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PTX Series Interface Module Reference

Published
2021-06-23

Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

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The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

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Use this guide to determine the supported interface modules for PTX Series routers.

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PART

Overview

CHAPTER 1

PTX Series Interface Modules Support

IN THIS CHAPTER

PICs Supported on the PTX Series

Table 1 on page 2 lists the PICs supported on the PTX Series and the first Junos OS release that supports each PIC.

See "PTX Series PIC/FPC Compatibility" on page 5 for information about supported FPC and PIC combinations.

NOTE: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

Table 1: PICs Supported on the PTX Series

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
10-Gigabit Ethernet				
"10-Gigabit Ethernet PIC with SFP+ (PTX Series)" on page 33	24	P1-PTX-24-10GE-SFPP	13.2R2	12.1X48 12.3R1 13.2R1

Table 1: PICs Supported on the PTX Series *(Continued)*

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
"10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)" on page 40	24	P1-PTX-24-10G-W-SFPP	13.2R2	12.3R2 13.2R1
10-Gigabit Ethernet/40-Gigabit Ethernet				
"10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)" on page 56	12	P2-10G-40G-QSFPP	15.1F6 16.1R2 17.1R1	14.1R2
"24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)" on page 62	24	P3-24-U-QSFP28	15.1F6 16.1R2 17.1R1	15.1F3 16.1R2 17.1R1
40-Gigabit Ethernet				
"40-Gigabit Ethernet PIC with CFP (PTX Series)" on page 50	2	P1-PTX-2-40GE-CFP	13.2R2	12.1X48 12.3R1 13.2R1
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet				

Table 1: PICs Supported on the PTX Series *(Continued)*

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
"10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)" on page 68	10	P3-10-U-QSFP28	16.1R3 17.1R1 **NOTE**: The P3-10-U-QSFP28 PIC is supported on PTX3000 on a service release version of Junos OS 15.1F6-S2.	17.1R1
"15-Port 10-Gigabit, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)" on page 74	15	P3-15-U-QSFP28	Not supported	15.1F5 16.1R2 17.1R1
100-Gigabit Ethernet				
"100-Gigabit Ethernet PIC with CFP (PTX Series)" on page 79	2	P1-PTX-2-100GE-CFP	13.2R2	12.1X48 12.3R1 13.2R1
"100-Gigabit Ethernet PIC with CFP2 (PTX Series)" on page 86	4	P2-100GE-CFP2	Not supported	14.1R1

Table 1: PICs Supported on the PTX Series *(Continued)*

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
"100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)" on page 90	4	P2-100GE-OTN	15.1F6 16.1R2 17.1R1	14.1R2
100-Gigabit DWDM OTN				
"100-Gigabit DWDM OTN PIC (PTX Series)" on page 97	2	P1-PTX-2-100G-WDM	13.3R1	13.2R1
"100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)" on page 108	5	PTX-5-100G-WDM	15.1F6 17.1R1	15.1F6 17.1R1

PTX Series PIC/FPC Compatibility

IN THIS SECTION

Table 2 on page 6 and Table 3 on page 8 list the PICs supported on each PTX Series router, the FPCs that support each PIC, and the first Junos OS release that supports each PIC and FPC combination.

NOTE: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

PTX3000 PIC/FPC Compatibility

Table 2 on page 6 describes PIC/FPC compatibility for the PTX3000.

Table 2: PTX3000 PIC/FPC Compatibility

PIC Family and Type	Model Number	PIC First Supported on FPC-SFF-PTX-P1	PIC First Supported on FPC-SFF-PTX-T	PIC First Supported on FPC3-SFF-PTX
10-Gigabit Ethernet				
"10-Gigabit Ethernet PIC with SFP+ (PTX Series)" on page 33	P1-PTX-24-10GE-SFPP	13.2R2	14.1R1	Not supported
"10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)" on page 40	P1-PTX-24-10G-W-SFPP	13.2R2	14.1R1	15.1F6 16.1R2 17.1R1
10-Gigabit Ethernet/40-Gigabit Ethernet				
"10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)" on page 56	P2-10G-40G-QSFPP	Not supported	Not supported	15.1F6 16.1R2 17.1R1

Table 2: PTX3000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-SFF-PTX-P1	PIC First Supported on FPC-SFF-PTX-T	PIC First Supported on FPC3-SFF-PTX
"24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)" on page 62	P3-24-U-QSFP28	Not supported	Not supported	15.1F6 16.1R2 17.1R1
40-Gigabit Ethernet				
"40-Gigabit Ethernet PIC with CFP (PTX Series)" on page 50	P1-PTX-2-40GE-CFP	13.2R2	14.1R1	Not supported
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet				
"10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)" on page 68	P3-10-U-QSFP28	Not supported	Not supported	16.1R3 17.1R1 **NOTE**: The P3-10-U-QSFP28 PIC is supported on PTX3000 on a service release version of Junos OS 15.1F6-S2.
100-Gigabit Ethernet				
"100-Gigabit Ethernet PIC with CFP (PTX Series)" on page 79	P1-PTX-2-100GE-CFP	13.2R2	14.1R1	Not supported

