basic recovery operations, such as, power cycle or reset of managed entities.
- Provides low-level hardware management services to manage the power, cooling, and interconnect resources of a chassis.
- Provides non-volatile storage of configuration data and software loads.
- Enables operator control of all modules in the system.
- Supports an industry-standard CLI, NETCONF, and SNMP.

Figure 28: CMM Module

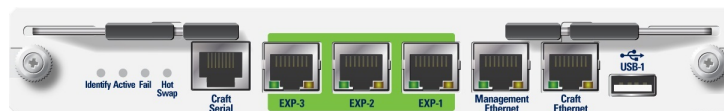


Table 39: CMM Ports

Port	Physical Interface	Description
Craft Serial (RS-232)	RJ-45	Provides local craft serial access for diagnostic and commissioning functions.
Expansion (EXP-1 to EXP-3)	RJ-45	Provides management plane connectivity in a multichassis configuration.
Management Ethernet (eth1)	RJ-45	Provides management network connectivity.
Craft Ethernet (eth0)	RJ-45	Provides local craft Ethernet access for diagnostic and commissioning functions.
USB-1	USB 2.0 Standard Type-A Receptacle	Provides the ability for the CMM to boot from a system repair drive.

Figure 29: CMM Slot Locations on BT17814



Figure 30: CMM Slot Locations on BT17802

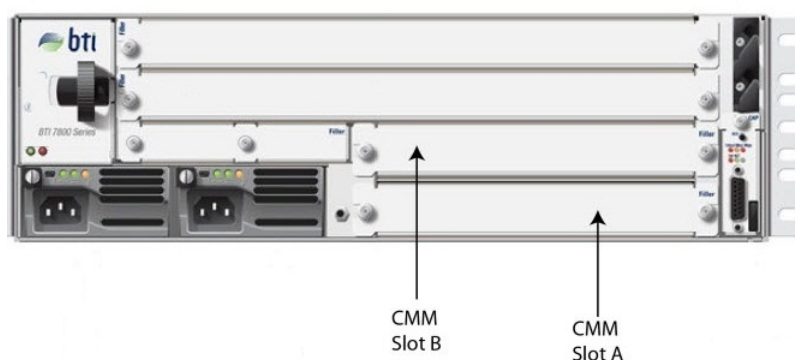


Figure 31: CMM Slot Location on BT17801 (Rear View)



CMM1 Specifications

Table 40: Chassis Management Module 1 (BT8A78CMM1) Specifications

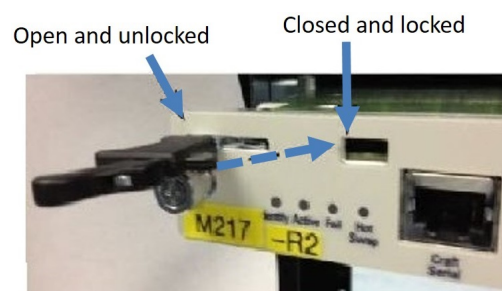
Item	Specification	
Physical Dimensions		
Width	8.38 in	212.9 mm
Height	1.12 in	314.4 mm
Depth	12.38 in	30.5 mm
Weight	3.0 lb	1.36 kg
Chassis	BT17814, BT17802, BT17801	

Table 40: Chassis Management Module 1 (BT8A78CMM1) Specifications (continued)

Item		Specification	
Power Consumption (40°C ambient)		Typical: 70 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.		Maximum: 77 W	
CPU		1.86 GHz Dual-Core	
Memory		4 GB DRAM	
Non-volatile Storage		16 GB Flash	
Supported Management Protocols		CLI, SNMP, NETCONF	
Interfaces	Connector	Standard	Speed
Craft Serial	RJ45	RS232	115200 bps 8N1 (8 data bits, No parity, 1 stop bit)
EXP-1 to EXP-3	RJ45	IEEE 802.3 Ethernet	10/100/1000 Mbps
Management Ethernet	RJ45	IEEE 802.3 Ethernet	10/100/1000 Mbps
Craft Ethernet	RJ45	IEEE 802.3 Ethernet	10/100/1000 Mbps
USB-1	USB 2.0 Standard-A Receptacle	USB 2.0	n/a
LEDs	Name	Color	Description
	Identify	Amber	Not used.
	Active	Green	The CMM is operationally up.
	Fail	Red	The CMM is operationally down or the CMM is not recognized.
	Hot Swap	Blue	The CMM does not match the provisioned CMM.
Port LEDs	Link (right)	Green	The link is up.
	Activity (left)	Green	The LED flickers to indicate activity on the link.

CMM1 Latches

The CMM latches have a spring-loaded locking mechanism. The latches must be fully closed and locked for proper module operation.



Installing a CMM

Use this procedure to install a CMM.

It is recommended that you install two CMMs for redundancy.

Tools Required

- Number 2 Phillips screwdriver



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Remove the filler panel from the slot into which you are installing the module and store it in a safe place for future use.
2. Remove the module from its antistatic bag, holding it by its edges and faceplate to prevent damage to the module circuitry.
Visually inspect the module, including the pins and connectors that attach to the backplane, for signs of damage before installation.
3. Install the module.
 - a. Ensure that all latches are in the fully open position. See [“CMM1 Latches” on page 113](#).
 - b. Facing the front of the chassis, position the module horizontally so that the text on the faceplate is in the correct orientation.
 - c. Align the module with the slot guides.
 - d. Insert the module edges in the slot guides and carefully slide the module until it contacts the backplane.

e. Press firmly on a part of the faceplate away from the latches. The latches close by themselves as the module is seated. Take care not to pinch your fingers as the latches close.

f. Lock the latches by closing the latches until the locking mechanism springs shut.

When the latches are in the locked position, the latches cannot be opened without squeezing the spring-loaded locking mechanism to disengage the lock from the module faceplate.

4. Carefully tighten the faceplate thumbscrews.

You have successfully completed this procedure.

Removing a CMM

Use this procedure to remove a CMM from a chassis.

Tools Required

- Number 2 Phillips screwdriver
- Antistatic bag



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Disconnect the cables from the module.



NOTE: Ensure that cables are protected with protective caps while disconnected.

2. Loosen the two faceplate thumbscrews. Use a screwdriver if necessary.

3. Squeeze the spring-loaded locking mechanism to disengage the latch from the module faceplate, and pull the latches to the open and unlocked position to unseat the module. See [“CMM1 Latches” on page 113](#).

4. Slide the module from the slot and place it in an antistatic bag.

5. If the slot is to remain empty, install a CMM filler plate.

You have successfully completed this procedure.

Universal Forwarding Module (UFM)

The Universal Forwarding Module (UFM) is a transport service module that performs functions such as transponding and muxponding. UFM's are available in different types from fixed to highly flexible configurations.

Table 41: UFM Types

Module Type	Description	
Universal Forwarding Module (UFM3), BT8A78UFM3	Supports: <ul style="list-style-type: none"> Two BTI Interface Cards 	 <p>Diagram of the UFM3 module showing two BIC slots. Labels with arrows point to the top and bottom slots, both labeled "BIC slot".</p>
Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (UFM4), BT8A78UFM4	Supports: <ul style="list-style-type: none"> One integrated 100G Coherent MSA XCVR One BTI Interface Card 	 <p>Diagram of the UFM4 module showing a 100G Coherent MSA XCVR and a BIC slot. Labels with arrows point to the top component labeled "100G Coherent MSA XCVR" and the bottom slot labeled "BIC slot".</p>
Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (UFM6), BT8A78UFM6-I02	Supports: <ul style="list-style-type: none"> One integrated 400G Coherent MSA XCVR with two 200-Gbps ports QSFP+/QSFP28 client ports: Ten QSFP+ ports (40 x 10-Gbps) when deployed with ten GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassettes (see "Fiber Breakout" on page 225), or 4 x 100-Gbps QSFP28 ports <p>CAUTION: Each UFM6 is affixed with a CAUTION HOT SURFACE label  indicating that some components and heat sinks on the module are hot. Do not touch any components or heat sinks when removing the module.</p>	 <p>Diagram of the UFM6 module showing client ports and 200G line ports. Labels with arrows point to the top ports labeled "Client ports" and the bottom ports labeled "200G line ports".</p>

- [UFM Specifications on page 116](#)
- [UFM Latches on page 116](#)

- [Installing a UFM on page 117](#)
- [Removing a UFM on page 119](#)
- [Replacing a UFM4 with a UFM3 on page 120](#)
- [UFM6 Installation Rules on page 121](#)

UFM Specifications

Table 42: UFM Specifications

Item	Specification
Physical Dimensions	
Width	1.14 in 28.9 mm
Height	13.75 in 350.0 mm
Depth	11.75 in 300.0 mm
Power Consumption (40°C ambient)	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	
Universal Forwarding Module (BT8A78UFM3)	Typical: 32 W Maximum: 35 W
Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (BT8A78UFM4)	Typical: 140 W Maximum: 154 W
Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (BT8A78UFM6-I02)	Typical: <ul style="list-style-type: none"> • With 10 x QSFP+ transceivers installed: 305 W • With 4 x QSFP28 transceivers installed: 295 W
LEDs	See “Service Module LEDs” on page 151 .

UFM Latches

The top and bottom latches of a UFM must be fully closed for proper module operation.

[“UFM Latches” on page 116](#) and [“UFM Latches” on page 116](#) show the open and closed positions of the top latch on each type of UFM.

Figure 32: Top Latch - UFM3 and UFM6



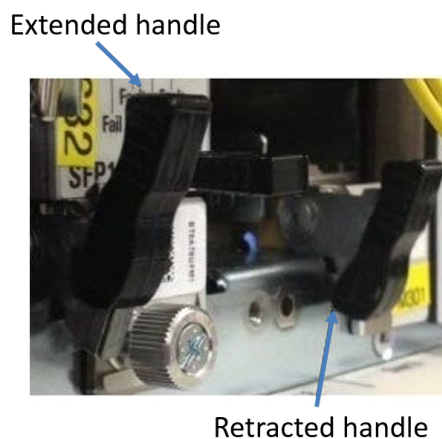
Figure 33: Top Latch - UFM4



NOTE: The design of the UFM4 top latch accommodates the space taken up by the integrated MSA transceiver.

The bottom latch on all UFM's ("UFM Latches" on page 116) has an extendable handle that provides leverage when you open or close the latch.

Figure 34: Bottom Latch - UFM's



Installing a UFM

Use this procedure to install a Universal Forwarding Module (UFM).

Prerequisites:

- If you are installing a (UFM6) module on a BT17814 chassis, ensure that BT17814 Booster Fans are also installed in the chassis. See "[BT17814 Booster Fans](#)" on page 57.

- If you have pre-provisioned the module, ensure the module is administratively enabled. If the module is not administratively enabled, the module will not be acknowledged by the CMM. For information on how to enable the module, see the *BT17800 Software Configuration Guide*.
- If you have not pre-provisioned the module and you are relying on auto-provisioning, then the system will automatically provision and enable the module for you. You do not need to manually enable the module in this case.

This procedure covers all UFM types.

Tools Required

- Number 2 Phillips screwdriver



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).



NOTE: Installation rules exist for UFM6 modules. See [“UFM6 Installation Rules” on page 121](#) for more information.

1. Remove the filler panel from the slot into which you are installing the module and store it in a safe place for future use.
2. Remove the module from its antistatic bag, holding it by its edges and faceplate to prevent damage to the module circuitry.

Visually inspect the module, including the pins and connectors that attach to the backplane, for signs of damage before installation.

3. Install the module.
 - a. Ensure that all latches are in the open position and that the black handles are extended as applicable. See [“UFM Latches” on page 116](#).
 - b. Position the module.
 - **BT17814:** Position the module vertically so that the faceplate is toward you and the latches are on the left side.
 - **BT17801, BT17802:** Position the module horizontally so that the faceplate is toward you and the latches are on the bottom.
 - c. Align the module with the slot guides.
 - d. Insert the module edges on the slot guides.

Carefully slide the module until it contacts the backplane and push in firmly on the faceplate.

- e. Close the latches by moving both latches to the inward position and push in until they fully close.
The latches are angled slightly outward from the faceplate when fully engaged.
- f. Retract the black handles to allow clearance for the BIC modules, as applicable.
4. Carefully tighten the faceplate thumbscrews. Use a screwdriver if necessary.
5. If you are installing a UFM6, connect a fiber from a GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette to the desired QSFP+ port to get access to the individual 10-Gbps signals. See [“Fiber Breakout” on page 225](#) for more information.

You have successfully completed this procedure.

Removing a UFM

Use this procedure to remove a Universal Forwarding Module (UFM) from a chassis.

Prerequisites:

- Ensure the module is administratively disabled. When the module is administratively disabled, the hot-swap LED shows a solid blue. For information on how to disable the UFM, see the *BT17800 Software Configuration Guide*.

This procedure covers all UFM types.


Tools Required

- Number 2 Phillips screwdriver
- Antistatic bag



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).



CAUTION: Each UFM6 is affixed with a CAUTION HOT SURFACE label  indicating that some components and heat sinks on the module are hot. Do not touch any components or heat sinks when removing the module.

1. Ensure the hot-swap LED is solid blue.
2. If you plan on removing the BICs from the UFM, do so now.
It is easier to remove a BIC from the UFM while the UFM is still in the chassis. For information on removing a BIC, see [“Removing a BIC” on page 126](#).
3. Move fibers aside as needed to get clear access to the module.

4. Disconnect all fibers from the module.



NOTE: Ensure that the fibers are protected with protective caps while disconnected.

5. Loosen the two faceplate thumbscrews located at each end of the module. They should spring out freely when fully loosened. Use a screwdriver if necessary.
6. Unseat the module from the backplane by simultaneously opening both latches. See [“UFM Latches” on page 116](#).
 - a. For latches with the extendable black handle, extend the black handle and use it as a lever to move the latch to the open position.
 - b. For latches with the J-handle, pull on the J-handle to move the latch to the open position.
7. Gently slide the module out of its slot and place it in the antistatic bag.
Handle the module by its edges and faceplate.
8. If the slot is to remain unoccupied, install a filler panel.

You have successfully completed this procedure.

Replacing a UFM4 with a UFM3

Use this procedure to replace a UFM4 with a UFM3.

Prerequisites:

- The UFM's must be similarly equipped. See the *BT17800 Series Software Configuration Guide* for the qualifying criteria.

This procedure describes a very specific type of UFM replacement where a UFM with an integrated 100G Coherent MSA XCVR is replaced by a UFM with a 1x CFP BIC and a 100G Coherent CFP. To facilitate this common use case, the system can automatically propagate the configuration from the UFM being replaced to the new UFM.

Specifically, when replacing a UFM4 with a similarly-equipped UFM3, the system can automatically unprovision the old UFM and provision the new UFM. This is called auto-reprovisioning, and includes the unprovisioning of the old equipment, interfaces, and cross-connects, and the reprovisioning of the new equipment, interfaces, and cross-connects.

When auto-reprovisioning is performed successfully, the new UFM boots seamlessly into the new configuration, preserving all provisioned interfaces and cross-connects. No manual reconfiguration is necessary.



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Mark all fibers that you plan to disconnect from the UFM4 and reconnect to the UFM3.
2. If the UFM being replaced contains a BIC in BIC slot 2, and if you want to reuse that BIC in the new UFM, follow the procedures in [“Removing a BIC” on page 126](#) to remove the BIC from BIC slot 2.
3. Follow the procedures in [“Removing a UFM” on page 119](#) to remove the UFM4 you want to replace.
4. Wait a minimum of 60 seconds to allow time for the CMM to recognize that the UFM has been removed.
5. Follow the procedures in [“Installing a UFM” on page 117](#) to install the UFM3.
6. Follow the procedures in [“Installing a BIC” on page 125](#) to install a 1x CFP BIC into BIC slot 1, and to reinstall the BIC that you removed in 2 into BIC slot 2 of the UFM.
7. Install a 100G Coherent CFP into the 1x CFP BIC.
8. Reconnect all fibers.

You have successfully completed this procedure.

UFM6 Installation Rules

Installation rules exist for the UFM6 when running on a BT17814 powered with AC PEMs.

Table 43: Installation Rules

Input voltage to AC PEM	Maximum number of UFM6 modules	Power available for other modules
100 VAC	8	100 W
110 VAC	9	100 W
180 VAC and above	No restrictions are necessary.	

The power available for other modules increases if you deploy fewer UFM6 modules than the maximums specified in the scenarios above. This increase is equal to the power saved for each UFM6 module allowed but not deployed. See [“BT17800 Series Component Power Consumption” on page 53](#) for the power consumption of the UFM6 and other modules.



NOTE: Failure to comply with these rules might lead to adverse thermal behavior and premature failure.

BTI Interface Card (BIC)

BTI Interface Cards (BICs) are modules that hold pluggable transceivers. The transceivers are plugged into the BICs, which in turn are inserted into the UFM. A BIC can be installed into a UFM3 or a UFM4.

There are different types of BICs depending on the pluggables required. By housing different BICs, a UFM can hold different combinations of 10-Gbps and 100-Gbps interfaces.

There is no restriction on which BIC or which pairing of BICs can be installed in a UFM.

- [12x SFP+ BIC on page 122](#)
- [1x CFP BIC on page 124](#)
- [BIC Handles and Latches on page 125](#)
- [Installing a BIC on page 125](#)
- [Removing a BIC on page 126](#)
- [Replacing a BIC on page 128](#)
- [Installing or Removing a BIC Filler Panel on page 128](#)
- [BIC LEDs on page 130](#)

12x SFP+ BIC

The 12x SFP+ BTI Interface Card (12x SFP+ BIC) contains twelve 10-Gbps ports.

The 12x SFP+ BIC supports SFP+ pluggable optics including 850nm, 1310nm, and DWDM.

Figure 35: 12x SFP+ BTI Interface Card



Table 44: 12x SFP+ BIC (BT8A78SFP12G) Specifications

Item	Specification	
Physical Dimensions		
Width	1.1 in	29.0 mm
Height	5.9 in	150.0 mm
Depth	6.4 in	163.0 mm
Weight	1.0 lb	0.45 kg
Power Consumption (40°C ambient)	Typical: 38 W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 43 W	
LEDs	See “BIC LEDs” on page 130.	
Supported Protocols	SONET OC192, 9.953Gbps	
	SDH STM64, 9.953Gbps	
	10GbE WAN PHY, 9.953Gbps	
	10GbE LAN PHY, 10.313Gbps	

Table 44: 12x SFP+ BIC (BT8A78SFP12G) Specifications (continued)

Item	Specification
	OTN OTU2, 10.709Gbps
Supported Forward Error Correction Modes (FEC)	RS FEC per G.975
	1.4 FEC per G.975.1
	1.7 FEC per G.975.1
Connectors/Ports	SFP+ (12)

1x CFP BIC

The 1x CFP BTI Interface Card (1x CFP BIC) contains one CFP transceiver.

Figure 36: 1x CFP BTI Interface Card



Table 45: 1x CFP BIC (BT8A78CFP1G) Specifications

Item	Specification	
Physical Dimensions		
Width	1.1 in	29.0 mm
Height	5.9 in	150.0 mm
Depth	6.4 in	163.0 mm

Table 45: 1x CFP BIC (BT8A78CFPIG) Specifications (continued)

Item	Specification	
Weight	1.0 lb	0.45 kg
Power Consumption (40°C ambient)	Typical: 32W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 38W	
LEDs	See “BIC LEDs” on page 130.	
Supported Protocols	100GbE, 103.125 Gbps	
	OTN OTU4, 111.809 Gbps	
Supported Forward Error Correction Modes (FEC)	RS FEC per G.975	
	Super FEC (proprietary)	
Connectors/Ports	CFP pluggable optics	

BIC Handles and Latches

Each BIC features a handle at the top and a latch at the bottom. The bottom latch must be fully closed for proper module operation.

Top handle



Bottom latch



Installing a BIC

Use this procedure to install a BTI Interface Card (BIC) into a UFM.

Prerequisites:

- If you have pre-provisioned the module, ensure the module is administratively enabled. If the module is not administratively enabled, the module will not be acknowledged by the CMM. For information on how to enable the module, see the *BT17800 Software Configuration Guide*.
- If you have not pre-provisioned the module and you are relying on auto-provisioning, then the system will automatically provision and enable the module for you. You do not need to manually enable the module in this case.

This procedure is the same for all BIC types.

You should install the BIC into a UFM that is already installed in a chassis. An installed UFM provides stability as you slide the BIC into the BIC slot. Otherwise you run the risk of damaging components on the BIC if there is movement when sliding it into the BIC slot.

Tools Required

- Number 2 Phillips screwdriver



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Locate the UFM in which you want to install the BIC and move aside any fibers blocking access.

Remove the BIC filler panel if installed.

2. Take the BIC out of its antistatic bag, holding it by its edges and faceplate to prevent damage to the module circuitry. Save the bag for future use.
3. Install the module.
 - a. Ensure that the bottom latch is in the open position. See [“BIC Handles and Latches” on page 125](#).
 - b. Position the module.
 - **BT17814:** Position the module vertically so that the faceplate is toward you and the latch is at the bottom.
 - **BT17801, BT17802:** Position the module horizontally so that the faceplate is toward you and the latch is on the right.
 - c. Align the module with the slot guides.
 - d. Hold the module by the top handle and bottom latch and insert the module edges in the slot guides. The module should slide in smoothly.

Carefully slide the module until it contacts the UFM connector and push on the faceplate firmly until the module is seated.
 - e. Close the bottom latch by pushing the latch straight in.
4. Carefully tighten the faceplate thumbscrew. Use a screwdriver if necessary.

You have successfully completed this procedure.

Removing a BIC

Use this procedure to remove a BTI Interface Card (BIC) from a UFM.

This procedure is the same for all BIC types.

You should remove the BIC from the UFM while the UFM is installed in the chassis. An installed UFM provides stability as you slide the BIC out of the BIC slot. Otherwise you run the risk of damaging components on the BIC if there is movement when sliding it out of the BIC slot.

Tools Required

- Number 2 Phillips screwdriver
- Antistatic bag
- BIC Extractor Tool: To assist with removing the BIC, use the BIC extractor tool:

Figure 37: BIC Extractor Tool



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Move cables aside as needed to get clear access to the module.
2. Disconnect the fibers from the BIC.



NOTE: Ensure that optical cables are protected with protective caps while disconnected.

3. Retract the black handle on the UFM latch if it is extended. An extended UFM latch can interfere with the BIC's removal. See [“BIC Handles and Latches” on page 125](#).
4. If the BIC is not in hot-swap mode, set the BIC into hot-swap mode using the BIC's bottom latch.

Extend the bottom latch until you see the blue hot-swap LED blinking. Do not pull on the module.



NOTE: The BIC must continue to remain in place for a minimum of 5 seconds after the H/S LED turns solid blue.



NOTE: The BIC can also be placed in hot-swap mode if the BIC is administratively disabled, or if the containing UFM is administratively disabled.

5. Loosen the BIC faceplate thumbscrew, located at the top of the BIC. Use a screwdriver if necessary.
6. When the H/S LED is solid blue, attach the extractor tool to the hole in the bottom latch and pull simultaneously on the top handle and on the extractor tool.
Gently slide the module all the way out from the UFM.
7. Place the module into an antistatic bag.
8. Attach a BIC filler panel to cover the empty BIC slot.

You have successfully completed this procedure.

Replacing a BIC

Use this procedure to replace a BIC. If you want to replace both BICs in a UFM, you must replace one BIC at a time.

1. Follow the procedure in [“Removing a BIC” on page 126](#) to remove a BIC.
Remove only one BIC from the UFM.
2. Follow the procedure in [“Installing a BIC” on page 125](#) to install the replacement BIC.

Repeat this procedure if you want to replace the other BIC.



NOTE: If you accidentally remove both BICs from the UFM, perform a warm reload of the UFM after you install the replacement BICs (`system reload warm ufm`).

Installing or Removing a BIC Filler Panel

Use this procedure to install or remove a BIC filler panel.

Filler panels should always be used to fill an open BIC slot to maintain system temperature and prevent debris from entering the system.

Figure 38: BIC Filler Panel



NOTE: Be familiar with the site, safety, and installation guidelines described in “[Module Installation and Removal Guidelines](#)” on page 108.

1. Locate the UFM in which you want to install the BIC filler panel and move aside any fibers blocking access.
2. To install the filler panel:
 - a. Insert the filler panel by engaging the bottom of the panel with the bottom of the slot. The filler panel should be at an angle, for example:



- b. Push the top half of the filler panel into the slot to complete the installation.
 - c. Tighten the screw.
3. Removal is opposite from installation.

You have successfully completed this procedure.

BIC LEDs

Table 46: BIC LEDs

LEDs	Color	Description
Active	Green	The module is operating normally.
Fail	Red	The module has failed.
H/S (Hot Swap)	Blue	<p>ON: The module is in a quiescent state, and can be removed from the slot after a minimum of 5 seconds in this state.</p> <p>BLINKING: The module is being placed into a quiescent state. It cannot be removed from the slot.</p> <p>OFF: The module is operating normally. It cannot be removed from the slot.</p>

For BIC port LEDs, see [“Port LEDs” on page 152](#).

96-Channel Amplifier (AMP1)

The 96-Channel Amplifier module integrates two erbium-doped optical amplifiers to provide bi-directional amplification of DWDM optical signals in a point-to-point configuration. The amplifier is optimized for 10-Gbps, 25-Gbps, and 100-Gbps signals. It includes an embedded optical supervisory channel (OSC) used for span loss control.

Table 47: AMP1 Ports

Port	Description
Monitor	Connects the amplifier to an external monitor.
DCM	Connects the amplifier to a Dispersion Compensation Module (DCM).
Line	Connects the amplifier to a line span.
C1	Connects the amplifier to a client.

Figure 39: 96-Channel Amplifier Module



- [AMP1 Specifications on page 131](#)
- [AMP1 Latches on page 133](#)
- [Installing an AMP1 Module on page 133](#)
- [Removing an AMP1 Module on page 134](#)

AMP1 Specifications

Table 48: AMP1 (BT8A78AMP1) Specifications

Item	Specification	
Physical Dimensions		
Width	1.20 in	30.5 mm
Height	13.81 in	350.8 mm
Depth	12.80 in	325.0 mm
Weight	4.2 lb	1.9 kg
Power Consumption (40°C ambient)	Typical: 68W	
NOTE: Before using for planning or implementation purposes, contact Juniper Networks Support to confirm the power consumption values.	Maximum: 75W	

Table 48: AMP1 (BT8A78AMP1) Specifications (continued)

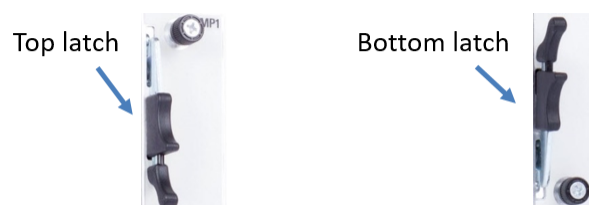
Item	Specification
Optical Performance	
Wavelength	1528.77 nm to 1566.72 nm
Supported Span Loss	0 dB to 23 dB
Supported DCM Loss	0 dB to 10 dB
Monitor Port Loss	19 dB to 21dB
Line Launch Power	-4.0 dBm to 21.0 dBm
Power Monitor Accuracy	+/-0.8 dB
OSC Wavelength	1510 nm
Supported Bit Rates	10.709 Gbps
	27.952 Gbps
	111.809 Gbps
	120.579 Gbps
Optical Safety	Class 1 Hazard 1M
Optical Safety Protection Mechanisms	APSD (Line port)
	APR (DCM and C1 ports)
Optical Control Features	Span Loss Control
	Tilt Control
	DCM Loss Compensation
LEDs	See “Service Module LEDs” on page 151 .
Port LEDs	Active (Green) The port is operating normally.
	Fault (Amber) A fault exists on the port.

Table 48: AMP1 (BT8A78AMP1) Specifications (continued)

Item	Specification
Connectors/Ports	Monitor
	DCM
	Line
	C1

AMP1 Latches

The top and bottom latches of the AMP1 have a spring-loaded locking mechanism. Both latches must be fully closed and locked for proper module operation.



Installing an AMP1 Module

Use this procedure to install a 96-Channel Amplifier (AMP1).

Prerequisites:

- If you have pre-provisioned the module, ensure the module is administratively enabled. If the module is not administratively enabled, the module will not be acknowledged by the CMM. For information on how to enable the module, see the *BT17800 Software Configuration Guide*.
- If you have not pre-provisioned the module and you are relying on auto-provisioning, then the system will automatically provision and enable the module for you. You do not need to manually enable the module in this case.

Tools Required

- Number 2 Phillips screwdriver



NOTE: Be familiar with the site, safety, and installation guidelines described in “[Module Installation and Removal Guidelines](#)” on page 108.

1. Remove the filler panel from the slot into which you are installing the module and store it in a safe place for future use.
2. Remove the module from its antistatic bag, holding it by its edges and faceplate to prevent damage to the module circuitry.

Visually inspect the module, including the pins and connectors that attach to the backplane, for signs of damage before installation.

3. Install the module.
 - a. Ensure the latches are in the open position by rotating the top and bottom latches such that they point straight out. See [“AMP1 Latches” on page 133](#).
 - b. Position the module.
 - **BT17814:** Position the module vertically so that the faceplate is toward you and the latches are on the left side.
 - **BT17802:** Position the module horizontally so that the faceplate is toward you and the latches are on the bottom.
 - c. Align the module with the slot guides.
 - d. Insert the module edges in the slot guides and carefully slide the module until it contacts the backplane.
 - e. Press firmly on a part of the faceplate away from the latches. The latches close by themselves as the module is seated. Take care not to pinch your fingers as the latches close.
 - f. Lock the latches by closing the latches until the locking mechanism springs shut.

When the latches are in the locked position, the latches cannot be opened without squeezing the spring-loaded locking mechanism to disengage the lock from the module faceplate.
4. Carefully tighten the faceplate thumbscrews.

You have successfully completed this procedure.

Removing an AMP1 Module

Use this procedure to remove a 96-Channel Amplifier (AMP1) from a chassis.

Prerequisites:

- Ensure the module is administratively disabled. When the module is administratively disabled, the hot-swap LED shows a solid blue. For information on how to disable the 96-Channel Amplifier, see the *BT17800 Software Configuration Guide*.

Tools Required

- Number 2 Phillips screwdriver

- Antistatic bag



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Ensure the hot-swap LED is solid blue.
2. Move fibers aside as needed to get clear access to the module.
3. Disconnect all fibers from the module.



NOTE: Ensure that the fibers are protected with protective caps while disconnected.

4. Loosen the two faceplate thumbscrews located at each end of the module. They should spring out freely when fully loosened. Use a screwdriver if necessary.
5. Squeeze the spring-loaded locking mechanism to disengage the latch from the module faceplate, and pull the latches to the open and unlocked position to unseat the module. See [“AMP1 Latches” on page 133](#).
6. Gently slide the module out of its slot and place it in the antistatic bag.
Handle the module by its edges and faceplate.
7. If the slot is to remain unoccupied, install a filler panel.

You have successfully completed this procedure.

Wavelength Protection Switch (WPS4)

The Wavelength Protection Switch (WPS4) is a protection switch that provides 1+1 revertive or non-revertive wavelength protection switching. Four wavelength protection groups can be provisioned per module.

Figure 40: WPS4 Module

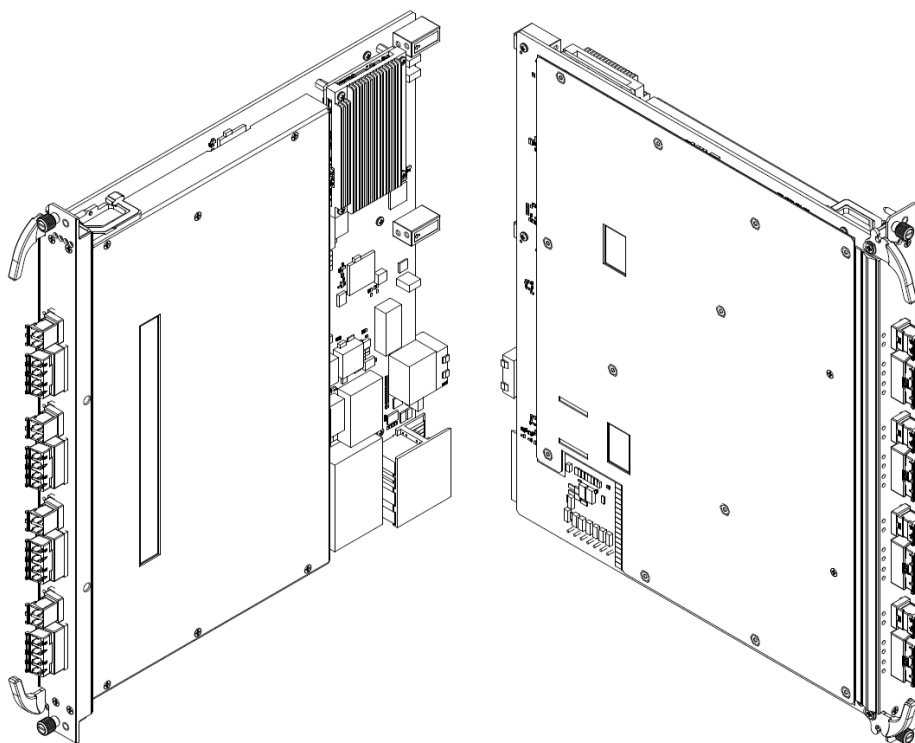
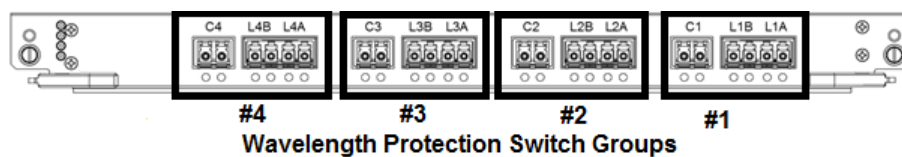


Figure 41: WPS4 Ports



Wavelength protection groups	Wavelength protection ports
Wavelength protection group #1	C1A L1B L1A
Wavelength protection group #2	C2A L2B L2A
Wavelength protection group #3	C3A L3B L3A
Wavelength protection group #4	C4A L4B L4A

- [WPS4 Specifications on page 137](#)
- [WPS4 Latches on page 138](#)
- [Installing a WPS4 on page 139](#)
- [Removing a WPS4 on page 141](#)

WPS4 Specifications

Table 49: WPS4 (BT8A78WPS4) Specifications

Item	Specification
Physical Dimensions	Width: 1.18 in (30 mm) Height: 13.7 in (350 mm) Depth: 11.75 in (300 mm) Weight: 5.30 lb (2.4 kg)
Power Consumption (40°C ambient)	Typical: 19 W Maximum: 26 W NOTE: Before using for planning or implementation purposes, contact Juniper Networks to confirm the power consumption values.
Maximum Optical Power at Any Port	27 dBm NOTE: The input signal must comply to a Class 1M laser hazard rating.
Wavelength Protection Groups	Four wavelength protection groups per module: <ul style="list-style-type: none"> Client port: One LC Duplex client port per wavelength protection group Line port: Two LC Duplex line ports per wavelength protection group
Operating Wavelength Range	C-band: 1500 to 1570 nm O-band: 1260 to 1350 nm L-band: 1560 to 1620 nm
Switching	Automatic (based on received power levels, configurable threshold) and manual NOTE: The threshold must be set according to the optical link budget in order for protection switching to operate as per specification. See the BT17800 Series Software Configuration Guide for information.
Switching Type	Revertive and non-revertive
LEDs	See “Service Module LEDs” on page 151.
Port LEDs	Active (Green) The port is operating normally. Fault (Amber) A fault exists on the port.



CAUTION: When the ports are optically connected, the WPS4 is capable of passing light from the Cn OUT, LnA OUT, and LnB OUT ports at all times even when not powered or not installed in the chassis.



CAUTION: Cn IN, LnA IN, LnB IN must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

Table 50: Wavelength Protection Group Specifications

Parameter	Minimum	Maximum	Units
Operating wavelength range	1260	1620	nm
Insertion Loss Cn_IN to LnA_OUT (C-band)	2.7	4.2	dB
Insertion Loss Cn_IN to LnB_OUT (C-band)	2.7	4.2	dB
Insertion Loss LnA_IN to Cn_OUT (C-band)	0.3	1.8	dB
Insertion Loss LnB_IN to Cn_OUT (C-band)	0.3	1.8	dB
Monitor Range (Cn_In)	-25.0	23.0	dBm
Monitor Range (LnA_In)	-40.0	18.0	dBm
Monitor Range (LnB_In)	-40.0	18.0	dBm
Monitor Accuracy	-1.3	1.3	dB
Directivity (LnA_IN to LnB_IN)	45.0	-	dB
Directivity (LnA_OUT to LnB_OUT)	45.0	-	dB
Switch Isolation	50.0	-	dB
Polarization Dependent Loss	-	0.2	dB
Polarization Mode Dispersion	-	0.1	ps
Return Loss	40.0	-	dB
Switching Time	-	50.0	ms

WPS4 Latches

The top and bottom latches of a WPS4 must be fully closed for proper module operation.

A WPS4 module has one of two types of top latches. “[WPS4 Latches](#)” on page 138 and “[WPS4 Latches](#)” on page 138 show a type of top latch in the open and closed positions.

Figure 42: Top Latch 1 - WPS4

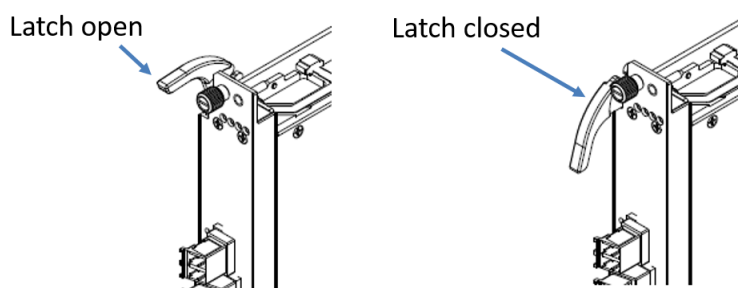


Figure 43: Top Latch 2 - WPS4



The bottom latch on a WPS4 ([“WPS4 Latches”](#) on [page 138](#)) has an extendable handle that provides leverage when you open or close the latch.

Figure 44: Bottom Latch - WPS4

Extended handle



Retracted handle

Installing a WPS4

Use this procedure to install a WPS4.

Prerequisites:

- If you have pre-provisioned the module, ensure the module is administratively enabled. If the module is not administratively enabled, the module will not be acknowledged by the CMM. For information on how to enable the module, see the *BT17800 Software Configuration Guide*.

- If you have not pre-provisioned the module and you are relying on auto-provisioning, then the system will automatically provision and enable the module for you. You do not need to manually enable the module in this case.

Tools Required

- Number 2 Phillips screwdriver



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).



NOTE: The wavelength ports do not support the ability to shut down the laser. When the ports are optically connected, the WPS4 is capable of passing light from the Cn OUT, LnA OUT and LnB OUT ports at all times even when not powered or not installed in the shelf.

Cn IN, LnA IN, LnB IN must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

1. Remove the filler panel from the slot into which you are installing the module and store it in a safe place for future use.
2. Remove the module from its antistatic bag, holding it by its edges and faceplate to prevent damage to the module circuitry.

Visually inspect the module, including the pins and connectors that attach to the backplane, for signs of damage before installation.

3. Install the module.
 - a. Ensure that all latches are in the open position and that the black handles are extended, if applicable. See [“WPS4 Latches” on page 138](#).
 - b. Position the module.
 - **BT17814:** Position the module vertically so that the faceplate is toward you and the latches are on the left side.
 - **BT17801, BT17802:** Position the module horizontally so that the faceplate is toward you and the latches are on the bottom.
 - c. Align the module with the slot guides.
 - d. Insert the module edges on the slot guides.

Carefully slide the module until it contacts the backplane and push in firmly on the faceplate.
 - e. Close the latches by moving both latches to the inward position and push in until they fully close.

The latches are angled slightly outward from the faceplate when fully engaged.

- f. Retract the black handles, if applicable.
4. Carefully tighten the faceplate thumbscrews. Use a screwdriver if necessary.

You have successfully completed this procedure.

Removing a WPS4

Use this procedure to remove a Wavelength Protection Switch (WPS4) from a chassis.

Prerequisites:

- Ensure the module is administratively disabled. When the module is administratively disabled, the hot-swap LED shows a solid blue. For information on how to disable the WPS4, see the *BT17800 Software Configuration Guide*.