Table 2: PTX3000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-SFF-PTX-P1	PIC First Supported on FPC-SFF-PTX-T	PIC First Supported on FPC3-SFF-PTX
"100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)" on page 90	P2-100GE-OTN	Not supported	Not supported	15.1F6 16.1R2 17.1R1
100-Gigabit DWDM OTN				
"100-Gigabit DWDM OTN PIC (PTX Series)" on page 97	P1-PTX-2-100G-WDM	13.3R1	14.1R1	Not supported
"100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)" on page 108	PTX-5-100G-WDM	Not supported	Not supported	15.1F6 17.1R1

PTX5000 PIC/FPC Compatibility

Table 3 on page 8 describes PIC/FPC compatibility for the PTX5000.

Table 3: PTX5000 PIC/FPC Compatibility

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
10-Gigabit Ethernet					

Table 3: PTX5000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
"10-Gigabit Ethernet PIC with SFP+ (PTX Series)" on page 33	P1-PTX-24-10GE-SFPP	12.1X48 12.3 13.2	14.1R1	Not supported	Not supported
"10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)" on page 40	P1-PTX-24-10G-W-SFPP	12.3R2 12.3 13.2	14.1R1	15.1F5	15.1F5
10-Gigabit Ethernet/40-Gigabit Ethernet					
"10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)" on page 56	P2-10G-40G-QSFPP	Not supported	14.1R2	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
"24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)" on page 62	P3-24-U-QSFP28	Not supported	Not supported	15.1F3 16.1R2 17.1R1	15.1F3 16.1R2 17.1R1
40-Gigabit Ethernet					

Table 3: PTX5000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
"40-Gigabit Ethernet PIC with CFP (PTX Series)" on page 50	P1-PTX-2-40GE-CFP	12.1X48 12.3 13.2	14.1R2	Not supported	Not supported
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet					
"10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)" on page 68	P3-10-U-QSFP28	Not supported	Not supported	17.1R1	17.1R1
"15-Port 10-Gigabit, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)" on page 74	P3-15-U-QSFP28	Not supported	Not supported	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
100-Gigabit Ethernet					
"100-Gigabit Ethernet PIC with CFP (PTX Series)" on page 79	P1-PTX-2-100GE-CFP	12.1X48 12.3 13.2	14.1R2	Not supported	Not supported

Table 3: PTX5000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
"100-Gigabit Ethernet PIC with CFP2 (PTX Series)" on page 86	P2-100GE-CFP2	Not supported	14.1R1	Not supported	Not supported
"100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)" on page 90	P2-100GE-OTN	Not supported	14.1R2	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
100-Gigabit DWDM OTN					
"100-Gigabit DWDM OTN PIC (PTX Series)" on page 97	P1-PTX-2-100G-WDM	13.2R1	14.1R1	Not supported	Not supported
"100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)" on page 108	PTX-5-100G-WDM	Not supported	Not supported	15.1F6 17.1R1	15.1F6 17.1R1

CHAPTER 2

Network Interface Specifications

IN THIS CHAPTER

Determining Transceiver Support and Specifications

You can find information about the pluggable transceivers supported on your Juniper Networks device by using the Hardware Compatibility Tool. In addition to transceiver and connector type, the optical and cable characteristics—where applicable—are documented for each transceiver. The Hardware Compatibility Tool allows you to search by product, displaying all the transceivers supported on that device, or category, displaying all the transceivers by interface speed or type. The Hardware Compatibility Tool is located at https://apps.juniper.net/hct/.

Some transceivers support additional monitoring using the operational mode CLI command **show interfaces diagnostics optics**. Use the Hardware Compatibility Tool to determine if your transceiver supports monitoring. See the Junos OS documentation for your device for a description of the monitoring fields.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

RELATED DOCUMENTATION

- show interfaces diagnostics optics (Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet, and Virtual Chassis Port)
- show interfaces diagnostics optics (SONET)
- show interfaces diagnostics optics
- show interfaces diagnostics optics
- show interfaces diagnostics optics

Cable and Connector Specifications for MX and PTX Series Devices

IN THIS SECTION

The transceivers that are supported on MX Series and PTX Series devices use fiber-optic cables and connectors. The type of connector and the type of fiber depends on the transceiver type.

You can determine the type of cable and connector required for your specific transceiver by using the Hardware Compatibility Tool.

CAUTION: To maintain agency approvals, use only a properly constructed, shielded cable.