Tools Required

- Number 2 Phillips screwdriver
- Antistatic bag



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).



NOTE: The wavelength ports do not support the ability to shut down the laser. When the ports are optically connected, the WPS4 is capable of passing light from the Cn OUT, LnA OUT and LnB OUT ports at all times even when not powered or not installed in the shelf.

Cn IN, LnA IN, LnB IN must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

1. Ensure the hot-swap LED is solid blue.
2. Move fibers aside as needed to get clear access to the module.
3. Disconnect all fibers from the module.



NOTE: Ensure that the fibers are protected with protective caps while disconnected.

4. Loosen the two faceplate thumbscrews located at each end of the module. They should spring out freely when fully loosened. Use a screwdriver if necessary.

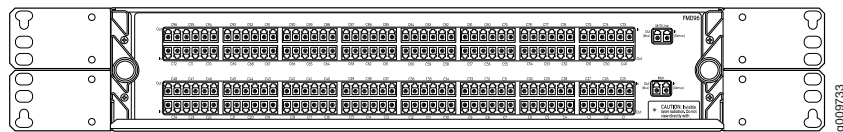
5. Extend the black handles on the latches to give you more leverage. See ["WPS4 Latches" on page 138](#).
6. Unseat the module from the backplane by simultaneously moving both latches to the open position.
7. Gently slide the module out of its slot and place it in the antistatic bag.
Handle the module by its edges and faceplate.
8. If the slot is to remain unoccupied, install a filler panel.

You have successfully completed this procedure.

96-Channel Fixed Mux/Demux (FMD96)

The 96-Channel Fixed Mux/Demux (FMD96) is a passive, rack-mounted module that is installed alongside a ROADM node to provide local fixed grid access to all 96 wavelengths in the DWDM 50-GHz channel plan. It has a single bidirectional line port, a monitor port, and 96 bidirectional client ports with each client port carrying a different fixed wavelength. See ["DWDM 50-GHz Wavelength Plan" on page 219](#) for the wavelength to client port mapping. See [Figure 45 on page 142](#).

Figure 45: Front Panel

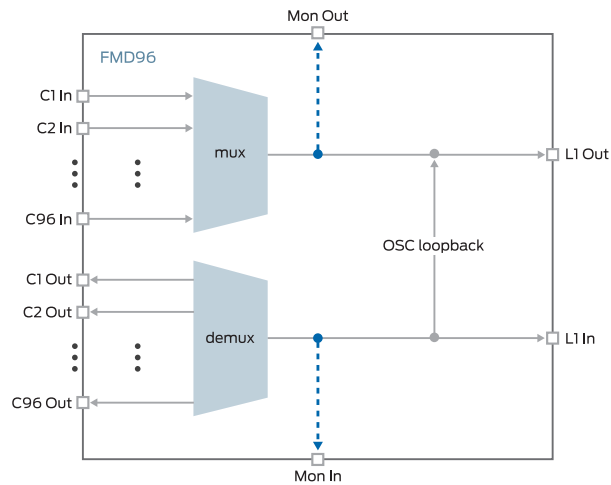


The module is standalone and does not communicate with the attached ROADM node, but it can be represented as part of a ROADM element when managed with a supported network management system.

The L1 port carries the composite DWDM signal and connects to the ROADM module. The client ports C1 through C96 provide add/drop access to the individual wavelengths and typically connect to transponder modules in colocated equipment. The MON port allows you to monitor the composite signal at the output of the multiplexer and at the input to the demultiplexer.

The block diagram of the FMD96 is shown in [Figure 46 on page 143](#).

Figure 46: Block Diagram



This topic includes the following information:

- [C-Band on page 143](#)
- [OSC on page 143](#)
- [Monitoring Points on page 143](#)
- [96-Channel Fixed Mux/Demux Specifications on page 144](#)
- [Installing a 96-Channel Fixed Mux/Demux \(BT8A78MD03\) on page 145](#)
- [Removing an FMD96 on page 150](#)

C-Band

In the line-in direction, the incoming C-band channels from the L1 port are demultiplexed into individual wavelengths for output onto the respective client ports.

In the client-in direction, the individual C-band channels are multiplexed onto a composite signal for output on the L1 port.

OSC

The FMD96 does not process the OSC signal from the attached ROADM module. Instead, the FMD96 demultiplexes the OSC signal from the composite signal on the L1-In port and multiplexes it back into the composite signal for output on the L1-Out port. This allows the connected ROADM module to detect the presence of the FMD96 if applicable.

Monitoring Points

The FMD96 provides diagnostic equipment (connected to the MON port), monitoring access to internal blocks.

In the line-in direction, the monitoring point is at the input to the demultiplexing stage after the OSC signal has been extracted. In the line-out direction, the monitoring point is at the output of the multiplexing stage before the OSC signal is multiplexed back in.

96-Channel Fixed Mux/Demux Specifications

See [Table 51 on page 144](#) for the FMD96 specifications.

Table 51: FMD96 (BT8A78MD03) Specifications

Parameters	Range		
Physical			
Width	438 mm		
Height	88 mm		
Depth	280 mm		
Weight			
Environmental			
Temperature and Humidity	See “Site Requirements” on page 75.		
Power Consumption	Not applicable, passive		
Optical	Minimum	Typical	Maximum
Central Wavelengths (C-band)	1528.77 nm		1566.72 nm
Number of Channels (50-GHz spacing)			96 channels
Insertion Loss (client in to line out)	4.0 dB		6.5 dB
Insertion Loss (line in to client out)	4.0 dB		6.5 dB
Monitor In Port Loss ¹	19.6 dB		22.3 dB
Monitor Out Port Loss ²	17.9 dB		21.2 dB
L1 Composite Input Signal Power			23 dBm
Client Input Signal Power			5 dBm/port ³
Wavelength (OSC, Line Port) ⁴	1266 nm	1310nm	1360 nm
Fiber Type	SMF-28 or equivalent		
Connector	LC/UPC		

Table 51: FMD96 (BT8A78MD03) Specifications (continued)

Parameters	Range
------------	-------

¹ Relative to L1 In.

² Relative to L1 Out.

³ The input power per client port must not exceed this limit to ensure that the optical safety on line output is within Class 1M requirements.

⁴ For connection to ROADM client ports.

Installing a 96-Channel Fixed Mux/Demux (BT8A78MD03)

Use this procedure to install a 96-Channel Fixed Mux/Demux (FMD96).

The FMD96 is a standalone, passive module that is designed to be installed directly into the following types of racks:

- 23-inch ANSI equipment rack
- 19-inch ANSI equipment rack
- 19-inch (410 mm) ETSI equipment rack
- 21-inch (500 mm) ETSI equipment rack



NOTE: The FMD96 is not NEBS-3 certified.

The FMD96 is shipped as a complete unit with hinged cover and latch, fiber support, and 21/23-inch mounting bracket attached. An installation kit with a 19-inch mounting bracket and installation hardware is included with the FMD96.

Tools Required

- Installation kit (included)
- Grounding cable
- Grounding cable connector to ground source
- Number 2 Phillips screwdriver (for ground screw)
- Number 2 Robertson screwdriver or hex wrench (for fasteners that attach the module to the frame)



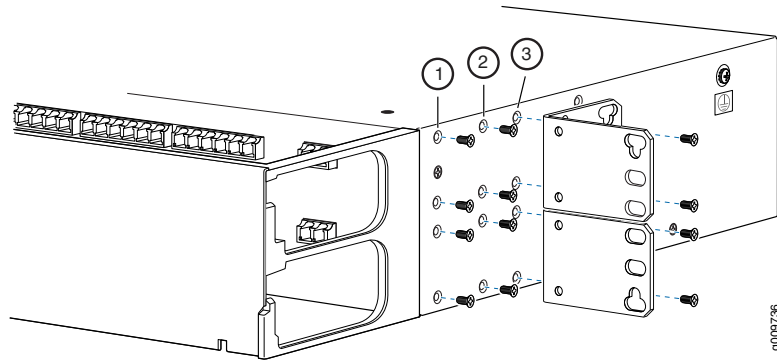
NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines”](#) on page 108.

Two L-shaped mounting brackets are installed on each side of the FMD96. The mounting brackets attached to the FMD96 are dual-function with the 21 and 23-inch configuration

governed by orientation. Three mounting positions are available. Choose the mounting position that ensures the FMD96 is flush with adjacent equipment. The FMD96 is shipped with the mounting brackets installed in the 23-inch orientation and mounted in the mid position.

1. Choose one of the following options based on the frame requirements and the mounting position.
 - a. To install the 23-inch brackets (see [Figure 47 on page 147](#)):

Figure 47: 23-inch Bracket Mounting Positions



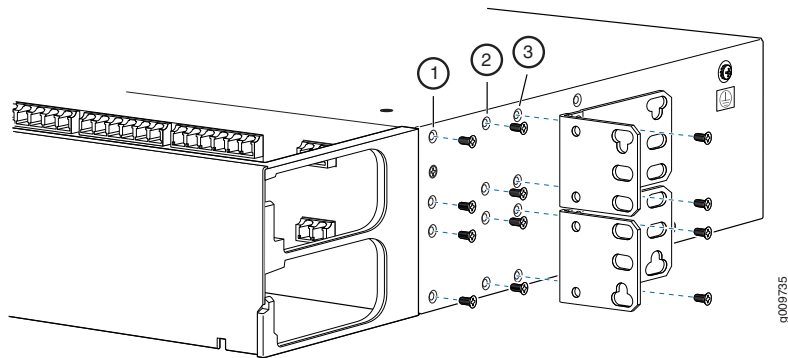
1—Mounting position	3—Mounting position
2—Mounting position	

Choose the mounting positions that enable the module to be installed flush with adjacent equipment.

If required, remove the mounting brackets and attach the brackets to the new mounting positions.

- b. To install the 21-inch brackets ([Figure 48 on page 147](#)):

Figure 48: 21-inch Bracket Mounting Positions



1—Mounting position	3—Mounting position
2—Mounting position	

Remove the screws from the 23-inch mounting brackets if installed. Choose the mounting position that enables the module to be installed flush with adjacent equipment.

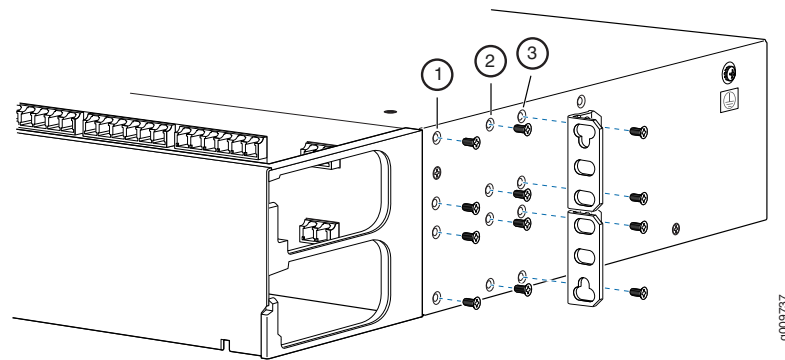
Reuse the mounting bracket screws to fasten the 21-inch mounting bracket to the module.

- c. To install the 19-inch brackets ([Figure 49 on page 148](#)):

Remove the 23-inch mounting brackets if installed. Choose the mounting position that enables the module to be installed flush with adjacent equipment.

Reuse the mounting bracket screws to fasten the 19-inch mounting bracket to the module.

Figure 49: 19-inch Bracket Mounting Positions

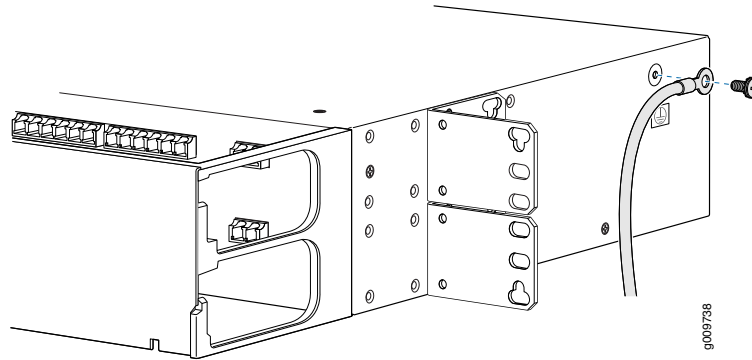


1—Mounting position	3—Mounting position
2—Mounting position	

2. Mount the module on the frame or the rack.
 - a. With one person at each side of the module, lift the module into position in the equipment frame.
 - b. Align the mounting holes in the mounting bracket with the mounting holes in the equipment frame.
 - c. Choose the set of mounting screws from the installation kit to mount the shelf into the equipment frame. Use one mounting screw and washer for each mounting bracket attachment. No locking nuts are required as the mounting screws fasten into the threaded screw inserts on the frame.
3. Ground the module.

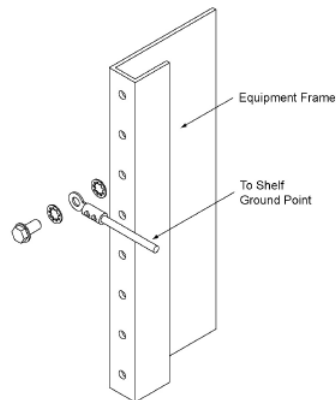
- a. Attach the ground cable (not supplied) to the grounding lug supplied in the installation kit.

Figure 50: Attach the Ground Cable



- b. Loosen the grounding screw and attach the lug over the ground screw.
- c. Secure the lug by fastening the ground screw.
- d. Attach the other end of the ground cable to ground.

The other end is connected to the frame using a biting star lock washer between the lug and the frame, and between the lug and the screw head.



4. Open the cover and connect fibers. The fibers should be routed between the front panel and the front cover to allow for the cover to be opened and closed.



CAUTION: When the ports are optically connected, the module is capable of passing light from all client and line ports at all times. The client and line port connections must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

5. Close the cover after connecting the fibers.

You have successfully completed this procedure.

Removing an FMD96

Use this procedure to remove the FMD96 from a rack.

Tools Required

- Number 2 Phillips screwdriver (for ground screw)
- Number 2 Robertson screwdriver or hex wrench (for fasteners that attach the module to the frame)
- Antistatic bag



NOTE: Be familiar with the site, safety, and installation guidelines described in [“Module Installation and Removal Guidelines” on page 108](#).

1. Open the hinged front cover and disconnect the fibers.



CAUTION: When working with the FMD96, follow the safety procedures associated with equipment containing Laser Safety Hazard Level 1M.

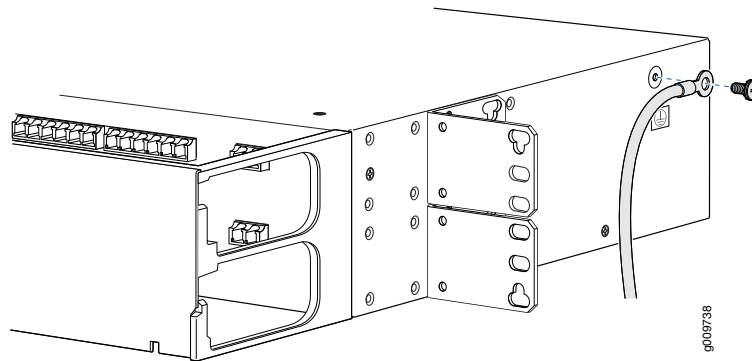


CAUTION: When the ports are optically connected, the module is capable of passing light from all client and line ports at all times. The client and line port connections must be limited to Class 1M (21.3 dBm) Laser Safety Regulations.

2. Disconnect the ground cable. See [Figure 51 on page 151](#)

Loosen the ground screw and remove the lug and ground cable. Secure the ground screw again.

Figure 51: Remove the Lug



3. Remove the FMD96 from the frame or the rack.
 - a. Position one person on each side of the FMD96 to secure the FMD96 during removal.
 - b. Remove the mounting screws and washer for each mounting bracket attachment.
 - c. Remove the FMD96 from the frame or the rack.
 - d. Place the FMD96 in antistatic packaging and stow in accordance with the environmental storage conditions.

You have successfully completed this procedure.

Service Module LEDs

The following table describes the LEDs for all service modules.

Table 52: Service Module LED Behavior

Name	Description	State	State Description
Identify (AMBER)	The Identify LED indicates whether the CMM has identified and acknowledged the newly-inserted module.	OFF	<p>The CMM has identified and acknowledged the module.</p> <p>The CMM can only acknowledge the module if the module is administratively up. A newly-inserted module is administratively up if either of the following is true:</p> <ul style="list-style-type: none"> The module has been pre-provisioned and configured to be administratively up. Auto-provisioning is enabled. If auto-provisioning is enabled and if the CMM is able to identify the module, the module is automatically provisioned and its administrative status is set to up.
		ON	The CMM has failed to identify or acknowledge the module.
		BLINKING	The CMM is attempting to identify and acknowledge the module.

Table 52: Service Module LED Behavior (continued)

Name	Description	State	State Description
Active (GREEN)	The Active LED reflects the operational status of the module.	OFF	The operational status of the module is down.
		ON	The operational status of the module is up.
Fail (RED)	The Fail LED reflects the operational status of the module.	OFF	The operational status of the module is up.
		ON	The operational status of the module is down.
H/S (BLUE)	The Hot Swap H/S LED indicates whether the module can be removed from the chassis.	OFF	The administrative status of the module is up, and the actual module matches the provisioned module. The module should not be removed from the chassis in this state.
		ON	The administrative status of the module is down, or the actual module does not match the provisioned module. The module can be removed from the chassis in this state.
		BLINKING	This is a transient state that occurs when plugging in a module, or when changing its administrative status. The module should not be removed from the chassis in this state.

Port LEDs

The BT17800 supports two kinds of port LEDs depending on the module. This is shown in the following tables.

Table 53: Port LEDs (UFMs and BICs)

LEDs	Color	Description
Fail	Red	The port has failed.
Fault	Amber	A fault exists on the port.

Table 54: Port LEDs (UFMs and Optical Modules)

LEDs	Color	Description
Active	Green	The port is operating normally.
Fault	Amber	A fault exists on the port.