NOTE: The terms multifiber push-on (MPO) and multifiber termination push-on (MTP) describe the same connector type. The rest of this topic uses MPO to mean MPO or MTP.

12-Fiber MPO Connectors

There are two types of cables used with 12-fiber MPO connectors on Juniper Networks devices—patch cables with MPO connectors on both ends, and breakout cables with an MPO connector on one end and four LC duplex connectors on the opposite end. Depending on the application, the cables might use

single-mode fiber (SMF) or multimode fiber (MMF). Juniper Networks sells cables that meet the supported transceiver requirements, but it is not required to purchase cables from Juniper Networks.

Ensure that you order cables with the correct polarity. Vendors refer to these crossover cables as *key up to key up*, *latch up to latch up*, *Type B*, or *Method B*. If you are using patch panels between two transceivers, ensure that the proper polarity is maintained through the cable plant.

Also, ensure that the fiber end in the connector is finished correctly. Physical contact (PC) refers to fiber that has been polished flat. Angled physical contact (APC) refers to fiber that has been polished at an angle. Ultra physical contact (UPC) refers to fiber that has been polished flat, to a finer finish. The required fiber end is listed with the connector type in the Hardware Compatibility Tool.

12-Fiber Ribbon Patch Cables with MPO Connectors

You can use 12-fiber ribbon patch cables with socket MPO connectors to connect two transceivers of the same type—for example, 40GBASE-SR4-to-40GBASESR4 or 100GBASE-SR4-to-100GBASE-SR4. You can also connect 4x10GBASE-LR or 4x10GBASE-SR transceivers by using patch cables—for example, 4x10GBASE-LR-to-4x10GBASE-LR or 4x10GBASE-SR-to-4x10GBASE-SR—instead of breaking the signal out into four separate signals.

Table 4 on page 14 describes the signals on each fiber. Table 5 on page 15 shows the pin-to-pin connections for proper polarity.

Table 4: Cable Signals for 12-Fiber Ribbon Patch Cables

Fiber	Signal
1	Tx0 (Transmit)
2	Tx1 (Transmit)
3	Tx2 (Transmit)
4	Tx3 (Transmit)
5	Unused
6	Unused

Table 4: Cable Signals for 12-Fiber Ribbon Patch Cables *(Continued)*

Fiber	Signal
7	Unused
8	Unused
9	Rx3 (Receive)
10	Rx2 (Receive)
11	Rx1 (Receive)
12	Rx0 (Receive)

Table 5: Cable Pinouts for 12-Fiber Ribbon Patch Cables

MPO Pin	MPO Pin
1	12
2	11
3	10
4	9
5	8
6	7

Table 5: Cable Pinouts for 12-Fiber Ribbon Patch Cables *(Continued)*

MPO Pin	MPO Pin
7	6
8	5
9	4
10	3
11	2
12	1

12-Fiber Ribbon Breakout Cables with MPO-to-LC Duplex Connectors

You can use 12-ribbon breakout cables with MPO-to-LC duplex connectors to connect a QSFP+ transceiver to four separate SFP+ transceivers—for example, 4x10GBASE-LR-to-10GBASE-LR or 4x10GBASE-SR-to-10GBASE-SR SFP+ transceivers. The breakout cable is constructed out of a 12-fiber ribbon fiber-optic cable. The ribbon cable splits from a single cable with a socket MPO connector on one end, into four cable pairs with four LC duplex connectors on the opposite end.

Figure 1 on page 16 shows an example of a typical 12-ribbon breakout cable with MPO-to-LC duplex connectors (depending on the manufacture, your cable may look different).

Figure 1: 12-Ribbon Breakout Cable

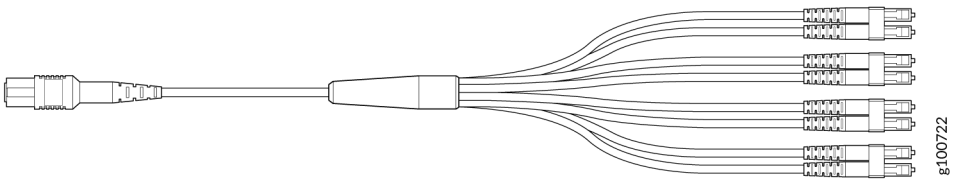


Table 6 on page 17 describes the way the fibers are connected between the MPO and LC duplex connectors. The cable signals are the same as those described in Table 4 on page 14.

Table 6: Cable Pinouts for 12-Fiber Ribbon Breakout Cables

MPO Connector Pin	LC Duplex Connector Pin
1	Tx on LC Duplex 1
2	Tx on LC Duplex 2
3	Tx on LC Duplex 3
4	Tx on LC Duplex 4
5	Unused
6	Unused
7	Unused
8	Unused
9	Rx on LC Duplex 4
10	Rx on LC Duplex 3
11	Rx on LC Duplex 2
12	Rx on LC Duplex 1

12-Ribbon Patch and Breakout Cables Available from Juniper Networks

Juniper Networks sells 12-ribbon patch and breakout cables with MPO connectors that meet the requirements described above. It is not required to purchase cables from Juniper Networks. Table 7 on page 18 describes the available cables.

Table 7: 12-Ribbon Patch and Breakout Cables Available from Juniper Networks

Cable Type	Connector Type	Fiber Type	Cable Length	Juniper Model Number
12-ribbon patch	Socket MPO/PC to socket MPO/PC, key up to key up	MMF (OM3)	1 m	MTP12-FF-M1M
			3 m	MTP12-FF-M3M
			5 m	MTP12-FF-M5M
			10 m	MTP12-FF-M10M
	Socket MPO/APC to socket MPO/APC, key up to key up	SMF	1 m	MTP12-FF-S1M
			3 m	MTP12-FF-S3M
			5 m	MTP12-FF-S5M
			10 m	MTP12-FF-S10M
12-ribbon breakout	Socket MPO/PC, key up, to four LC/UPC duplex	MMF (OM3)	1 m	MTP-4LC-M1M
			3 m	MTP-4LC-M3M
			5 m	MTP-4LC-M5M
			10 m	MTP-4LC-M10M
	Socket MPO/APC, key up, to four LC/UPC duplex	SMF	1 m	MTP-4LC-S1M

Table 7: 12-Ribbon Patch and Breakout Cables Available from Juniper Networks *(Continued)*

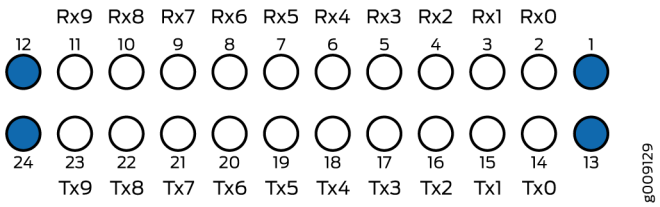
Cable Type	Connector Type	Fiber Type	Cable Length	Juniper Model Number
			3 m	MTP-4LC-S3M
			5 m	MTP-4LC-S5M
			10 m	MTP-4LC-S10M

24-Fiber MPO Connectors

You can use patch cables with 24-fiber MPO connectors to connect two supported transceivers of the same type—for example, 100GBASE-SR10-to-100GBASE-SR10.

Figure 2 on page 19 shows the 24-fiber MPO optical lane assignments.

Figure 2: 24-Fiber MPO Optical Lane Assignments



NOTE: Ensure that you order cables with the correct polarity. Vendors refer to these crossover cables as *key up to key up*, *latch up to latch up*, *Type B*, or *Method B*. If you are using patch panels between two transceivers, ensure that the proper polarity is maintained through the cable plant.

The MPO optical connector for the CFP2-100G-SR10-D3 is defined in *Section 5.6 of the CFP2 Hardware Specification and Section 88.10.3 of IEEE STD 802.3-2012*. These specifications include the following requirements:

- Recommended Option A in IEEE STD 802.3-2012.

- The transceiver receptacle is a plug. A patch cable with a socket connector is required to mate with the module.
- Ferrule finish shall be flat polished interface that is compliant with IEC 61754-7.
- Alignment key is key up.

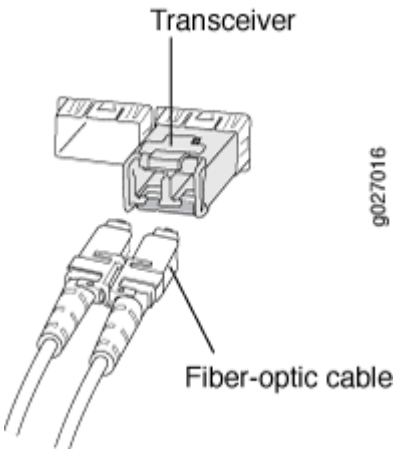
The optical interface must meet the requirement FT-1435-CORE in *Generic Requirements for Multi-Fiber Optical Connectors*. The module must pass the wiggle test defined by IEC 62150-3.

LC Duplex Connectors

You can use patch cables with LC duplex connectors to connect two supported transceivers of the same type—for example, 40GBASE-LR4-to-40GBASE-LR4 or 100GBASE-LR4-to100GBASE-LR4. The patch cable is one fiber pair with two LC duplex connectors at opposite ends. LC duplex connectors are also used with 12-fiber ribbon breakout cables, as described in "12-Fiber Ribbon Breakout Cables with MPO-to-LC Duplex Connectors" on page 16.

Figure 3 on page 20 shows an LC duplex connector being installed in a transceiver.