CHAPTER 6

BTI7800 Series Transceiver Specifications

- [BTI7800 Transceivers on page 153](#)
- [BTI7800 SFP+ Transceiver Optical Specifications on page 155](#)
- [BTI7800 QSFP+ Transceiver Optical Specifications on page 162](#)
- [BTI7800 QSFP28 Transceiver Optical Specifications on page 168](#)
- [BTI7800 100-Gbps Transceiver Optical Specifications on page 171](#)
- [BTI7800 400-Gbps Transceiver Optical Specifications on page 176](#)
- [Installation Rules for the 100G Coherent CFP on page 177](#)
- [Cleaning Transceivers on page 177](#)

BTI7800 Transceivers

Table 55: BTI7800 Series Transceivers

Type	Fiber Type	Bit Rate	PEC	Compatibility	Introduced
SFP+ 850nm 200m Dual-Rate 10.3 and 10.5Gbps	Multimode	10.3 and 10.5 Gbps	BP3AD6SS	12x SFP+ BIC in UFM3 and UFM4	Release 1.1
SFP+ 1310nm 10km Multi-Rate 9.9 to 11.1Gbps	Single-mode	9.9 to 11.1 Gbps	BP3AM6MS	12x SFP+ BIC in UFM3 and UFM4	Release 1.1
SFP+ DWDM Fixed 80km Multi-Rate 9.9 to 11.1Gbps	Single-mode	9.9 to 11.1 Gbps	BP3AM6DL-xx	12x SFP+ BIC in UFM3 and UFM4	Release 1.1
SFP+ DWDM Tunable 80km Multi-Rate 9.9 to 11.1Gbps	Single-mode	9.9 to 11.1 Gbps	BP3AM6TL	12x SFP+ BIC in UFM3 and UFM4	Release 1.1
QSFP+ 4x10GBASE LR	Parallel single-mode	4x10 Gbps	QSFPP-4X10GE-LR (740-054050)	UFM6	Release 4.1
QSFP+ 4x10G Ethernet/OTN LR	Parallel single-mode	4x10 Gbps	QSFPP-4X10GD-LR (740-058730)	UFM6	Release 4.2
QSFP+ 4x10GBASE SR	Parallel multimode	4x10 Gbps	QSFPP-4X10GE-SR (740-054053)	UFM6	Release 4.3

Table 55: BT17800 Series Transceivers (continued)

Type	Fiber Type	Bit Rate	PEC	Compatibility	Introduced
QSFP+ 40GE SR4	Multimode	40 Gbps	QSFP+40GBASE-SR4 (740-067443)	UFM6	Release 4.4
QSFP+ 40GE LR4	Single-mode	40 Gbps	QSFP+40GBASE-LR4 (740-073093 740-043308)	UFM6	Release 4.4
QSFP28 100GE AOC	Active Optical Cable	100 Gbps	JNP-100G-AOC-1M (740-065630)	UFM6	Release 4.4
			JNP-100G-AOC-3M (740-065631)		
			JNP-100G-AOC-5M (740-065632)		
			JNP-100G-AOC-7M (740-065633)		
			JNP-100G-AOC-10M (740-061411)		
			JNP-100G-AOC-15M (740-068217)		
			JNP-100G-AOC-20M (740-064981)		
			JNP-100G-AOC-30M (740-064980)		
QSFP28 100GE SR4	Multimode	100 Gbps	QSFP-100GBASE-SR4 (740-058734)	UFM6	Release 4.3
QSFP28 100GE Ethernet/OTN LR4	Single-mode	100 Gbps	QSFP-100G-LR4-D (740-073859)	UFM6	Release 4.3
QSFP28 100GE LR4	Single-mode	100 Gbps	QSFP-100G-LR4-2 (740-074685)	UFM6	Release 4.1
CFP 100GBASE-SR10 100m	Parallel multi-mode	100 Gbps	BP3AMASS	1x CFP BIC in UFM3 and UFM4	Release 1.1
CFP 100GBASE-LR4 10km	Single-mode	100 Gbps	BP3AMDLI	1x CFP BIC in UFM3 and UFM4	Release 1.1
100G Coherent CFP	Single-mode	100 Gbps	BP3AMCTL Installation rules exist for this transceiver. See “Installation Rules for the 100G Coherent CFP” on page 177.	1x CFP BIC in UFM3 and UFM4	Release 1.5

Table 55: BT17800 Series Transceivers (continued)

Type	Fiber Type	Bit Rate	PEC	Compatibility	Introduced
100G Coherent CFP-M05	Single-mode	100 Gbps	CFP-100GBASE-CHRT Installation rules exist for this transceiver. See “Installation Rules for the 100G Coherent CFP” on page 177.	1x CFP BIC in UFM3 and UFM4	Release 4.1
100G Coherent MSA XCVR	Single-mode	100 Gbps	Integrated on the Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (BT8A78UFM4)	UFM4	Release 1.1
400G Coherent MSA XCVR	Single-mode	2 x 200 Gbps	Integrated on the Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (BT8A78UFM6-I02)	UFM6	Release 4.1

BT17800 SFP+ Transceiver Optical Specifications



NOTE: Contact Juniper Networks Support to confirm the power consumption values for any transceiver before using for planning or implementation purposes.

Table 56: SFP+ 850nm 200m Dual-Rate 10.3 and 10.5Gbps (BP3AD6SS)

Parameter	Minimum	Typical	Maximum	Units
Bit Rate	10.3125	–	10.52	Gbps
Transmitter				
TX operating wavelength	840	850	860	nm
Average operating power	-7.3	–	-1	dBm
Spectral width (rms)	–	–	0.45	nm
Extinction ratio	3	–	–	dB
Optical return loss tolerance	–	–	12	dB
Receiver				

Table 56: SFP+ 850nm 200m Dual-Rate 10.3 and 10.5Gbps (BP3AD6SS) (continued)

Parameter	Minimum	Typical	Maximum	Units
Receiver operating wavelength	840	–	860	nm
Stressed receiver sensitivity (BER = 1e-12)	–	–	-7.5	dBm
Receiver overload	0.5	–	–	dBm
Optical path penalty	–	–	3.9	dB
Reflectance	–	–	-12	dB
Other				
Reach (50m MMF, 2000 MZHzkm)	–	–	300	m
Connector/Latch type	LC/Bail			
Power Consumption (40° ambient)	Typical: 0.8 W Maximum: 1 W			
Compliance	IEEE 802.3, SFP+ MSA			

Table 57: SFP+ 1310nm 10km Multi-Rate 9.9 to 11.1Gbps (BP3AM6MS)

Parameter	Minimum	Typical	Maximum	Units
Bit Rate	9.953	–	11.0957	Gbps
Transmitter				
Transmitter operating wavelength	1260	1310	1360	nm
Average operating power	-8.2	–	0.5	dBm
Spectral width (~20dB)	–	–	1	nm
Side mode suppression ratio	30	–	–	dB
Extinction ratio	3.5	–	–	dB
Optical return loss tolerance	–	–	-12	dB
Receiver				
Receiver operating wavelength	1260	–	1360	nm

Table 57: SFP+ 1310nm 10km Multi-Rate 9.9 to 11.1Gbps (BP3AM6MS) (continued)

Parameter	Minimum	Typical	Maximum	Units
Stressed receiver sensitivity (BER = $1e^{-12}$)	–	–	-10.3	dBm
Receiver overload	0.5	–	–	dBm
Optical path penalty (@ 6.6 ps/nm)	–	–	3.2	dB
Reflectance	–	–	-12	dB
Other				
Reach	–	–	10	km
Connector/Latch type	LC/Bail			
Power Consumption (40° ambient)	Typical: 0.8 W Maximum: 1 W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, SFP+ MSA			

Table 58: SFP+ DWDM Fixed 80km Multi-Rate 9.9 to 11.1Gbps (BP3AM6DL-xx Xx=[01,40])

Parameter	Minimum	Typical	Maximum	Units
Bit Rate	9.953	–	11.0957	Gbps
Transmitter				
Transmitter operating wavelength	192.1	–	196	THz
Average operating power	-1	–	3	dBm
Spectral width (-20dB)	–	–	0.3	nm
Side mode suppression ratio	30	–	–	dB
Extinction ratio	8.2	–	–	dB
Optical return loss tolerance	–	–	27	dB
Receiver				
Receiver operating wavelength	1260	–	1600	nm
Receiver overload	3	–	–	dBm

Table 58: SFP+ DWDM Fixed 80km Multi-Rate 9.9 to 11.1Gbps (BP3AM6DL-xx Xx=[01,40]) (continued)

Parameter	Minimum	Typical	Maximum	Units
Reflectance	–	–	-27	dB
Other				
Connector/Latch type	LC/Bail			
Power Consumption (40° ambient)	Maximum: 1.5 W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, SFP+ MSA			

Table 59: Receiver Transmission Optical Performance Specifications: BP3AM6DL-xx Xx=[01,40]

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR (dB)	Receiver Sensitivity (Min. to Max.)	BER
9.95/10.3	-400	≥30	-24 to -7	1e ⁻¹²
		≥27	-18 to -7	
	0	≥30	-23 to -7	
		≥25	-18 to -7	
	1200	≥30	-22 to -7	
		≥27	-18 to -7	
	1600	≥30	-22 to -7	
		≥28	-18 to -7	
10.5	-400	≥30	-20 to -7	1e ⁻¹²
		≥28	-18 to -7	
	0	≥30	-23 to -7	
		≥26	-18 to -7	
	1200	≥30	-22 to -7	
		≥28	-18 to -7	
	1600	≥30	-18 to -7	

Table 59: Receiver Transmission Optical Performance Specifications: BP3AM6DL-xx Xx=[01,40] (continued)

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR (dB)	Receiver Sensitivity (Min. to Max.)	BER
10.7 (FEC G.709)	-400	≥30	-24 to -7	1e ⁻⁴
		≥19	-18 to -7	
	0	≥30	-23 to -7	
		≥19	-18 to -7	
	1200	≥30	-22 to -7	
		≥28	-18 to -7	
	1600	≥30	-24 to -7	
		≥19	-18 to -7	
10.7 (EFEC)	-400	≥30	-25 to -7	1e ⁻³
		≥17	-18 to -7	
	0	≥30	-27 to -7	
		≥16	-18 to -7	
	1200	≥30	-26 to -7	
		≥16	-18 to -7	
	1600	≥30	-25 to -7	
		≥17	-18 to -7	

Table 59: Receiver Transmission Optical Performance Specifications: BP3AM6DL-xx Xx=[01,40] (continued)

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR (dB)	Receiver Sensitivity (Min. to Max.)	BER
11.1 (FEC G.709)	-400	≥30	-24 to -7	1e ⁻⁴
		≥19	-18 to -7	
	0	≥30	-26 to -7	
		≥18	-18 to -7	
	1200	≥30	-25 to -7	
		≥18	-18 to -7	
	1600	≥30	-24 to -7	
		≥19	-18 to -7	
11.1 (EFEC)	-400	≥30	-25 to -7	1e ⁻³
		≥17	-18 to -7	
	-400 to 0	≥30	-27 to -7	
		≥16	-18 to -7	
	1200	≥30	-25 to -7	
		≥16	-18 to -7	
	1600	≥30	-25 to -7	
		≥17	-18 to -7	

Table 60: SFP+ DWDM Tunable 80km Multi-Rate 9.9 to 11.1Gbps (BP3AM6TL)

Parameter	Minimum	Typical	Maximum	Units
Bit Rate	9.953	—	11.0957	Gbps
Transmitter				
TX operating wavelength	191.35	—	196.1	THz
Average operating power	-1	—	3	dBm
Spectral width (-20dB)	—	—	0.3	nm

Table 60: SFP+ DWDM Tunable 80km Multi-Rate 9.9 to 11.1Gbps (BP3AM6TL) (continued)

Parameter	Minimum	Typical	Maximum	Units
Side mode suppression ratio	30	–	–	dB
Extinction ratio	8.2	–	–	dB
Optical return loss tolerance	–	–	27	dB
Receiver				
Rx operating wavelength	1260	–	1600	nm
Rx overload	3	–	–	dBm
Reflectance	–	–	-27	dB
Other				
Connector/Latch type	LC/Bail			
Power Consumption (40° ambient)	Typical: 1.7 W Maximum: 2 W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, SFP+ MSA			

Table 61: Receiver Transmission Optical Performance Specifications: BP3AM6TL

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR (dB)	Receiver Sensitivity (Min. to Max.)	BER
9.95/10.3/10.5	0	≥30	-24 to -7	1e ⁻¹²
		≥25	-19 to -7	
	1600	≥30	-22 to -7	
		≥26	-19 to -7	
10.7 (FEC G.709)	0	≥30	-26 to -7	1e ⁻⁴
		≥16.5	-24 to -7	
	1600	≥30	-24 to -7	
		≥18.5	-24 to -7	

Table 61: Receiver Transmission Optical Performance Specifications: BP3AM6TL (continued)

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR (dB)	Receiver Sensitivity (Min. to Max.)	BER
10.7 (EFEC G.709)	0	≥30	-27 to -7	1e ⁻³
		≥14.5	-24 to -7	
	1600	≥30	-25 to -7	
		≥16.5	-24 to -7	

BT17800 QSFP+ Transceiver Optical Specifications



NOTE: Contact Juniper Networks Support to confirm the power consumption values for any transceiver before using for planning or implementation purposes.

Table 62: QSFP+ 4x10GBASE LR: QSFPP-4X10GE-LR (740-054050)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	10.3125 +/- 100 ppm			Gbps
Number of lanes	–	4	–	–
Lane center wavelength	1260	–	1355	nm
Transmitter				
Average launch power per lane	-8.2	–	0.5	dBm
Extinction ratio	3.5	–	–	dB
Optical return loss tolerance	–	–	12	dB
Receiver				
Average receive power per lane	-14.4	–	0.5	dBm
Stressed receiver sensitivity (OMA) per lane	–	–	-10.3	dBm
Reflectance	–	–	-12	dB
Other				

Table 62: QSFP+ 4x10GBASE LR: QSFPP-4X10GE-LR (740-054050) (continued)

Parameter	Minimum	Typical	Maximum	Units
Fiber type	SMF			
Reach	2	–	10000	m
Connector/Latch type	MTP/APC			
Power consumption	Maximum: 3.5 W			
Compliance	IEEE 802.3			

Table 63: QSFP+ 4x10G Ethernet/OTN LR: QSFPP-4X10GD-LR (740-058730)

Parameter		Minimum	Typical	Maximum	Units
Signaling speed per lane	10GBASE	–	10.3125	–	Gbps
	OC192/STM64	–	9.95428	–	Gbps
	OTU2	–	10.709	–	Gbps
	OTU2e	–	11.0957	–	Gbps
	8GFC	–	8.5 +/- 100 ppm	–	Gbps
	10GFC	–	10.51875 +/- 100 ppm	–	Gbps
Number of lanes		–	4	–	–
Lane center wavelength	10GBASE	1260	–	1355	nm
	OC192/STM64	1290	–	1320	nm
	OTU2	1290	–	1330	nm
	OTU2e	1290	–	1330	nm
	8GFC	1260	–	1360	nm
	10GFC	1260	–	1355	nm
Transmitter					

Table 63: QSFP+ 4x10G Ethernet/OTN LR: QSFP-4X10GD-LR (740-058730) (continued)

Parameter		Minimum	Typical	Maximum	Units
Average launch power per lane	10GBASE	-8.2	–	0.5	dBm
	OC192/STM64	-6	–	-1	dBm
	OTU2	-6	–	-1	dBm
	OTU2e	-6	–	-1	dBm
	8GFC	-8.4	–	-1	dBm
	10GFC	-8.2	–	0.5	dBm
Extinction ratio	10GBASE	3.5	–	–	dB
	OC192/STM64	6	–	–	dB
	OTU2	6	–	–	dB
	OTU2e	6	–	–	dB
	8GFC	3.5	–	–	dB
	10GFC	3.5	–	–	dB
Optical return loss tolerance		–	–	12	dB
Receiver					
Average receive power per lane		-14.4	–	0.5	dBm
Stressed receiver sensitivity (OMA) per lane		–	–	-10.3	dBm
Reflectance		–	–	-12	dB
Other					
Fiber type		SMF			
Reach		2	–	10000	m
Connector/Latch type		MTP/APC			
Power consumption		Maximum: 3.5 W			
Compliance		IEEE 802.3, GR-253-Core, FC-P1-4			

Table 64: QSFP+ 4x10GBASE SR: QSFP-4X10GE-SR (740-054053)

Parameter		Minimum	Typical	Maximum	Units
Signaling speed per lane	10GBASE	10.3125 +/- 100 ppm			Gbps
	40GBASE				
	8GFC	8.5 +/- 100 ppm			Gbps
	10GFC	10.51875 +/- 100 ppm			Gbps
Number of lanes		–	4	–	–
Lane center wavelength		840	–	860	nm
Transmitter					
Average launch power per lane	10GBASE	-7.3	–	-1.3	dBm
	40GBASE				
	8GFC	-8.2	–	-1.3	dBm
	10GFC	-7.3	–	-1.3	dBm
Extinction ratio		3	–	–	dB
Optical return loss tolerance		–	–	12	dB
Receiver					
Average receive power per lane	10GBASE	-9.9	–	-1.0	dBm
	40GBASE				
	8GFC	–	–	0	dBm
	10GFC	-9.9	–	-1.0	dBm
Stressed receiver sensitivity (OMA) per lane	10GBASE	–	–	-7.5	dBm
	40GBASE				
	8GFC	–	–	-8.3	dBm
	10GFC	–	–	-7.5	dBm
Reflectance		–	–	-12	dB
Other					
Fiber type		MMF			

Table 64: QSFP+ 4x10GBASE SR: QSFP-4X10GE-SR (740-054053) (continued)

Parameter	Minimum	Typical	Maximum	Units
Reach	0.5	–	300 (OM3) 400 (OM4)	m
Connector/Latch type	MTP/PC			
Power consumption	Maximum: 1.5 W			
Compliance	IEEE 802.3, FC-P1-4			

Table 65: QSFP+ 40GE SR4: QSFP-40GBASE-SR4 (740-067443)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	10.3125 +/- 100 ppm			Gbps
Number of lanes	–	4	–	–
Lane center wavelength	840	–	860	nm
Transmitter				
Average launch power per lane	-7.6	–	2.4	dBm
Extinction ratio	3	–	–	dB
Optical return loss tolerance	–	–	12	dB
Receiver				
Average receive power per lane	-9.5	–	2.4	dBm
Stressed receiver sensitivity (OMA) per lane	–	–	-5.4	dBm
Reflectance	–	–	-12	dB
Other				
Fiber type	MMF			
Reach	0.5	–	100 (OM3) 150 (OM4)	m
Connector/Latch type	12-Fiber MPO			
Power consumption	Maximum: 1.5 W			

Table 65: QSFP+ 40GE SR4: QSFPP-40GBASE-SR4 (740-067443) (continued)

Parameter	Minimum	Typical	Maximum	Units
Compliance	IEEE 802.3			

Table 66: QSFP+ 40GE LR4: QSFPP-40GBASE-LR4 (740-073093 740-043308)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	10.3125 +/- 100 ppm			Gbps
Number of lanes	–	4	–	–
Lane center wavelength	1264.5	–	1277.5	nm
	1284.5		1297.5	
	1304.5		1317.5	
	1324.5		1337.5	
Transmitter				
Average launch power per lane	-7	–	2.3	dBm
Extinction ratio	3.5	–	–	dB
Optical return loss tolerance	–	–	20	dB
Receiver				
Average receive power per lane	-13.7	–	2.3	dBm
Stressed receiver sensitivity (OMA) per lane	–	–	-9.6	dBm
Reflectance	–	–	-26	dB
Other				
Fiber type	SMF			
Reach	2	–	10000	m
Connector/Latch type	LC			
Power consumption	Maximum: 3.5 W			
Compliance	IEEE 802.3			

BT17800 QSFP28 Transceiver Optical Specifications



NOTE: Contact Juniper Networks Support to confirm the power consumption values for any transceiver before using for planning or implementation purposes.

Table 67: QSFP28 100GE LR4: QSFP-100G-LR4-2 (740-074685)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	25.78125 +/- 100 ppm			Gbps
Number of lanes	–	4	–	–
Lane center wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19			nm
Transmitter				
Average launch power per lane	-4.3	–	4.5	dBm
Extinction ratio	4	–	–	dB
Optical return loss tolerance	–	–	20	dB
Receiver				
Average receive power per lane	-10.6	–	4.5	dBm
Receiver sensitivity (OMA) per lane	–	–	-8.6	dBm
Stressed receiver sensitivity (OMA) per lane	–	–	-6.8	dBm
Reflectance	–	–	-26	dB
Other				
Fiber type	SMF			
Reach	2	–	10000	m
Connector/Latch type	LC/UPC			
Power consumption	Maximum: 3.5W			

Table 67: QSFP28 100GE LR4: QSFP-100G-LR4-2 (740-074685) (continued)

Parameter	Minimum	Typical	Maximum	Units
Compliance	IEEE 802.3			

Table 68: QSFP28 100GE Ethernet/OTN LR4: QSFP-100G-LR4-D (740-073859)

Parameter		Minimum	Typical	Maximum	Units
Signaling speed per lane	100GBASE	25.78125 +/- 100 ppm			Gbps
	OTN	27.952493			Gbps
Number of lanes		–	4	–	–
Lane center wavelengths (range)		1294.53 – 1296.59			nm
		1299.02 – 1301.09			
		1303.54 – 1305.63			
		1308.09 – 1310.19			
Transmitter					
Average launch power per lane	100GBASE	-4.3	–	4.5	dBm
	OTN	-0.6	–	4	dBm
Extinction ratio	100GBASE	4	–	–	dB
	OTN	4	–	6.5	dB
Optical return loss tolerance		–	–	20	dB
Receiver					
Average receive power per lane	100GBASE	-10.6	–	4.5	dBm
	OTN	-6.9	–	4	dBm
Receiver sensitivity (OMA) per lane		–	–	-8.6	dBm
Stressed receiver sensitivity (OMA) per lane		–	–	-6.8	dBm
Reflectance		–	–	-26	dB
Other					

Table 68: QSFP28 100GE Ethernet/OTN LR4: QSFP-100G-LR4-D (740-073859) (continued)

Parameter	Minimum	Typical	Maximum	Units
Fiber type	SMF			
Reach	2	–	10000	m
Connector/Latch type	LC/UPC			
Power consumption	Maximum: 3.5W			
Compliance	IEEE 802.3			

Table 69: QSFP28 100GE SR4: QSFP-100GBASE-SR4 (740-058734)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	25.78125 +/- 100 ppm			Gbps
Number of lanes	–	4	–	–
Lane center wavelengths (range)	840	–	860	nm
Transmitter				
Average launch power per lane	-8.4	–	2.4	dBm
Extinction ratio	2	–	–	dB
Optical return loss tolerance	–	–	12	dB
Receiver				
Average receive power per lane	-10.3	–	2.4	dBm
Stressed receiver sensitivity (OMA) per lane	–	–	-5.2	dBm
Reflectance	–	–	-12	dB
Other				
Fiber type	MMF			
Reach	0.5	–	70 (OM3) 100 (OM4)	m
Connector/Latch type	MTP/PC			

Table 69: QSFP28 100GE SR4: QSFP-100GBASE-SR4 (740-058734) (continued)

Parameter	Minimum	Typical	Maximum	Units
Power consumption	Maximum: 3.5 W			
Compliance	IEEE 802.3			

Table 70: QSFP28 100GE AOC: JNP-100G-AOC-xx (740-06xxxx)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane	25.78125 +/- 100 ppm			Gbps
Number of lanes	—	4	—	—
Reach	JNP-100G-AOC-1M (740-065630) - 1 m JNP-100G-AOC-3M (740-065631) - 3 m JNP-100G-AOC-5M (740-065632) - 5 m JNP-100G-AOC-7M (740-065633) - 7 m JNP-100G-AOC-10M (740-061411) - 10 m JNP-100G-AOC-15M (740-068217) - 15 m JNP-100G-AOC-20M (740-064981) - 20 m JNP-100G-AOC-30M (740-064980) - 30 m			
Connector/Latch type	Not applicable			
Power consumption	Maximum: 3.5 W			
Compliance	IEEE 802.3			

BT17800 100-Gbps Transceiver Optical Specifications



NOTE: Contact Juniper Networks Support to confirm the power consumption values for any transceiver before using for planning or implementation purposes.