Figure 3: LC Duplex Connector



100-Gigabit DWDM OTN PIC Integrated Transceiver Optical Interface Specifications

The 100-Gigabit Dense Wavelength Division Multiplexing (DWDM) Optical Transport Network (OTN) PIC (model number P1-PTX-2-100G-WDM) is designed for metro, regional, or long-haul applications.

Table 8 on page 21 and Table 9 on page 22 show the optical interface specifications for the 100-Gigabit DWDM OTN PIC integrated transceiver.

Table 8: 100-Gigabit DWDM OTN PIC Integrated Transceiver Optical Interface Specifications

Specifications	P1-PTX-2-100G-WDM
Transceiver type	• DWDM integrated transceiver
Standards	• ITU-T G.709—Interfaces for the optical transport network. • ITU-T G.798—Characteristics of optical transport network hierarchy equipment functional blocks • ITU-T G.694.1—Spectral grids for WDM applications: DWDM frequency grid • RFC 3591—Definitions of Managed Objects for the Optical Interface Type
Optical interface	• Single-mode optical fiber (ITU-T G.652) • Duplex LC connector (Rx and Tx)
Line interface	• Line rate: 127.156441 Gbps • Modulation format: Dual polarization-quadrature phase-shift keying (DP-QPSK), non-return-to-zero (NRZ) • FEC type: Soft decision • Channel-plan wavelength range: 1529.55 through 1567.54 nm • Channel-plan frequency range: 191.25 through 196.00 THz • Channel spacing: 50 GHz • Channel tunability: 96 channels—see Table 9 on page 22

Table 8: 100-Gigabit DWDM OTN PIC Integrated Transceiver Optical Interface Specifications *(Continued)*

Specifications	P1-PTX-2-100G-WDM
Optical transmitter	• Output power (on): –2 dBm • Output power (off): ≤–45 dBm • Wavelength accuracy: +/–2.5 GHz • Channel tuning time: ≤30 seconds
Optical receiver	• Average receive power (input power range): –18 to –5 dBm • Input sensitivity (unamplified/dark-fiber applications): –28 dBm • LO wavelength accuracy: +/–2.5 GHz • Channel tuning time: ≤30 seconds • Damage input power threshold: +10 dBm • Minimum OSNR (back-to-back): 13.5 dB typical • Minimum OSNR (back-to-back): 14.5 dB worst-case, EOL • Chromatic dispersion tolerance: +/–50,000 ps/nm • PMD tolerance: 25 ps (mean DGD) • Polarization tracking: 150 krad/s

Table 9 on page 22 provides the supported wavelengths in both terahertz (THz) and nanometers (nm).

Table 9: 100-Gigabit DWDM OTN Supported Wavelengths

100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm
–	–	191.25	1567.54

Table 9: 100-Gigabit DWDM OTN Supported Wavelengths *(Continued)*

100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm
191.30	1567.13	191.35	1566.72
191.40	1566.31	191.45	1565.90
191.50	1565.50	191.55	1565.09
191.60	1564.68	191.65	1564.27
191.70	1563.86	191.75	1563.45
191.80	1563.05	191.85	1562.64
191.90	1562.23	191.95	1561.83
192.00	1561.42	192.05	1561.01
192.10	1560.61	192.15	1560.20
192.20	1559.79	192.25	1559.39
192.30	1558.98	192.35	1558.58
192.40	1558.17	192.45	1557.77
192.50	1557.36	192.55	1556.96
192.60	1556.55	192.65	1556.15

Table 9: 100-Gigabit DWDM OTN Supported Wavelengths *(Continued)*

100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm
192.70	1555.75	192.75	1555.34
192.80	1554.94	192.85	1554.54
192.90	1554.13	192.95	1553.73
193.00	1553.33	193.05	1552.93
193.10	1552.52	193.15	1552.12
193.20	1551.72	193.25	1551.32
193.30	1550.92	193.35	1550.52
193.40	1550.12	193.45	1549.72
193.50	1549.32	193.55	1548.91
193.60	1548.51	193.65	1548.11
193.70	1547.72	193.75	1547.32
193.80	1546.92	193.85	1546.52
193.90	1546.12	193.95	1545.72
194.00	1545.32	194.05	1544.92

Table 9: 100-Gigabit DWDM OTN Supported Wavelengths *(Continued)*

100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm
194.10	1544.53	194.15	1544.13
194.20	1543.73	194.25	1543.33
194.30	1542.94	194.35	1542.54
194.40	1542.14	194.45	1541.75
194.50	1541.35	194.55	1540.95
194.60	1540.56	194.65	1540.16
194.70	1539.77	194.75	1539.37
194.80	1538.98	194.85	1538.58
194.90	1538.19	194.95	1537.79
195.00	1537.40	195.05	1537.00
195.10	1536.61	195.15	1536.22
195.20	1535.82	195.25	1535.43
195.30	1535.04	195.35	1534.64
195.40	1534.25	195.45	1533.86

Table 9: 100-Gigabit DWDM OTN Supported Wavelengths *(Continued)*

100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm
195.50	1533.47	195.55	1533.07
195.60	1532.68	195.65	1532.29
195.70	1531.90	195.75	1531.51
195.80	1531.12	195.85	1530.72
195.90	1530.33	195.95	1529.94
196.00	1529.55	–	–

RELATED DOCUMENTATION

100-Gigabit DWDM OTN PIC (PTX Series) | **97**

100-Gigabit DWDM OTN CFP2-ACO Transceiver Wavelengths

MX Series routers support a 1-port 100-Gigabit Dense Wavelength Division Multiplexing (DWDM) Optical Transport Network (OTN) MIC with CFP2 (model number MIC3-100G-DWDM). PTX Series routers support a 5-port 100-Gigabit DWDM OTN PIC with CFP2 (model number PTX-5-100G-WDM). MIC3-100G-DWDM and PTX-5-100G-WDM interface cards support a CFP2 analog coherent optics (CFP2-ACO) transceiver (model number TCFP2-100G-C).

NOTE: Additional specifications for the TCFP2-100G-C CFP2-ACO transceiver are located in the Hardware Compatibility Tool, at https://pathfinder.juniper.net/hct/model/?component=TCFP2-100G-C.

Table 10 on page 27 provides the supported wavelengths in both terahertz (THz) and nanometers (nm).

Table 10: 100-Gigabit DWDM OTN CFP2-ACO Supported Wavelengths

100-GHz Grid		50-GHz Offset	
THz	nm	THz	nm
–	–	191.15	1568.36
191.20	1567.95	191.25	1567.54
191.30	1567.13	191.35	1566.72
191.40	1566.31	191.45	1565.90
191.50	1565.50	191.55	1565.09
191.60	1564.68	191.65	1564.27
191.70	1563.86	191.75	1563.45
191.80	1563.05	191.85	1562.64
191.90	1562.23	191.95	1561.83
192.00	1561.42	192.05	1561.01
192.10	1560.61	192.15	1560.20

Table 10: 100-Gigabit DWDM OTN CFP2-ACO Supported Wavelengths *(Continued)*

100-GHz Grid		50-GHz Offset	
THz	nm	THz	nm
192.20	1559.79	192.25	1559.39
192.30	1558.98	192.35	1558.58
192.40	1558.17	192.45	1557.77
192.50	1557.36	192.55	1556.96
192.60	1556.55	192.65	1556.15
192.70	1555.75	192.75	1555.34
192.80	1554.94	192.85	1554.54
192.90	1554.13	192.95	1553.73
193.00	1553.33	193.05	1552.93
193.10	1552.52	193.15	1552.12
193.20	1551.72	193.25	1551.32
193.30	1550.92	193.35	1550.52
193.40	1550.12	193.45	1549.72
193.50	1549.32	193.55	1548.91

Table 10: 100-Gigabit DWDM OTN CFP2-ACO Supported Wavelengths *(Continued)*

100-GHz Grid		50-GHz Offset	
THz	nm	THz	nm
193.60	1548.51	193.65	1548.11
193.70	1547.72	193.75	1547.32
193.80	1546.92	193.85	1546.52
193.90	1546.12	193.95	1545.72
194.00	1545.32	194.05	1544.92
194.10	1544.53	194.15	1544.13
194.20	1543.73	194.25	1543.33
194.30	1542.94	194.35	1542.54
194.40	1542.14	194.45	1541.75
194.50	1541.35	194.55	1540.95
194.60	1540.56	194.65	1540.16
194.70	1539.77	194.75	1539.37
194.80	1538.98	194.85	1538.58
194.90	1538.19	194.95	1537.79

Table 10: 100-Gigabit DWDM OTN CFP2-ACO Supported Wavelengths *(Continued)*

100-GHz Grid		50-GHz Offset	
THz	nm	THz	nm
195.00	1537.40	195.05	1537.00
195.10	1536.61	195.15	1536.22
195.20	1535.82	195.25	1535.43
195.30	1535.04	195.35	1534.64
195.40	1534.25	195.45	1533.86
195.50	1533.47	195.55	1533.07
195.60	1532.68	195.65	1532.29
195.70	1531.90	195.75	1531.51
195.80	1531.12	195.85	1530.72
195.90	1530.33	195.95	1529.94
196.00	1529.55	196.05	1529.16
196.10	1528.77	–	–