Table 71: CFP 100GBASE-SR10 100m: BP3AMASS

Parameter	Minimum	Typical	Maximum	Units
Transmitter				
Signaling speed per lane (100GbE)	—	10.3125	—	Gbps

Table 71: CFP 100GBASE-SR10 100m: BP3AMASS (continued)

Parameter	Minimum	Typical	Maximum	Units
Signaling speed per lane (OTU4)	-	11.1809	-	Gbps
TX operating wavelength	840	-	860	nm
Average launch power per Lane	-7.6	-	2.4	dBm
Spectral width (RMS)	-	-	0.65	nm
Extinction ratio	3	-	-	dB
Optical return loss tolerance	-	-	12	dB
Receiver				
Receiver operating wavelength	840	-	860	nm
Stressed receiver sensitivity per lane	-	-	-5.4	dBm
Rx overload	3.4	-	-	dBm
Optical path penalty	-	-	3.5	dB
Other				
Power Consumption (40° ambient)	Typical: 10W Maximum: 12W			
Compliance	IEEE 802.3, CFP MSA			

Table 72: CFP 100GBASE-LR4 10km: BP3AMDLI

Parameter	Minimum	Typical	Maximum	Units
Transmitter				
Signaling speed per lane (100GbE)	-	25.78	-	Gbps
Signaling speed per lane (OTU4)	-	27.95	-	Gbps
Lane wavelengths	1294.53	1295.56	1296.59	nm
	1299.02	1300.05	1301.09	nm
	1303.54	1304.58	1305.63	nm
	1308.09	1309.14	1310.19	nm

Table 72: CFP 100GBASE-LR4 10km: BP3AMDLI (continued)

Parameter	Minimum	Typical	Maximum	Units
Average launch power per Lane	-4.3	-	4.5	dBm
Total average launch power	0	-	10.5	dBm
Side mode suppression ratio (SMSR)	30	-	-	dB
Extinction ratio (OTU4)	7	-	-	dB
Optical return loss tolerance	-	-	20	dB
Receiver				
Stressed Rx sensitivity per lane	-	-	-6.8	dBm
Receiver overload	-	-	5.5	dBm
Reflectance	-	-	-26	dB
Other				
Power Consumption (40° ambient)	Typical: 20W Maximum: 24W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, CFP MSA			

Table 73: 100G Coherent CFP-M05: CFP-100GBASE-CHRT

Parameter	Minimum	Typical	Maximum	Units
Transmitter				
Signaling speed (100GbE)	10.3125			Gbps
Signaling speed (OTU4)	11.1809			Gbps
Transmitter frequency range	191.25	—	196.10	THz
Laser frequency stability	-1.8	—	1.8	GHz
Output power tuning range	-15	—	1	dBm
Transmitter OSNR (in-band)	39	—	—	dB
Optical return loss tolerance	27	—	—	dB
Receiver				

Table 73: 100G Coherent CFP-M05: CFP-100GBASE-CHRT (continued)

Parameter	Minimum	Typical	Maximum	Units
Receiver frequency range	191.25	–	196.10	THz
Input power range	-13	–	0	dBm
Extended input power range	-18	–	–	dBm
OSNR sensitivity	13.3	–	14	dB/0.1nm
PMD tolerance	–	–	25	ps
PDL tolerance	3	–	–	dB
Dispersion tolerance	-40000		40000	ps/nm
Optical return loss from receiver	27	–	–	dB
Other				
Power Consumption (40° ambient)	Maximum: 32W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, CFP MSA			

Table 74: 100G Coherent CFP: BP3AMCTL

Parameter	Minimum	Typical	Maximum	Units
Transmitter				
Transmitter frequency range	191.35	-	196.10	THz
Laser frequency stability	-1.8	-	1.8	GHz
Output power tuning range	-15	-	1	dBm
Transmitter OSNR (in-band)	27	-	-	dB
Optical return loss tolerance	27	-	-	dB
Receiver				
Receiver frequency range	191.35	-	196.10	THz
Input power range	-18 (-21dBm in unamplified applications)	-	0	dBm
OSNR tolerance	17.1	-	-	dB

Table 74: 100G Coherent CFP: BP3AMCTL (continued)

Parameter	Minimum	Typical	Maximum	Units
PMD tolerance	-	-	15	ps
PDL tolerance	-	-	3	dB
Dispersion tolerance	-22000	-	22000	ps/nm
Optical return loss from receiver	27	-	-	dB
Other				
Power Consumption (40° ambient)	Typical: 25W Maximum: 32W			
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709, CFP MSA			

Table 75: 100G Coherent MSA XCVR on UFM4

Parameter	Minimum	Typical	Maximum	Units
Transmitter				
Transmitter frequency range	191.35	-	196.10	THz
Laser frequency stability	-1.8	-	1.8	GHz
Output power tuning range	-5	-	1	dBm
Transmitter OSNR (in-band)	40	-	-	dB
Optical return loss tolerance	27	-	-	dB
Receiver				
Receiver frequency range	191.35	-	196.10	THz
Input power range	-18 (-22dBm in unamplified systems)	-	-2	dBm
OSNR tolerance	13.7	-	-	dB
PMD tolerance	-	-	30	ps
PDL tolerance	-	-	3	dB
Dispersion tolerance	-50000	-	50000	ps/nm

Table 75: 100G Coherent MSA XCVR on UFM4 (continued)

Parameter	Minimum	Typical	Maximum	Units
Optical return loss from receiver	27	-	-	dB
Other				
Compliance	IEEE 802.3, Telcordia GR-253, ITU-T G.709			

BT17800 400-Gbps Transceiver Optical Specifications



NOTE: Contact Juniper Networks Support to confirm the power consumption values for any transceiver before using for planning or implementation purposes.

Table 76: 400G Coherent MSA XCVR (2 X 200-Gbps) on UFM6

Parameter		Minimum	Typical	Maximum	Units
Transmitter					
Transmitter frequency range		191.35	—	196.10	THz
Laser frequency stability		-1.8	—	1.8	GHz
Output power tuning range		-10	—	2.5	dBm
Transmitter OSNR (in-band)		36	—	—	dB / 0.1 nm
Optical return loss tolerance		27	—	—	dB
Receiver					
Receiver frequency range		191.35	—	196.10	THz
Input power range		-18	—	0	dBm
OSNR sensitivity	16-QAM (sd-fec-25pc)	—	—	19.5	dB / 0.1 nm
	QPSK (sd-fec-25pc)	—	—	11.5	dB / 0.1 nm
	QPSK (soft-fec)	—	—	13.5	dB / 0.1 nm
PMD tolerance	16-QAM	15	—	—	ps
	QPSK	30	—	—	ps

Table 76: 400G Coherent MSA XCVR (2 X 200-Gbps) on UFM6 (continued)

Parameter		Minimum	Typical	Maximum	Units
PDL tolerance		3	–	–	dB
Dispersion tolerance	16-QAM	-30000	–	30000	ps/nm
	QPSK	-70000	–	70000	ps/nm
Optical return loss from receiver		27	–	–	dB
Other					
Power Consumption		–	115	125	W
Connector		LC/UPC			

Installation Rules for the 100G Coherent CFP

The following rules must be followed when installing the 100G Coherent CFP (BP3AMCTL, CFP-100GBASE-CHRT) in a BT17814 chassis.

Table 77: Installation Rules for the 100G Coherent CFP in a BT17814 Chassis

Rule	Description
Placement within the UFM	The 100G Coherent CFP must be installed in a BIC in BIC slot 2 of the UFM (lower slot of the UFM when viewed vertically).
Placement within the chassis	The UFM with the 100G Coherent CFP must be installed to the immediate right of a fully occupied slot, or in slot 1 (leftmost slot) of the chassis. A fully occupied slot is a slot that contains a module. If that module is a UFM, then that UFM must have BIC modules in all of its BIC slots.



NOTE: Failure to comply with these rules might lead to adverse thermal behavior and premature failure.

Cleaning Transceivers

When cleaning transceivers, use an industry standard fiber optic cleaner or a 1.25 mm cotton-tipped swab to insert into the receptacle. The swabs can be used to clean the optical surface and to clean debris from the inner sleeve. Use extreme care as it is easy to scratch the optical plane.

CHAPTER 7

BTI7800 Series Field Replaceable Units (FRUs)

- BTI7814 Field-Replaceable Units (FRUs) on page 179
- BTI7802 Field-Replaceable Units (FRUs) on page 193
- BTI7801 Field-Replaceable Units (FRUs) on page 199

BTI7814 Field-Replaceable Units (FRUs)

Field-replaceable units are pre-installed when the BTI7814 is delivered. This section describes how to remove and replace the FRUs on the BTI7814.



WARNING: Use proper caution when working with the equipment. This chapter might not cover every possible hazardous condition.

Safety Warnings

- This equipment is intended to be installed and serviced by qualified personnel.
- Be familiar with the safety guidelines described in the *BTI7800 Series Hardware Overview and Installation Guide*.
- Ensure the chassis is installed properly and secured onto the rack.
- Ensure you have an unobstructed path to the chassis.
- Avoid contact with rotating fan blades.

Electrical Warnings



CAUTION: Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures. ESD can occur when a module is improperly handled.

To prevent ESD damage to a module, follow these guidelines:

- Always wear an ESD grounding device, such as an ESD wrist strap, when handling a module.
- Do not remove a module from its antistatic bag until installation. Store removed modules in antistatic packaging.
- If you need to set a module down, place it back into its antistatic packaging or on a properly-grounded antistatic mat.
- Handle the module by its edges and/or its faceplate and avoid touching any pins, leads, or solder connections on the circuit board.
- [Replacing the BT17814 DC PEM on page 180](#)
- [Replacing the BT17814 AC PEM on page 182](#)
- [Replacing the BT17814 CAP on page 187](#)
- [Replacing a BT17814 FAN3 on page 188](#)
- [Replacing a BT17814 Booster Fan on page 189](#)
- [Performing a First Time Installation of the BT17814 Booster Fans on page 190](#)
- [Replacing a BT17814 Air Filter on page 191](#)

Replacing the BT17814 DC PEM

Use this procedure to remove and replace the 14-Slot Chassis DC Power Entry Module (DC PEM) on the BT17814 chassis.

The DC PEM that you are replacing must be disconnected from its power source. The other DC PEMs can remain powered.



WARNING:

- Ensure that you are familiar with the safety and electrical warnings described in [“BT17814 Field-Replaceable Units \(FRUs\)” on page 179](#).
 - Ensure that the plastic shields are in place over the other DC PEMs, and that there is no exposed wiring.
-

Tools Required

- Number 2 Phillips screwdriver
- 10 mm nut driver
- Multimeter

1. Disconnect the faulty PEM from its power source. Choose one of the following options:

The faulty DC PEM might be connected to the external power source directly, or to another DC PEM from which it receives its power:

- If you are removing the DC PEM that is connected to an external power source, follow the appropriate steps to disconnect the DC PEM from that source.
- If the faulty DC PEM receives its power from another PEM, follow the appropriate steps to disconnect this other DC PEM from the power source.

2. Label all cables to make them easier for you to reconnect later.
3. Remove the plastic shield covering the studs.
4. Remove the cables from the faulty DC PEM by removing the nuts, washers and double lugs from the studs.
5. Remove the DC PEM from the chassis.
 - a. Loosen the four thumbscrews (one on each corner of the DC PEM).
 - b. Pull out the module. Be careful to keep the module straight along the slot guides to avoid damage to DC PEM components.

Once the module is removed, place it in an antistatic bag or on a grounded antistatic mat.

6. Install the replacement DC PEM.

Carefully slide the module along the slot guides until the DC PEM connects to the backplane. Carefully tighten the thumbscrews.

7. Connect the cabling to the replacement DC PEM, using the following setup for each stud:

First add one nut to the stud. Add the double hole lug, the washers and the remaining nut.

8. Orient and reinstall the plastic shield.

The plastic shield has small holes to allow instrument access to the terminals while the shield is in place. Align the holes with the terminals when installing.

9. Follow the appropriate procedures in your plant to reconnect power from the plant power source.

The LEDs start to light up. The ACT LED turns solid green to acknowledge the module is powered on and installed successfully.

10. Perform a voltage checklist. You can check the voltage through the instrument access holes in the plastic shields on the DC PEMs.

With a portable multimeter, measure the voltage at each DC PEM as follows:

- **- Minus Feed:** -42 VDC to -60 VDC as measured from the Feed to the Return.
- **+ Positive Return:** Within less than 2 V of the frame or chassis ground.

You have successfully completed this procedure.

Replacing the BT17814 AC PEM

Use this procedure to remove and replace the AC Power Entry Module (AC PEM) on the BT17814 chassis.

The AC PEM that you are replacing must be disconnected from its power source. The other AC PEMs can remain powered.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “[BT17814 Field-Replaceable Units \(FRUs\)](#)” on page 179.



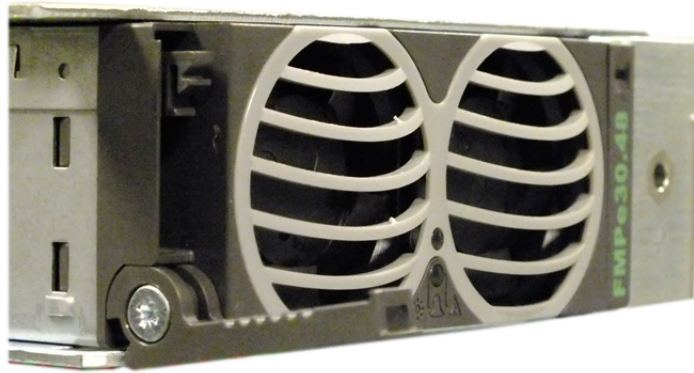
NOTE: If you plan on reusing the AC PEM that you are removing, you must wait for a minimum of 60 seconds before reinserting the removed PEM into another slot or chassis.

Tools Required

- Number 2 Phillips screwdriver
- Multimeter

1. Identify the faulty PEM. The faulty PEM has the red or amber LED illuminated.
2. Turn off power and unplug the AC cable to the faulty PEM. There is an ON/OFF switch on the AC PEM housing for each PEM.
3. Remove the AC PEM housing cover to expose the AC PEM modules.
 - a. Loosen the four thumbscrews on each corner of the AC PEM housing cover so that the screws spin freely. Ensure the thumbscrews are completely disengaged from their threaded holes. You might need a Phillips screwdriver for this step.
 - b. Using the thumbscrews as handles, gently pull the cover away from the housing. You might need to alternately pull on one pair of thumbscrews, and then on the other pair.
 - c. Set the cover down so that it does not get in your way.
4. Remove the defective AC PEM module.

- a. Identify the faulty PEM again and ensure the switch for the PEM is OFF, and the AC cable is unplugged.
- b. Grasp the AC PEM latch and push it down to unseat the PEM module.



- c. Pull the module straight out until the connector on the PEM module is clear of the mating PEM connector on the backplane.
- d. Still grasping the latch, pivot the AC PEM module towards you and remove it from the housing.



- e. Place the module into an anti-static bag or on a ground mat.



NOTE: If you plan on reusing this AC PEM, you must wait for a minimum of 60 seconds before reinserting it into another slot or chassis.

5. Install the replacement AC PEM.

- a. Pull open the latch on the replacement module.
- b. Ensure the module is right-side up, and insert it into the chassis. You can insert the module at an angle if necessary.
- c. Rotate the module until its exposed side is flush and parallel with the exposed sides of the other AC PEM modules.

The connector on the PEM module is now inline with the mating PEM connector on the backplane.

- d. Carefully push the front of the module until the latch engages with the housing. The latch is engaged when it starts to move to the closed position by itself.
- e. Finish seating the module by closing the latch completely.



NOTE: If the latch is not engaged with the housing, the latch will close but the module will not seat.

6. Reinstall the housing cover.

- a. Orient the cover by aligning the three slots in the cover with the three flanges on the housing.



- b. Gently push the cover onto the housing while keeping the flanges aligned.



NOTE: If the module is not seated properly, you will not be able to reinstall the housing cover.

- c. Make minor adjustments as necessary to align the four thumbscrews with the threaded holes.
 - d. Tighten the four thumbscrews.
- #### 7. Plug the AC cable back in and switch on the power to the PEM.

The AC OK LED turns solid green to acknowledge the module is powered on and installed successfully.

You have successfully completed this procedure.

Replacing the Fuses on a BT17814 AC PEM

Use this procedure to remove and replace a fuse on an AC Power Entry Module (AC PEM) on the BT17814 chassis.

Changing a fuse on the AC PEM must be performed with the power off to some rectifiers. If the blown fuse is located in the top fuse array, then the rectifiers in Slot 1 and Slot 2 must be disconnected from their power source. If the blown fuse is located in the bottom fuse array, then the rectifiers in Slot 3 and Slot 4 must be disconnected from their power source. The slots are numbered 1 to 4 from top to bottom.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “BT17814 Field-Replaceable Units (FRUs)” on page 179.



NOTE: The cause of the blown fuse must be understood and the problem rectified prior to changing the fuse.

Tools Required

- Number 2 Phillips screwdriver

1. Identify the slot for which the fuse has blown.
2. Look at the fuse location diagram to determine the fuse array that contains the blown fuse.

The fuses are divided into two fuse arrays. The top fuse array protects the DC output of the A feed, and is located behind the AC PEM in Slot 2. The bottom fuse array protects the DC output of the B feed, and is located behind the AC PEM in Slot 3.

F12B= FFM1, TMM1	F12A= FFM1, TMM1	Fuse Top Array
F11B= Slot 13 & 14	F11A= Slot 13 & 14	
F10B= Slot 11 & 12	F10A= Slot 11 & 12	
F9B= CMM2, EXT1&2	F9A= CMM2, EXT1&2	
F8B= Slot 9 & 10	F8A= Slot 9 & 10	
F7B= FFM3 & TMM2	F7A= FFM3 & TMM2	
F6B= Slot 7 & 8	F6A= Slot 7 & 8	
F5B= Slot 5 & 6	F5A= Slot 5 & 6	
F4B= Slot 3 & 4	F4A= Slot 3 & 4	
F3B= CMM1, Front Fans	F3A= CMM1, Front Fans	
F2B= FFM2, FFM Aux Fans	F2A= FFM2, FFM Aux Fans	
F1B= Slot 1 & 2	F1A= Slot 1 & 2	
Replacement : Blade fuse; max 30A; 80Vdc; Littelfuse p/n: 166.7000.5xxx or equivalent.		Fuse Bottom Array

- Turn off power and unplug the AC cables as follows:
If the blown fuse is located in the top fuse array, turn off power and unplug the AC power cables from Slot 1 and Slot 2.
If the blown fuse is located in the bottom fuse array, turn off power and unplug the AC power cables from Slot 3 and Slot 4.
- Follow the steps in [“Replacing the BT17814 AC PEM” on page 182](#) and remove the AC PEM that is in front of the fuse array to which you need to gain access.
- Using needle-nose pliers, extract the fuse you want to replace and discard appropriately.
- Using needle-nose pliers, insert the replacement fuse (of the same rating) into the empty socket.
- Follow the steps in [“Replacing the BT17814 AC PEM” on page 182](#) and reinstall the AC PEM and housing cover.
- Plug the AC cables back and switch on the power to all the PEMs.
The AC OK LED turns solid green on all the PEMs.

You have successfully completed this procedure.

Replacing the BT17814 CAP

This topic describes how to remove and replace the Chassis Alarm Panel (CAP) on the BT17814 chassis.

The CAP is hot-swappable, and can be replaced while the system is powered on and operational.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “BT17814 Field-Replaceable Units (FRUs)” on page 179.

The CAP is accessible from the rear of the chassis.

Tools Required

- Number 2 Phillips screwdriver

1. Remove all cable or other obstructions.
2. Remove the rear chassis access cover that hides the CAP.
 - a. Completely loosen the four thumbscrews that hold the cover in place.

The thumbscrews should spin freely once they are disengaged from their threaded holes.
 - b. Use the two thumbscrews on each side as handles and pull the cover outwards towards your body to disengage from the top edge.
 - c. Lift the cover out from the bottom rail guide.
 - d. Set the cover aside out of the way.
3. Loosen the two thumbscrews on the CAP.
4. Carefully grip the loosened thumbscrews and gently pull out the module.

Place the module in an antistatic bag or on a grounded antistatic mat.
5. Align the new CAP with the slot guides.
6. Gently push the module until it connects to the backplane.
7. Carefully tighten the thumbscrews.
8. Replace the rear chassis access cover.
 - a. Orient the cover and insert the bottom edge along the bottom rail guide.
 - b. Gently push the top of the cover into place against the top edge.

- c. Make minor adjustments to align the thumbscrews with their threaded holes.
- d. Tighten the four thumbscrews that hold the cover in place.

You have successfully completed this procedure.

Replacing a BT17814 FAN3

Use this procedure to replace a 14-Slot Chassis Front Cooling Module on the BT17814 chassis.

The cooling modules are hot-swappable and can be replaced while the system is powered on and operational.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in [“BT17814 Field-Replaceable Units \(FRUs\)” on page 179](#).

Tools Required

- Number 2 Phillips screwdriver

1. Open the cooling module door, located in the front of the chassis above the service module slots.

Open the door by pushing on the side latches (one on each side of the door).

2. Remove the faulty cooling module.

- a. Unseat the faulty cooling module. Wait until the blades have fully stopped before proceeding to the next step.

- b. Hold the cooling module handle and slowly slide the module out of the chassis.

3. Place the cooling module in an antistatic bag or a grounded antistatic mat.

4. Install the new cooling module.

Before installing, ensure the correct handle is attached to the new module.

The upper FAN3 modules have a different handle from the lower FAN3 modules. The lower modules are recessed deeper in the chassis and therefore require a deeper handle. The deeper handle has a circular cutout so that air flow is not obstructed to the FAN3 module directly above.

Depending on whether you are replacing a lower or an upper FAN3 module, you might need to change the metal handle. The handle for the upper FAN3 module is attached with two screws. The handle for the lower FAN3 module is attached with four screws.

Once the correct handle is attached to the new module, insert the module into the slot until it is seated.

5. Close the cooling module door.

- a. Gently push both sides of the door until the cooling module door is flush with the chassis.
- b. Pull on the side latches until they lock into place.

You have successfully completed this procedure.

Replacing a BT17814 Booster Fan

Use this procedure to replace a BT17814 Booster Fan (FAN9) on the BT17814.

FAN9 modules are hot-swappable and can be replaced while the system is powered and operational.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “BT17814 Field-Replaceable Units (FRUs)” on page 179.

Tools Required

- Number 2 Phillips screwdriver.
1. At the rear of the chassis, use the screwdriver to unfasten the four screws that secure the ventilation cover, and then pull the cover away from the chassis.
 2. Remove the faulty FAN9 module.
 - a. Loosen the two thumbscrews that secure the module to the chassis, and grasp the module by its handle.
 - b. Wait for the module's fans to stop.
 - c. Carefully slide the module out of the chassis, and place it either in an antistatic bag or on a grounded antistatic mat.
 3. Install the replacement FAN9 module.
 - a. Properly orient the module for installation, and carefully slide it into the chassis until it is fully seated.
 - b. Secure the module by tightening the two thumbscrews.



CAUTION: If you are replacing both FAN9 modules in a chassis that is powered and operational, install only one replacement module at a time, ensuring that the first replacement module is fully secured before installing the second replacement module.

4. Replace the ventilation cover.
 - a. Place the ventilation cover on the chassis, and align it with the pilot holes of the four screws that will secure it.
 - b. Loosely fasten the screws, and re-adjust the positioning of the cover if required.

- c. Fully fasten the screws.

You have successfully completed this procedure.

Performing a First Time Installation of the BTI7814 Booster Fans

Use this procedure to install BTI7814 Booster Fan (FAN9) modules in a BTI7814 in which FAN9 modules are not already installed.

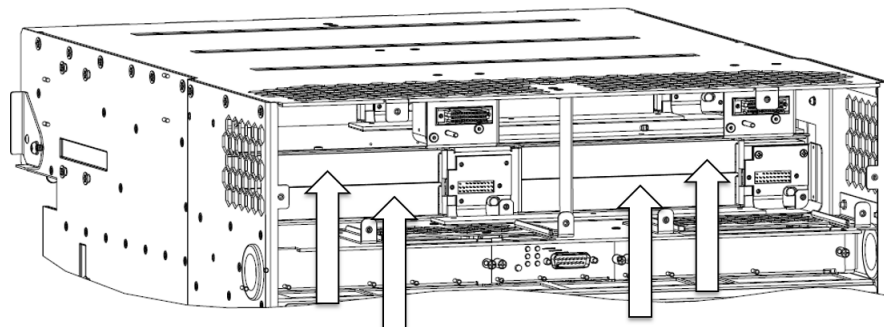
FAN9 modules can be installed while the system is powered and operational.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “BTI7814 Field-Replaceable Units (FRUs)” on page 179.

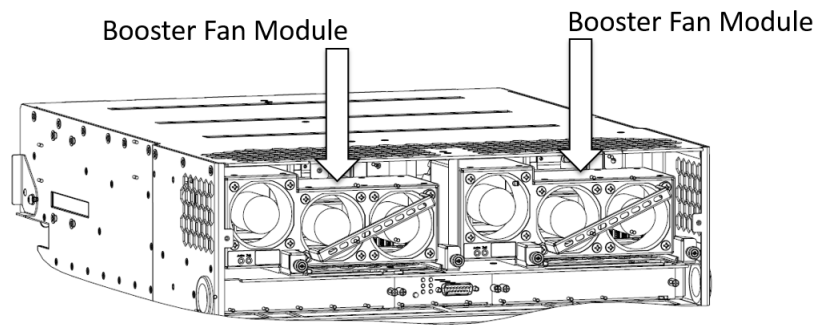
Tools Required

- Number 2 Phillips screwdriver.
1. At the rear of the chassis, use the screwdriver to unfasten the four screws that secure the ventilation cover, and then pull the cover away from the chassis.
 2. Remove each of the four back flow dampers from the chassis by raising the damper and carefully pulling on it until it detaches.



Back Flow Dampers

3. Do the following to install each FAN9 module:
 - a. Properly orient the module for installation, and carefully slide it into the chassis until it is fully seated.
 - b. Secure the module by tightening the two thumbscrews.



CAUTION: If you are installing the FAN9 modules in a chassis that is powered and operational, install only one module at a time, ensuring that the first module is fully secured before installing the second module.

4. Replace the ventilation cover.
 - a. Place the ventilation cover on the chassis, and align it with the pilot holes of the four screws that will secure it.
 - b. Loosely fasten the screws, and re-adjust the positioning of the cover if required.
 - c. Fully fasten the screws.

You have successfully completed this procedure.

Replacing a BT17814 Air Filter

Use this procedure to replace an air filter on the BT17814 chassis.

The air filter is hot-swappable and can be replaced while the system is powered on and operational.

The filter should be replaced every six months in a clean environment. If the dust level in your plant is high, replace the filter every three months. Usually the air filters in chassis installed lower in a rack require replacement more often than those installed higher in a rack.



WARNING: Ensure that you are familiar with the safety and electrical warnings described in “[BT17814 Field-Replaceable Units \(FRUs\)](#)” on page 179.

Tools Required

- Number 2 Phillips screwdriver

1. Remove the front air intake grille by loosening the two thumbscrews. The grille is located immediately below the service modules and above the CMMs.
2. The air filter bracket is mounted at an angle on the ceiling of the plenum. Using both hands, push down on the front air deflector.

The air filter bracket will drop down once its front edge clears the front support lip.
3. Carefully slide the air filter bracket out .
4. Place the filter bracket upright on a working surface. The filter bracket should be standing along the long edge of the air deflector.
5. Remove the dirty air filter from the bracket.
 - a. Using both hands, grasp the air filter element to the right and to the left of the air filter element holding flange. Your thumbs should be on top of the filter element, and your fingers should be behind the filter element.
 - b. Flex the filter element slightly by using your fingers to exert pressure from behind.
 - c. Once the filter element has bent sufficiently to clear the holding flange, lift the filter element away from the bottom rail guide.
6. Install the new air filter element into the bracket.
 - a. Insert the new air filter element into the bottom rail guide.
 - b. Using both hands, grasp the air filter element to the right and to the left of the air filter element holding flange. Your thumbs should be on top of the filter element, and your fingers should be behind the filter element.
 - c. Bend the filter element slightly by using your fingers to exert pressure from behind.
 - d. Once the filter element has bent sufficiently to clear the holding flange, push it in place behind the flange.
 - e. Examine along all edges to make sure the filter element is in place.
7. Slide the replacement air filter bracket along the top of the CMM. Do not lift the bracket. Let it rest on the air deflector as you slide it in.
8. Using both hands, apply pressure to the top edge of the air filter bracket and gently push upwards. Once the front edge clears the front support lip, the bracket will snap into place.
9. Reinstall the front air intake grille.

You have successfully completed this procedure.

BT17802 Field-Replaceable Units (FRUs)

Field-replaceable units are pre-installed when the BT17802 is delivered. This section describes how to remove and replace the FRUs on the BT17802.



WARNING: Use proper caution when working with the equipment. This chapter might not cover every possible hazardous condition.

Safety Warnings

- This equipment is intended to be installed and serviced by qualified personnel.
- Be familiar with the safety guidelines described in the *BT17800 Series Hardware Overview and Installation Guide*.
- Ensure the chassis is installed properly and secured onto the rack.
- Ensure you have an unobstructed path to the chassis.
- Avoid contact with rotating fan blades.

Electrical Warnings



CAUTION: Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures. ESD can occur when a module is improperly handled.

To prevent ESD damage to a module, follow these guidelines:

- Always wear an ESD grounding device, such as an ESD wrist strap, when handling a module.
- Do not remove a module from its antistatic bag until installation. Store removed modules in antistatic packaging.
- If you need to set a module down, place it back into its antistatic packaging or on a properly-grounded antistatic mat.
- Handle the module by its edges and/or its faceplate and avoid touching any pins, leads, or solder connections on the circuit board.
- [Replacing the BT17802 PEM on page 193](#)
- [Replacing the BT17802 CAP on page 195](#)
- [Replacing the BT17802 FAN2 on page 195](#)
- [Replacing a BT17802 Air Filter on page 197](#)

Replacing the BT17802 PEM

Use this procedure to remove and replace the power entry modules on the BT17802 chassis. The procedure is the same for replacing the DC PEM and AC PEM.

The PEM that you are replacing must be disconnected from its power source. The other PEMs can remain powered.



NOTE: Ensure that you are familiar with the safety and electrical warnings described in “[BT17802 Field-Replaceable Units \(FRUs\)](#)” on page 193.



NOTE: If you plan on reusing the AC PEM that you are removing, you must wait for a minimum of 60 seconds before reinserting the removed PEM into another slot or chassis.

1. Follow the appropriate steps to disconnect the PEM from the power source in your plant.
2. Disconnect the power cable from the faulty PEM.
3. Remove the PEM from the chassis.
 - a. Loosen the latch thumbscrew. Pull the latch into the open position.



- b. Slowly pull out the module.

Once the module is removed, place it in an antistatic bag or on a grounded antistatic mat.



NOTE: If you plan on reusing this AC PEM, you must wait for a minimum of 60 seconds before reinserting it into another slot or chassis.

- c. Move the latch to the closed position. Gently tighten the thumbscrew.
4. Install the replacement PEM.
 - a. Pull the latch into the open position
 - b. Carefully slide the replacement module along the slot guides until the PEM connects to the backplane
 - c. Move the latch to the closed position. Gently tighten the thumbscrew.
5. Attach the power cable to the PEM.
6. Follow the appropriate steps to connect the new PEM to the power source.
7. Power on the PEM. The DC OK LED lights up.

You have successfully completed this procedure.

Replacing the BT17802 CAP

This topic describes how to remove and replace the Chassis Alarm Panel (CAP) on the BT17802 chassis.

The CAP is hot-swappable and can be replaced while the system is powered on and operational.



NOTE: Ensure that you are familiar with the safety and electrical warnings described in “BT17802 Field-Replaceable Units (FRUs)” on page 193.

Tools Required

- Number 2 Phillips screwdriver
1. Remove all cable or other obstructions.
 2. Loosen the thumbscrew at the top of the module.
 3. Carefully grip the handle. Gently pull the module out of the chassis.



4. Place the module in an antistatic bag or on a grounded antistatic mat.
5. Align the replacement CAP with the slot guides.
6. Gently push the module until it connects to the backplane.
Once the module is in place, the ACT LED turns solid green.
7. Carefully tighten the thumbscrew.

You have successfully completed this procedure.

Replacing the BT17802 FAN2

Use this procedure to replace a 2-Slot Chassis Cooling Module on the BT17802 chassis.

The cooling module is hot-swappable, and can be replaced while the system is powered on and operational.



NOTE: Ensure that you are familiar with the safety and electrical warnings described in “[BT17802 Field-Replaceable Units \(FRUs\)](#)” on page 193.

Do not pull out the cooling module until the fan blades have stopped rotating.



NOTE: To ensure there is no risk of the system overheating, you should complete this task within five minutes in a 30°C (86°F) working ambient.

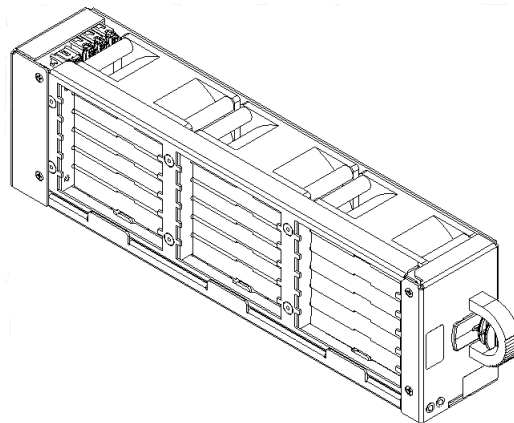
Tools Required

- Number 2 Phillips screwdriver



NOTE: The BT8A78CH2-I02 chassis supports the BT8A78FAN2 cooling module only. An Equipment Mismatch (eqptMism) alarm is raised if a different cooling module is installed.

1. Slide the latch to the left and pull the handle to unseat the module. Do not pull out the module until the fan blades have stopped rotating.



2. Remove the faulty cooling module.
Hold the module handle, and slowly slide the cooling module out.
3. Place the cooling module in an antistatic bag or a grounded antistatic mat.

4. Align the replacement cooling module with the slot guides.
5. Gently push the module until it connects to the backplane.

Once the module is in place, the Active LED turns solid green.

You have successfully completed this procedure.

Replacing a BT17802 Air Filter

Use this procedure to replace an air filter on the BT17802 chassis.

The air filter can be replaced while the system is powered on and operational.

The filter should be replaced every six months in a clean environment. If the dust level in your plant is high, replace the filter every three months. Usually the air filters in chassis installed lower in a rack require replacement more often than those installed higher in a rack.



NOTE: You must use the type of air filters BT8A78AFR2 that are delivered with the BT17802.

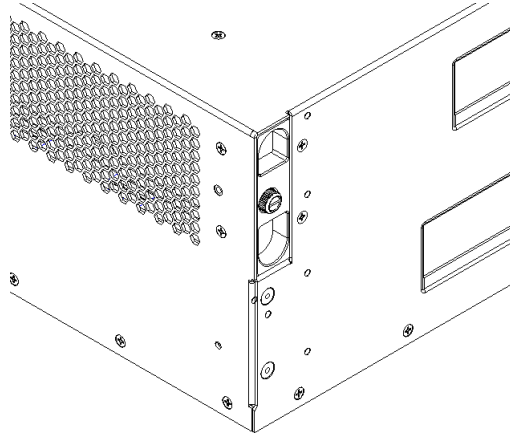


NOTE: Ensure that you are familiar with the safety and electrical warnings described in “[BT17802 Field-Replaceable Units \(FRUs\)](#)” on page 193.

Tools Required

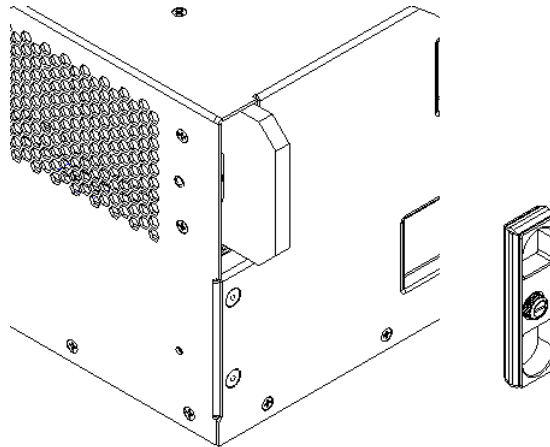
- Number 2 Phillips screwdriver

1. Go to the rear of the BT17802 chassis and unfasten the screw to remove the filter cover.



NOTE: The cover is detachable when unfastened. The screw is captive in the cover. Use the finger and thumb inserts on the filter cover as an aid to detach the cover.

2. Remove the air filter from the channel and discard it.



3. Ensure the channel is free from debris before installing the new filter.
4. Install a new air filter.

- a. Remove the filter from the packaging and insert fully into the channel, ensuring the filter remains straight and contains no creases.
5. Replace the filter cover and tighten the captive screw, ensuring the cover is fitted correctly and fastened securely.

You have successfully completed this procedure.

BT17801 Field-Replaceable Units (FRUs)

Field-replaceable units are pre-installed when the BT17801 is delivered. This section describes how to remove and replace the FRUs on the BT17801.



WARNING: Use proper caution when working with the equipment. This chapter might not cover every possible hazardous condition.

Safety Warnings

- This equipment is intended to be installed and serviced by qualified personnel.
- Be familiar with the safety guidelines described in the *BT17800 Series Hardware Overview and Installation Guide*.
- Ensure the chassis is installed properly and secured onto the rack.
- Ensure you have an unobstructed path to the chassis.
- Avoid contact with rotating fan blades.

Electrical Warnings



CAUTION: Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures. ESD can occur when a module is improperly handled.

To prevent ESD damage to a module, follow these guidelines:

- Always wear an ESD grounding device, such as an ESD wrist strap, when handling a module.
- Do not remove a module from its antistatic bag until installation. Store removed modules in antistatic packaging.

- If you need to set a module down, place it back into its antistatic packaging or on a properly-grounded antistatic mat.
- Handle the module by its edges and/or its faceplate and avoid touching any pins, leads, or solder connections on the circuit board.
- [Replacing the BTI7801 PEM on page 200](#)
- [Replacing the BTI7801 FAN5 on page 200](#)
- [Replacing the BTI7801 ESL on page 201](#)

Replacing the BTI7801 PEM

The BTI7801 uses the same PEM as the BTI7802. See [“Replacing the BTI7802 PEM” on page 193](#) for replacement instructions.

Replacing the BTI7801 FAN5

Use this procedure to replace a 1-Slot Chassis Front Cooling Module on the BTI7801 chassis.

The cooling module is hot-swappable, and can be replaced while the system is powered on and operational.