RELATED DOCUMENTATION

100-Gigabit DWDM OTN MIC with CFP2-ACO | 0

2

PART

PIC Descriptions

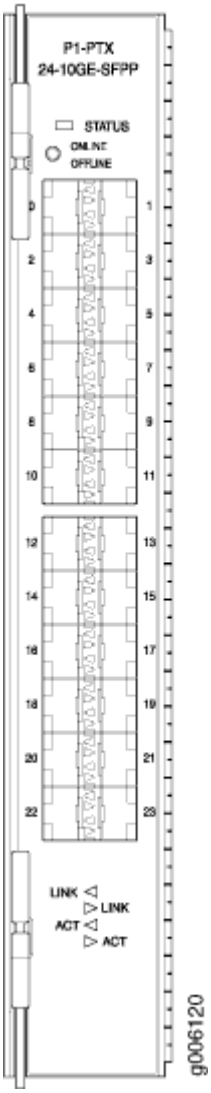
CHAPTER 3

Ethernet PIC Descriptions

IN THIS CHAPTER

10-Gigabit Ethernet PIC with SFP+ (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 13.2R2 and later
- PTX5000: Junos OS Release 12.1X48 and later, Junos OS Release 12.3R1 and later, and Junos OS Release 13.2R1 and later

> **NOTE**: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Twenty-four 10-Gigabit Ethernet SFP+ ports
- Model number: P1-PTX-24-10GE-SFPP
- Name in the CLI: **24x 10GE (LAN) SFP+**
- Power requirements: 1.45 A @ –48 V (70 W)
- High-performance throughput: LAN-PHY mode at 10.3 Gbps
- Full-duplex mode
- Large maximum transmission units (MTUs):
  - Junos OS Release 12.1X48: up to 9192 bytes
  - Junos OS Release 12.1X48R2 and later 12.1X48 releases: up to 9500 bytes
  - Junos OS Release 12.3R1 and later: up to 9500 bytes

Software Features

Table 11 on page 35 shows the first supported Junos OS release for each software feature.

Table 11: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Dual-rate speed (all ports are configured for 1 Gbps or 10 Gbps, no mixed-mode speed)	13.3R3 14.1R3 14.2R2 15.1R1	14.2R2 15.1R1
Flexible-ethernet-services encapsulation	13.2R2	12.1X48 12.3R1 13.2R1

Table 11: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible VLAN tagging	13.2R2	12.1X48 12.3R1 13.2R1
IFINFO / IFMON	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.1 ag OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3 ah OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3ad link aggregation	13.2R2	12.1X48 12.3R1 13.2R1
Interrupt-driven link-down detection for MPLS FRR	13.2R2	12.1X48 12.3R1 13.2R1

Table 11: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
MAC accounting per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1
MAC filter per port for destination addresses and source addresses	13.2R2	12.1X48 12.3R1 13.2R1
MAC filter per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1
SNMP	13.2R2	12.1X48 12.3R1 13.2R1
Up to 8000 logical interfaces shared across all ports on a single Packet Forwarding Engine	13.2R2	12.1X48 12.3R1 13.2R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

This PIC supports the following transceivers:

- 10GBASE-ER (model number: SFPP-10GE-ER)
- 10GBASE-LR (model number: SFPP-10GE-LR)
- 10GBASE-SR (model number: SFPP-10GE-SR)
- 10GBASE-ZR (model number: SFPP-10GE-ZR) supported in Junos OS Release 12.3 and later
- 10GBASE-ZR (model number: SFPP-10G-OTN-XT)
  - Supported in Junos OS Release 12.3R5, 13.2R3, and 13.3R1, and later
  - NEBS compliant
  - Dual-rate extended temperature transceiver that supports LAN-PHY and WAN-PHY modes, and OTN rates
- 10GBASE-ZR (model number: SFPP-10G-DT-ZRC2)
  - Supported in Junos OS Release 13.2R5, 13.3R3, 14.1R2, and 14.2R1, and later
  - Supports LAN-PHY and WAN-PHY modes
  - Supports OTN rates of 10.70932 Gbps (OTU2) and 11.0957 Gbps (OTU2e)
  - Tunable by configuring the **wavelength** statement at the **[edit interfaces *interface-name* optics-options]** hierarchy level (see "wavelength")
  - NEBS compliant
- 1000BASE-LX (model number: SFP-1GE-LX) supported in Junos OS Release 13.3R3, 14.1R3, 14.2R2, and 15.1R1, and later
- 1000BASE-SX (model number: SFP-1GE-SX) supported in Junos OS Release 13.3R3, 14.1R3, 14.2R2, and 15.1R1, and later

LEDs

The **STATUS** LED is located above the **ONLINE OFFLINE** button. The **LINK** and **ACT** LEDs are located next to each port. The **LINK** and **ACT** label is located at the bottom of the PIC.Table 12 on page 39 describes the functions of these LEDs.

Table 12: 10-Gigabit Ethernet PIC with SFP+ LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is operating normally.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
LINK (for each port)	Green	On steadily	Port is on with no alarms or errors.
	Red	On steadily	Port has detected an alarm or error.
	–	Off	Port is off.
ACT (for each port)	Green	Flashing	Link has activity.
	–	Off	No activity.