.....
NOTE: Ensure that you are familiar with the safety and electrical warnings described in [“BTI7801 Field-Replaceable Units \(FRUs\)” on page 199](#).

Do not pull out the cooling module until the fan blades have stopped rotating.
.....

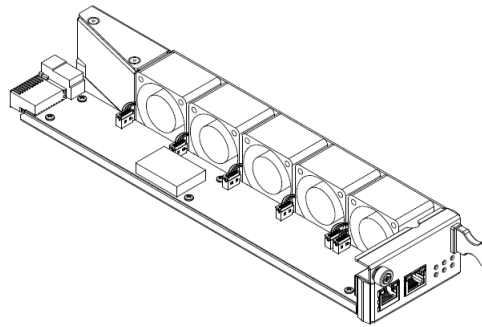


.....
NOTE: To ensure there is no risk of the system overheating, you should complete this task within five minutes in a 30°C (86°F) working ambient.
.....

Tools Required

- Number 2 Phillips screwdriver

1. Loosen the thumbscrew holding the module in place. Use a screwdriver if necessary. Do not pull out the module until the fan blades have stopped rotating.



2. Remove the faulty cooling module.
Hold the module handle, and slowly slide the cooling module out.
3. Place the cooling module in an antistatic bag or on a grounding mat.
4. Align the replacement cooling module with the slot guides.
5. Gently push the module until it is connected to the backplane.
Once the module is in its place, the Active LED turns solid green.
6. Tighten the thumbscrew.

You have successfully completed this procedure.

Replacing the BT17801 ESL

Use this procedure to replace an Ethernet and Serial Link module on the BT17801 chassis.

The ESL module is hot-swappable, and can be replaced while the system is powered on and operational.

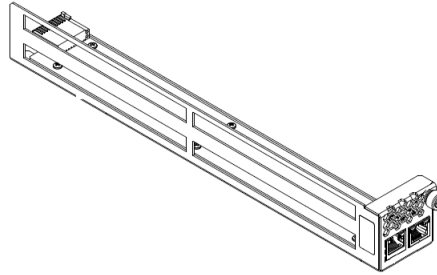


NOTE: Ensure that you are familiar with the safety and electrical warnings described in [“BT17801 Field-Replaceable Units \(FRUs\)” on page 199](#).

Tools Required

- Number 2 Phillips screwdriver

1. Disconnect all cables from the ESL module.
2. Loosen the thumbscrew holding the module in place. Use a screwdriver if necessary.



3. Remove the faulty ESL module.
Hold the module handle, and slowly slide the ESL module out.
4. Place the ESL module in an antistatic bag or on a grounded antistatic mat.
5. Align the replacement ESL module with the slot guides.
6. Gently push the module until it is connected to the backplane.
7. Tighten the thumbscrew.
8. Reconnect all cables.

You have successfully completed this procedure.

CHAPTER 8

AC Rectifier (External)

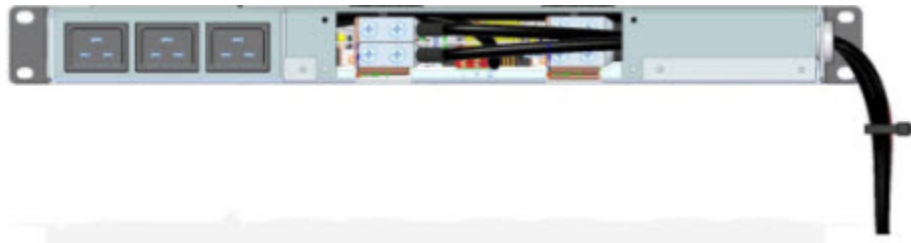
- [AC Rectifier on page 203](#)
- [Installing the AC Rectifier on page 205](#)

AC Rectifier

Instead of installing AC PEMs to power the BT17814 chassis, you can optionally install the Power-One[®] rack-mounted 1U high AC rectifier.

Each rectifier provides 2900 W (nominal) and is installed on a 1U -48V power shelf. The shelf contains two common DC power feeds that provide total load balancing and supports up to three rectifiers. The shelf includes three IEC 60320 C19 / C20 AC plugs with a 20 Amp rating, and each rectifier is powered by a single plug. The fourth slot contains a management module. The rectifiers are hot-swappable.

Figure 52: Rectifier Shelf: Rear View



Rectifier Kits

The rectifier ships as a kit that includes the following components. The number of rectifiers in the kit is dependent on your BT17814 configuration requirements. To determine the power requirements for your system, refer to [“BT17800 Series Component Power Consumption” on page 53](#).

Table 78: Rectifier Kits

Kit	Component	Quantity	Product Equipment Code (PEC)
Rectifier	2900 W Rectifier	1	BT8A78ACP1
	1U Power Shelf	1	
	C19 AC plug 14 AWG power cords	3	
	Mounting brackets and screws for 23" rack	2 brackets, 4 screws	
	Advanced Controller Card Extended (ACC)	1	
	PEM cable jumper and cable kit	1	
	Ground lugs	1 single hole, 1 double hole	
Rectifier	2900 W Rectifier	2	BT8A78ACP2
	1U Power Shelf	1	
	C19 AC plug 14 AWG power cords	3	
	Mounting brackets and screws for 23" rack	2 brackets, 4 screws	
	Advanced Controller Card Extended (ACC)	1	
	PEM cable jumper and cable kit	1	
	Ground lugs	1 single hole, 1 double hole	
Rectifier	2900 W Rectifier	3	BT8A78ACP3
	1U Power Shelf	1	
	C19 AC plug 14 AWG power cords	3	
	Mounting brackets and screws for 23" rack	2 brackets, 4 screws	
	Advanced Controller Card Extended (ACC)	1	
	PEM cable jumper and cable kit	1	
	Ground lugs	1 single hole, 1 double hole	

Table 78: Rectifier Kits (continued)

Kit	Component	Quantity	Product Equipment Code (PEC)
Spare Rectifier	2900 W Rectifier	1	BT8A78ACM1

Rack-Mounting Support

The following table describes the rack support for the shelf. For rack-mounting procedures refer to [“Installing the AC Rectifier” on page 205](#).

Table 79: Rectifier Shelf Rack Support

Issue	Description
BT17814 Rack size	ANSI 19 in or ETSI 450 mm
	ANSI 21 in or ETSI 500 mm
	ANSI 23 in
Cabinet size	19 in
	ETSI 600 mm x 600 mm, 1.25" and 1.75" centers
Shelf placement in rack	Up to two at the top of the rack
	One above the BT17814
	One below the BT17814

Installing the AC Rectifier

Safety and Electrical Requirements



NOTE: NEBS Compliance Statement for GR-1089:

- All centralized power sources not embedded into a BT17800 chassis are to be grounded to the Central Office (CO) electrical ground system (GND). The return terminal of the power source is to be connected to the CO GND.
- An external Surge Protection Device (SPD) is to be used at the AC power service entrance.

Installing the rectifier involves the following procedures, which are described below:

1. Installing the cables to the DC feeds
2. Mounting the rectifier shelf
3. Ground the shelf

4. Installing the rectifier
5. Connecting the shelf communication and current sharing connectors
6. Connecting the rectifier to the BT17814

Tools

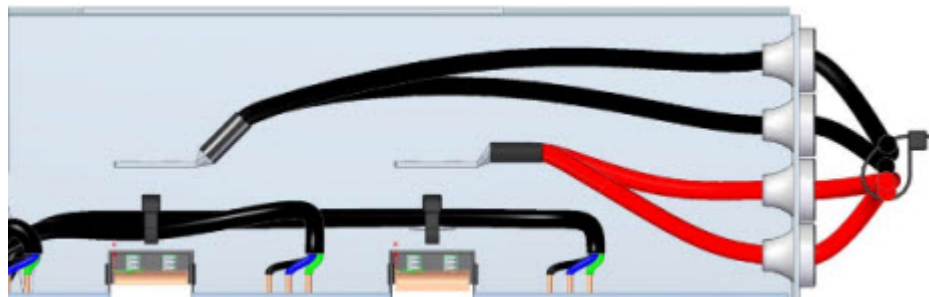
- Philips screwdriver
- Socket wrench
- Ground cable 4 AWG green, approximately 1 foot (0.3048 meters)
- Stripper for ground cable
- Lug crimper
- 8-pin patch cable and plug

Installing the Cables to the DC Feeds

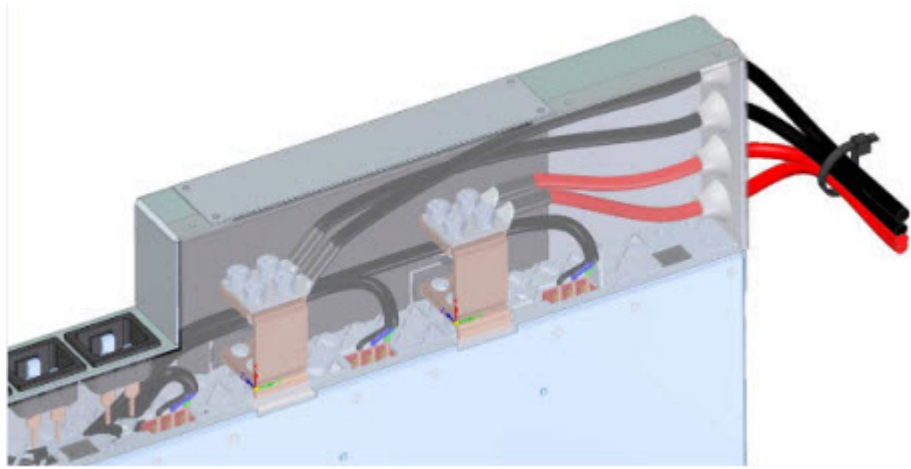
You can connect up to two common DC feeds per BT17814 PEM pair—A1 and A2, or B1 and B2. Although the cables can be installed after mounting the shelf, we recommend that they are installed first, otherwise, it is difficult to maneuver around the installed shelf to install the cables.

1. Feed the cables through the grommets that are on the side of the rectifier shelf. The grommets are used to relieve strain from the cables and to protect the cables.

You might need to trim the grommets to fit the cables.

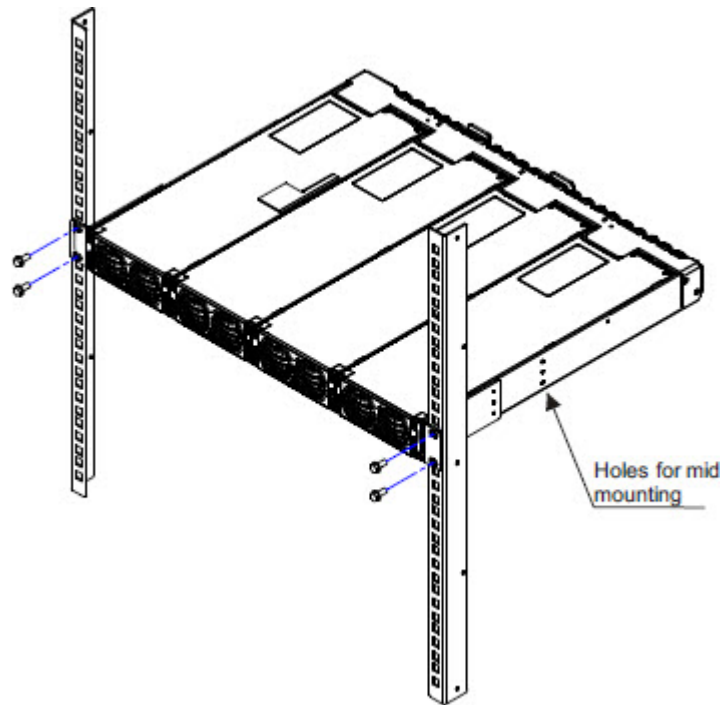


2. Connect the cables to the DC feeds, and tighten using the socket wrench.



3. Mount the rectifier shelf. Note the following prerequisites:
 - If more than one shelf is being mounted, first mount the bottom shelf.
 - The shelf should have a minimum of 5 cm between the back of the shelf and any obstruction to allow for air flow out the back of the rectifier.
 - Adjust mounting brackets, as needed, for different front to back depths.
 - Verify that all cabling length is sufficient for all connections.
4. Verify which mounting brackets you need to use for the rack size, and position the shelf.

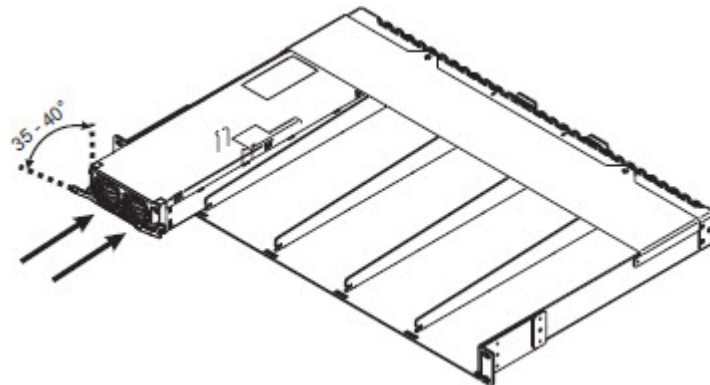
Secure the shelf to the rack with four mounting screws.



5. Ground the shelf, using the ground lugs included in the rectifier kit from Juniper Networks.

From the two M5 size grounding screws at the shelf rear, connect the shelf to the rack in which the shelf is installed, or to the building ground.

6. Install the rectifier. Rectifiers should be installed from the left to right shelf position.
 - a. Open the rectifier handle (35 to 40 degree angle) and place the rectifier into the mounting slot.



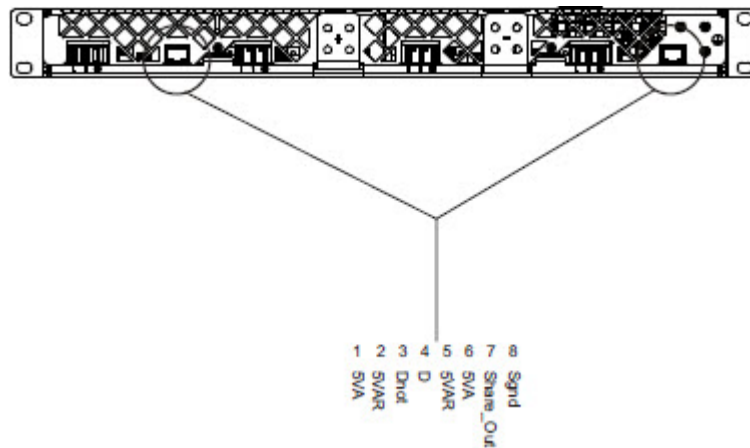
- b. Slide the rectifier until it connects to the rear of the shelf.
 - c. Lock the rectifier into position by pushing the rectifier handles towards the shelf.

Repeat these steps for each rectifier you are installing.

7. If more than one shelf is installed, you can connect the shelves for communication and current sharing between the rectifiers.

Locate the two connectors on the rear of the shelf. They are parallel and either one can be used.

Using a standard 8-pin patch cable and plug, connect the sharing connectors.



8. Connect the shelf to the BTI7814 PEMs (power entry modules).

See [“Connecting the DC Power Feeds to a BTI7814 DC PEM”](#) on page 94 for the procedures to connect the shelf to the chassis.

You have successfully completed this procedure.

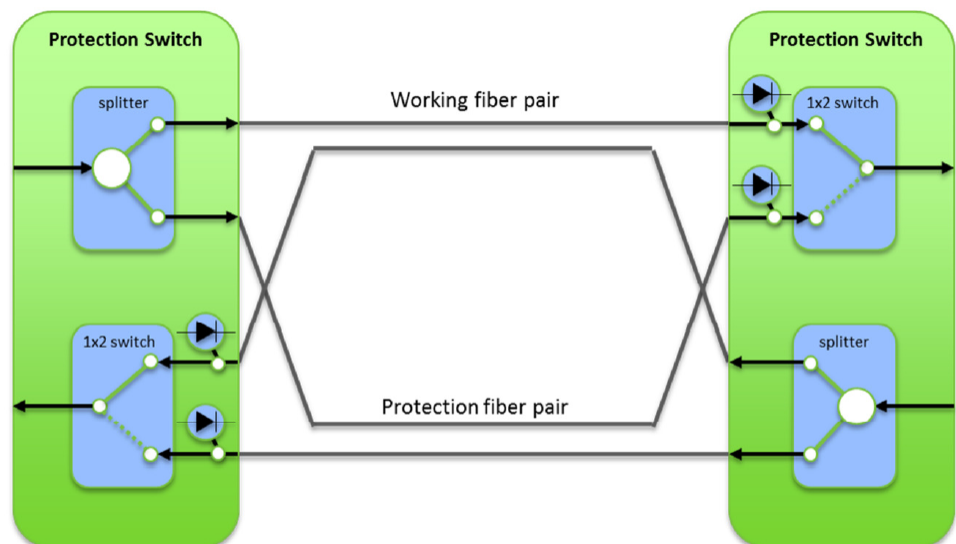
CHAPTER 9

Optical Protection Switch (OPS)

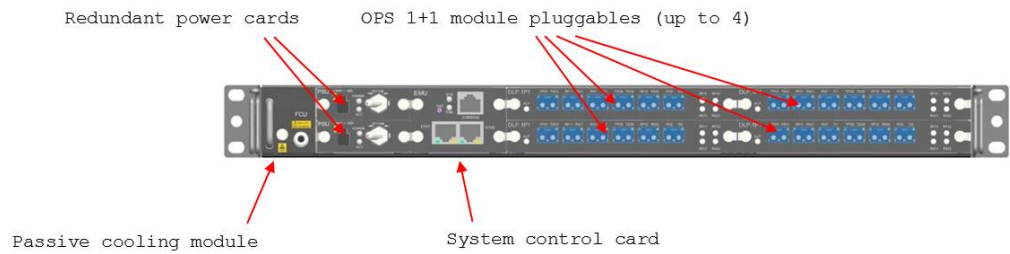
- [OPS Overview on page 211](#)
- [OPS Equipment on page 212](#)
- [OPS Specifications on page 213](#)
- [OPS AC power unit Specifications on page 214](#)

OPS Overview

The Optical Protection Switch provides 1+1 optical protection switching in a 1RU form factor. When used with diversely routed fiber pairs, the Optical Protection Switch can protect against fiber plant failure by switching to the good fiber pair. An optical splitter at the head end broadcasts the DWDM wavelengths on both fibers and a 1x2 optical switch at the tail end selects the surviving signal. Optical photo detectors at the switch end monitor power levels that are used for switching decisions.



Each chassis contains two OPS power cards for redundant power, an OPS system control card, a passive cooling unit, and slots for up to four OPS 1+1 module pluggables. Each OPS 1+1 module pluggable contains two independent switches. A fully populated chassis can support eight 1+1 protected links.



Management of the OPS is performed using a Web GUI, reachable through the local Ethernet ports on the OPS system control card. The OPS can also be discovered and monitored by the proNX Service Manager.

OPS Equipment

The Optical Protection Switch is ordered as a kit, which includes the chassis, redundant DC power, a control card, a switch card, and mounting brackets and cables ([Table 80 on page 212](#)):

Table 80: Optical Protection Switch Kit - Dual Switch Card (BT7A39AS)

Component	Quantity in Kit	Component PEC
OPS 1RU chassis	1	BT7A39AA
OPS 1+1 module pluggable	1	BT7A39AB
OPS system control card	1	BT7A39AC
OPS power card	2	BT7A39AP
OPS accessories kit (includes mounting brackets and DC power cables)	1	BT7A39AD

Equipment for AC operation is ordered separately ([Table 81 on page 212](#)):

Table 81: AC Power and Power Cables

Component	Component PEC	Notes
OPS AC power unit	BT7A39AE	<p>The OPS AC power unit takes AC input and provides DC output to the OPS power card (BT7A39AP) over a DC power cable (included). The AC power cable is not included and must be ordered separately.</p> <p>Two units are required per OPS (one unit for each OPS power card (BT7A39AP)).</p>

Table 81: AC Power and Power Cables (continued)

Component	Component PEC	Notes
1.5 meter AC Power Cord with North American Plug	BP1A58GA	Plug (to power source): NEMA 5-15 Connector (to chassis): IEC 60320 C13 Two cables are required per OPS (one cable for each OPS AC power unit (BT7A39AE)).
1.5 meter AC Power Cord with European Plug	BP1A58HA	Two cables are required per OPS (one cable for each OPS AC power unit (BT7A39AE)).
1.5 meter AC Power Cord with UK Plug	BP1A58JA	Two cables are required per OPS (one cable for each OPS AC power unit (BT7A39AE)).
1.5 meter AC Power Cord with Australian Plug	BP1A58KA	Two cables are required per OPS (one cable for each OPS AC power unit (BT7A39AE)).

OPS Specifications

All specifications are end of life and over the full operating temperature range.

Table 82: OPS Specifications

Parameter	Specification
Physical and Environmental	
1RU 19" and 23" rack mountable chassis	436mm (W) x 195mm (D) x 44mm (H)
Weight	4 kg (fully populated)
Power Consumption	15 W (maximum)
Input Voltage	-48 VDC to -60 VDC
Operating Temperature Range	-5°C to +55°C
Storage Temperature Range	-40°C to 70°C
Optical	
Operating Wavelength Range 1	1500 nm to 1620 nm
Operating Wavelength Range 2 ¹	1260 nm to 1360 nm
Insertion Loss ² (splitter)	4.0 dB (maximum)
Polarization Dependent Loss	0.2 dB (maximum)

Table 82: OPS Specifications (continued)

Parameter	Specification
Return Loss (all ports, with connector)	40 dB (minimum)
Input Power Range (switch side)	-35 dBm to 19 dBm
Switching time	50 ms (maximum)
Optical Interface	SMF-28 fiber, LC/UPC

¹ Power accuracy for setting the switching threshold over Range 2 might be up to 2 dB less accurate than over Range 1.

² Includes one mating pair of connectors.

OPS AC power unit Specifications

The OPS AC power unit is an AC/DC adapter that provides DC power to the OPS power card (BT7A39AP). It requires a DC cable (included) to connect to the OPS power card and an AC cable (not included) to connect to the building AC supply.

Table 83: OPS AC power unit (BT7A39AE) Specifications

Parameter	Specification
Power Capacity	24W
Voltage	
Output (nominal)	-48.0V
Input Range	90VAC to 264VAC
	47Hz to 63Hz
Environmental	
Storage Temperature Range	-20C to +80C
AC Cord Inlet	IEC 60320 C14

CHAPTER 10

Appendix

- [FIT Rates on page 215](#)
- [CAP Telco Alarm Connector Pin Assignments on page 218](#)
- [DWDM 50-GHz Wavelength Plan on page 219](#)
- [Maintaining Fiber-Optic Connectors on page 223](#)
- [Fiber Breakout on page 225](#)

FIT Rates

Table 84: BT17801 FIT Rates

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
BT17801 chassis	BT8A78CH1	196	5,102,041	582.4
1-Slot Chassis Front Cooling Module (FAN5)	BT8A78FAN5	1233.2	810,898	92.5
Ethernet and Serial Link (ESL)	BT8A78ESL1	52.5	19,047,619	2174

Table 85: BT17802 FIT Rates

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
BT17802 chassis	BT8A78CH2	1182	846,024	97
2-Slot Chassis Alarm Panel (CAP2)	BT8A78CAP2	307	3,257,329	372
2-Slot Chassis Cooling Module (FAN1)	BT8A78FAN1	2293	436,110	50
1-Slot/2-Slot Chassis DC Power Entry Module (DC PEM)	BT8A78PEMI-DC	354	2,824,859	322

Table 85: BT17802 FIT Rates (continued)

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
1-Slot/2-Slot Chassis AC Power Entry Module (AC PEM)	BT8A78PEM1-AC	4000	250,000	29

Table 86: BT17814 FIT Rates

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
BT17814 chassis	BT8A78CH14	1,662	601,685	69
14-Slot Chassis Alarm Panel (CAP1)	BT8A78CAP1	1,342	745,156	85
14-Slot Chassis Front Cooling Module (FAN3)	BT8A78FAN3	4,000	250,000	29
BT17814 Booster Fan (FAN9)	BT8A78FAN9	1131.6	883720	100
14-Slot Chassis DC Power Entry Module (DC PEM)	BT8A78PEM3-DC	400	2,500,000	285
2900W (53.5V) AC Rectifier Module (AC PEM)	BT8A78ACM1	3,287	304,229	35

Table 87: BT17800 Series Module and BIC FIT Rates and MTBF

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
Modules				
Chassis Management Module (CMM1)	BT8A78CMM1	4,763	209,969	24
Universal Forwarding Module (UFM3)	BT8A78UFM3	3,360	297,619	34
Universal Forwarding Module with Integrated 100G Coherent MSA XCVR (UFM4)	BT8A78UFM4	7,015	142,554	16
Universal Forwarding Module with Integrated 400G Coherent MSA XCVR (UFM6)	BT8A78UFM6-IO2	11,350	88,105	10
96-Channel Amplifier (AMP1)	BT8A78AMP1	3,227	309,885	35

Table 87: BT17800 Series Module and BIC FIT Rates and MTBF (continued)

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
96-Channel Fixed Mux/Demux (FMD96)	BT8A78MD03	95	10,526,316	1201
Wavelength Protection Switch (WPS4)	BT8A78WPS4	3,081	324,570	37
BTI Interface Cards (BICs)				
12x SFP+ BTI Interface Card (12x SFP+ BIC)	BT8A78SFP12G	715	1,398,993	160
1x CFP BTI Interface Card (1x CFP BIC)	BT8A78CFPIG	510	1,959,632	224

Table 88: BT17800 Series Transceiver FIT Rates and MTBF

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
SFP+ 850nm 200m Dual-Rate 10.3 and 10.5Gbps	BP3AD6SS	175	5,714,286	652
SFP+ 1310nm 10km Multi-Rate 9.9 to 11.1Gbps	BP3AM6MS	184	5,434,783	620
SFP+ DWDM Fixed 80km Multi-Rate 9.9 to 11.1Gbps	BP3AM6DL-xx	526	1,901,141	217
SFP+ DWDM Tunable 80km Multi-Rate 9.9 to 11.1Gbps	BP3AM6TL	235	4,255,319	486
QSFP+ 4x10GBASE LR	QSFP-4X10GE-LR (740-054050)	299	3,340,348	381
QSFP+ 4x10G Ethernet/OTN LR	QSFP-4X10GD-LR (740-058730)	709	1,410,437	161
QSFP28 100GE LR4	QSFP-100G-LR4-2 (740-074685)	742	1,347,709	154
CFP 100GBASE-SR10 100m	BP3AMASS	1,222	818,331	93
CFP 100GBASE-LR4 10km	BP3AMDLI	3,566	280,426	32
100G Coherent CFP-M05	CFP-100GBASE-CHRT	2849	350,949	40
100G Coherent CFP	BP3AMCTL	3,758	266,099	30

Table 89: Optical Protection Switch (OPS) FIT Rates and MTBF

Product	PEC	FIT Rate (40C/90%)	MTBF	
			Hours	Years
OPS 1+1 module pluggable	BT7A39AB	223	4.49x10 ⁶	512
OPS system control card	BT7A39AC	439	2.28x10 ⁶	260

CAP Telco Alarm Connector Pin Assignments

Table 90: CAP Telco Alarm Connector Pin Assignments

Pin	Description	Input Voltage Limits	
		Minimum	Maximum
1	Minor Reset +	5 volts	70 volts
2	Minor Reset -	5 volts	70 volts
3	Major Reset +	5 volts	70 volts
4	Major Reset -	5 volts	70 volts
5	Critical Alarm NO	Output	
6	Critical Alarm NC	Output	
7	Critical Alarm COM	Output	
8	Minor Alarm NO	Output	
9	Minor Alarm NC	Output	
10	Minor Alarm COM	Output	
11	Major Alarm NO	Output	
12	Major Alarm NC	Output	
13	Major Alarm COM	Output	
14	Power NO	Output	
15	Power COM	Output	

DWDM 50-GHz Wavelength Plan

The DWDM 50-GHz wavelength plan is aligned with the ITU C-Band grid.

Table 91: DWDM Wavelength Plan (50-GHz Spacing)

Frequency (THz)	Wavelength (nm)	Client Port Number (multiplexer/demultiplexer)
196.10	1528.77	C96
196.05	1529.16	C95
196.00	1529.55	C94
195.95	1529.94	C93
195.90	1530.33	C92
195.85	1530.72	C91
195.80	1531.12	C90
195.75	1531.51	C89
195.70	1531.90	C88
195.65	1532.29	C87
195.60	1532.68	C86
195.55	1533.07	C85
195.50	1533.47	C84
195.45	1533.86	C83
195.40	1534.25	C82
195.35	1534.64	C81
195.30	1535.04	C80
195.25	1535.43	C79
195.20	1535.82	C78
195.15	1536.22	C77
195.10	1536.61	C76

Table 91: DWDM Wavelength Plan (50-GHz Spacing) (continued)

Frequency (THz)	Wavelength (nm)	Client Port Number (multiplexer/demultiplexer)
195.05	1537.00	C75
195.00	1537.40	C74
194.95	1537.79	C73
194.90	1538.19	C72
194.85	1538.58	C71
194.80	1538.98	C70
194.75	1539.37	C69
194.70	1539.77	C68
194.65	1540.16	C67
194.60	1540.56	C66
194.55	1540.95	C65
194.50	1541.35	C64
194.45	1541.75	C63
194.40	1542.14	C62
194.35	1542.54	C61
194.30	1542.94	C60
194.25	1543.33	C59
194.20	1543.73	C58
194.15	1544.13	C57
194.10	1544.53	C56
194.05	1544.92	C55
194.00	1545.32	C54
193.95	1545.72	C53

Table 91: DWDM Wavelength Plan (50-GHz Spacing) (continued)

Frequency (THz)	Wavelength (nm)	Client Port Number (multiplexer/demultiplexer)
193.90	1546.12	C52
193.85	1546.52	C51
193.80	1546.92	C50
193.75	1547.32	C49
193.70	1547.72	C48
193.65	1548.11	C47
193.60	1548.51	C46
193.55	1548.91	C45
193.50	1549.32	C44
193.45	1549.72	C43
193.40	1550.12	C42
193.35	1550.52	C41
193.30	1550.92	C40
193.25	1551.32	C39
193.20	1551.72	C38
193.15	1552.12	C37
193.10	1552.52	C36
193.05	1552.93	C35
193.00	1553.33	C34
192.95	1553.73	C33
192.90	1554.13	C32
192.85	1554.54	C31
192.80	1554.94	C30

Table 91: DWDM Wavelength Plan (50-GHz Spacing) (continued)

Frequency (THz)	Wavelength (nm)	Client Port Number (multiplexer/demultiplexer)
192.75	1555.34	C29
192.70	1555.75	C28
192.65	1556.15	C27
192.60	1556.55	C26
192.55	1556.96	C25
192.50	1557.36	C24
192.45	1557.77	C23
192.40	1558.17	C22
192.35	1558.58	C21
192.30	1558.98	C20
192.25	1559.39	C19
192.20	1559.79	C18
192.15	1560.20	C17
192.10	1560.61	C16
192.05	1561.01	C15
192.00	1561.42	C14
191.95	1561.83	C13
191.90	1562.23	C12
191.85	1562.64	C11
191.80	1563.05	C10
191.75	1563.45	C9
191.70	1563.86	C8
191.65	1564.27	C7

Table 91: DWDM Wavelength Plan (50-GHz Spacing) (continued)

Frequency (THz)	Wavelength (nm)	Client Port Number (multiplexer/demultiplexer)
191.60	1564.68	C6
191.55	1565.09	C5
191.50	1565.50	C4
191.45	1565.91	C3
191.40	1566.31	C2
191.35	1566.72	C1

Maintaining Fiber-Optic Connectors

- [Inspecting Fiber-Optic Connectors on page 223](#)
- [Cleaning Fiber-Optic Connectors on page 224](#)

Inspecting Fiber-Optic Connectors

Protective dust plugs should be left on connectors when they are not in use. The fiber used on the optical components of the modules has a light carrying core that is less than 10 millionths of a meter in diameter. Therefore, a single microscopic piece of dust on a connector end-face can significantly block the light traveling through the fiber. Accurate and repeatable measurements require clean connections.



WARNING: Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Using an optical fiber scope, visually inspect all fiber optic interconnects prior to use. A minimum of 200x magnification is required for proper inspection.

Use the following procedure to inspect a fiber connector.

Use the following guidelines to achieve the best possible performance:

- Using an optical fiber scope, visually inspect fiber ends for signs of damage.
- Use dry connections whenever possible.
- Keep connectors covered when not in use.
- Use care in handling all fiber-optic connectors.

The primary hazard of exposure to laser radiation from an optical fiber communications system is damage to the eye by accidental exposure to the beam emitted by a laser source, or from viewing a connector attached to an energized fiber.

Before using an optical scope to examine the fiber, ensure that optical power is not emitted from the fiber. Use of a handheld optical fiber scope (that is, where the output is sent to a video display) prevents accidental exposure to the beam emitted by a laser source.

Keep all interconnects as clean as possible. When cleaning fiber connectors, be sure to use appropriate cleaning methods.

Cleaning Fiber-Optic Connectors

Use this procedure to clean a fiber connector.



NOTE: Improper cleaning can result in high attenuation due to dirt or dust, or can cause mechanical damage to the fiber end face, resulting in decreased performance.

1. Verify that the opposite end of the fiber is disconnected from its laser source.
2. Using an optical fiber scope, inspect the end of the fiber face.
3. If the fiber end-face condition is ideal, no further action is required.

If you need to clean or repolish the fiber end-face, use the instructions in the cleaning procedure that follows.
4. Use a new, lint-free, nonabrasive cleaning pad, lens paper, or swab to clean the fiber end. Move the cleaning pad back and forth across the fiber end several times. If using a swab, gently rotate the swab as you wipe across the end-face. When done, discard the used pad or paper.
5. Obtain a filtered, dry, compressed air dust remover. Aim the duster at a shallow angle to the fiber end-face and blow across the connector end face from a distance of 6 to 8 inches.
6. Verify that the opposite end of the fiber is still disconnected from its laser source.
7. Verify that the fiber-optic connector is free from dirt and dust. To inspect the connector, use an optical fiber scope that uses an indirect image converter or a filtered optical instrument of optical density (OD) sufficient to reduce the exposure levels below the appropriate maximum permissible exposure.
8. Do one of the following:

- If the fiber optic connector is clean, cover the connector with a protective dust cover until ready for use.
 - If the fiber-optic connector is not completely clean, continue with the next step.
9. Clean the fiber end by moving the cleaning pad back and forth across the fiber end several times. If using a swab, gently rotate the swab as you wipe across the end face.
 10. Immediately dry the fiber end with a clean, dry, lint-free cleaning pad or lens paper.
 11. Discard the optical cleaning pads and lens paper.
 12. Use a filtered, dry, compressed air dust remover. Aim the duster at a shallow angle to the fiber end face and blow across the connector end-face from a distance of 6 to 8 inches.
 13. Verify that the fiber-optic connector is free from dirt and dust. To inspect the connector, use an optical fiber scope that uses an indirect image converter or a filtered optical instrument of optical density (OD) sufficient to reduce the exposure levels below the appropriate maximum permissible exposure.
 14. Once the fiber is clean, cover the connector with a protective dust cover until ready for use.

You have successfully completed this procedure.

Fiber Breakout

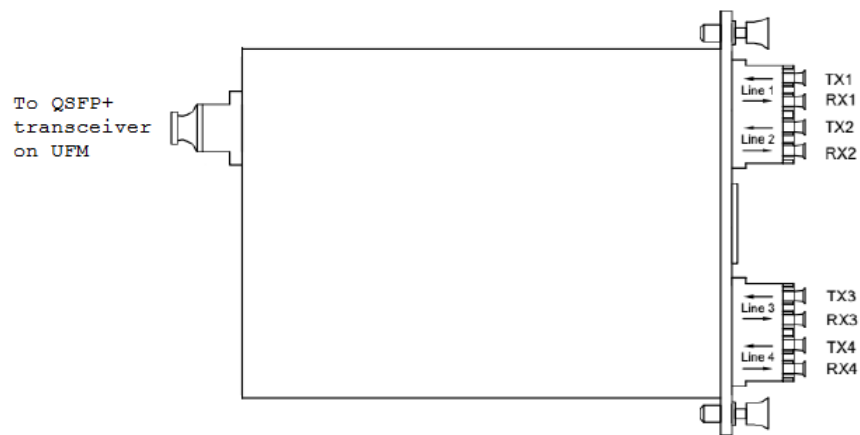
- [Fiber Breakout for UFM6 QSFP+ Ports on page 225](#)
- [GigaLight SMF Elite MTP \(Angled\) LC/UPC 1x8F to MTP MiniCassette Specifications on page 226](#)
- [GigaLight 1U GigaC Rack Specifications on page 227](#)
- [Fiber Breakout Components on page 227](#)

Fiber Breakout for UFM6 QSFP+ Ports

The QSFP+ transceivers used on the UFM6 are parallel single mode transceivers that have four parallel 10-Gbps lanes. To provide access to these individual 10-Gbps channels, Juniper Networks has adopted GigaLight's fiber breakout solution, which consists of a fiber cassette and rack.

The QSFP+ transceiver connects to the GigaLight fiber cassette through a single cable (consisting of multiple single-mode fibers), which is split within the cassette into individual 10-Gbps fiber pairs that are accessible from the cassette faceplate ([Figure 53 on page 226](#)). The cassette can be mounted into a GigaLight 1U GigaC Rack (holds 12 cassettes).

Figure 53: GigaLight Cassette



Alternatively, you can provide access to the individual 10-Gbps channels through a fiber breakout cable directly, without using the GigaLight fiber cassette solution. The breakout cable connects to the QSFP+ transceiver at one end and provides four LC/UPC connectors at the other end for access to the four individual 10-Gbps channels.

The components for both of these options are listed in *Fiber Breakout Components*.

GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette Specifications

The GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette connects to the QSFP+ transceiver through an MTP connector and provides access to the individual 10-Gbps channels through four LC/UPC ports.

Table 92: GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette Specifications

Attribute	Specification			
Physical Dimensions				
Width (includes faceplate)	103 mm			
Height	12 mm			
Depth	120 mm			
Optical	Minimum	Typical	Maximum	Units
Insertion loss (MTP)	-	0.25	0.35	dB
Insertion loss (LC/UPC)	-	0.1	0.3	dB
Connector	MTP, LC/UPC			

GigaLight 1U GigaC Rack Specifications

The GigaLight 1U GigaC Rack is a 1U 19-inch multislotted chassis that can hold up to 12 GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassettes.

Table 93: GigaLight 1U GigaC Rack Specifications

Attribute	Specification
Width	431.4 mm
Height	44.0 mm
Depth	260 mm
Cassette capacity	up to 12

Fiber Breakout Components

Component	PEC
GigaLight 1U GigaC Rack	BT8A78RCK1
GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette	BT8A78CAS1
Cables (MTP to MTP patch, for use with the GigaLight SMF Elite MTP (Angled) LC/UPC 1x8F to MTP MiniCassette)	
MTP/APC to MTP/APC SMF patch cable, 1m length	MTP12-FF-S1M
MTP/APC to MTP/APC SMF patch cable, 3m length	MTP12-FF-S3M
MTP/APC to MTP/APC SMF patch cable, 5m length	MTP12-FF-S5M
MTP/APC to MTP/APC SMF patch cable, 10m length	MTP12-FF-S10M
SMF Cables (MTP to LC/UPC breakout)	
MTP/APC to 4xLC/UPC SMF passive breakout cable, 1m length	MTP-4LC-S1M
MTP/APC to 4xLC/UPC SMF passive breakout cable, 3m length	MTP-4LC-S3M
MTP/APC to 4xLC/UPC SMF passive breakout cable, 5m length	MTP-4LC-S5M
MTP/APC to 4xLC/UPC SMF passive breakout cable, 10m length	MTP-4LC-S10M
MMF Cables (MTP to LC/UPC breakout)	
MTP/PC to 4xLC/UPC MMF passive breakout cable, 1m length	MTP-4LC-M1M

Component	PEC
MTP/PC to 4xLC/UPC MMF passive breakout cable, 3m length	MTP-4LC-M3M
MTP/PC to 4xLC/UPC MMF passive breakout cable, 5m length	MTP-4LC-M5M
MTP/PC to 4xLC/UPC MMF passive breakout cable, 10m length	MTP-4LC-M10M



NOTE: All MTP cables and connectors are polarity type B.