RELATED DOCUMENTATION

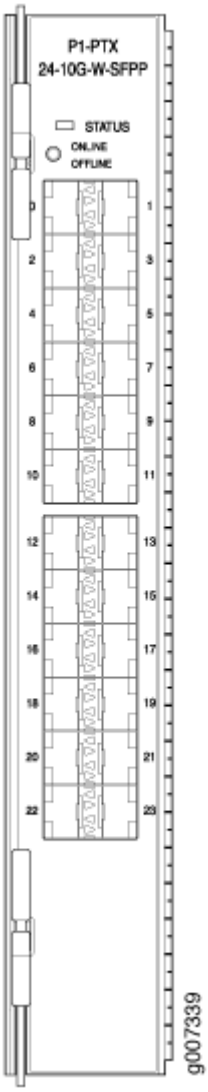
PICs Supported on the PTX Series | **2**

PTX3000 PIC Description | **0**

PTX5000 PIC Description | **0**

10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 13.2R2 and later
- PTX5000: Junos OS Release 12.3R2 and later, Junos OS Release 13.2R1 and later

> **NOTE**: PTX5000 does not support Junos OS Release 13.1.

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Twenty-four 10-Gigabit Ethernet SFP+ ports
- Model number: P1-PTX-24-10G-W-SFPP
- Name in the CLI: **24x 10GE(LWO) SFP+**
- Power requirements: 2.67 A @ –48 V (128 W)
- High-performance throughput: LAN-PHY mode at 10.3125 Gbps and WAN-PHY mode at 9.95 Gbps

  Configurable modes:

  - LAN-PHY
  - WAN-PHY
  - OTN
- Full-duplex mode
- Large maximum transmission units (MTUs): up to 9500 bytes

Software Features

Table 13 on page 42 shows the first supported Junos OS release for each software feature.

Table 13: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible-ethernet-services encapsulation	13.2R2	12.3R2 13.2R1
Flexible VLAN tagging	13.2R2	12.3R2 13.2R1

Table 13: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
IFINFO / IFMON	13.2R2	12.3R2 13.2R1
IEEE 802.1 ag OAM	13.2R2	12.3R2 13.2R1
IEEE 802.3 ah OAM	13.2R2	12.3R2 13.2R1
IEEE 802.3ad link aggregation	13.2R2	12.3R2 13.2R1
Interrupt-driven link-down detection for MPLS FRR	13.2R2	12.3R2 13.2R1
MAC accounting per logical interface for source addresses	13.2R2	12.3R2 13.2R1
MAC filter per port for destination addresses and source addresses	13.2R2	12.3R2 13.2R1
MAC filter per logical interface for source addresses	13.2R2	12.3R2 13.2R1

Table 13: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
SNMP	13.2R2	12.3R2 13.2R1
Up to 8000 logical interfaces shared across all ports on a single Packet Forwarding Engine	13.2R2	12.3R2 13.2R1
Compliant with ITU G.709, G.975.1 I.4 and G.975.1 I.7	14.2R1	14.2R1
Provides a transport interface and state model (GR-1093)	14.2R1	14.2R1
OTN mapping modes: • 10G LAN-PHY over OTU2e/OTU1e • 10G WAN-PHY over OTU2	14.2R1	14.2R1
Performance monitoring such as alarms, threshold crossing alerts, OTU/ODU error seconds and pre-FEC statistics	14.2R1	14.2R1
SNMP management of the PIC based on RFC 3591, Managed Objects for the Optical Interface Type • Set functionality • Juniper Networks Black-Link MIB • IFOTN MIB • Optics MIB • FRU MIB	14.2R1	14.2R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

This PIC supports the following transceivers:

- 10GBASE-SR (model number: SFPP-10GE-SR)
- 10GBASE-LR (model number: SFPP-10GE-LR)
- 10GBASE-ER (model number: SFPP-10GE-ER)
- 10GBASE-ZR (model number: SFPP-10GE-ZR)
- 10GBASE-ZR (model number: SFPP-10G-CT50-ZR)
  - Supported in Junos OS Release 13.2R3, 13.3R2, 14.1R2, and later
  - Supports LAN-PHY and WAN-PHY modes, and OTN rates
  - Tunable by configuring the **wavelength** statement at the **[edit interfaces *interface-name* optics-options]** hierarchy level (see "wavelength")
- 10GBASE-ZR (model number: SFPP-10G-DT-ZRC2)
  - Supported in Junos OS Release 13.2R5, 13.3R3, 14.1R2, and 14.2, and later
  - Supports LAN-PHY and WAN-PHY modes
  - Supports OTN rates of 10.70932 Gbps (OTU2) and 11.0957 Gbps (OTU2e)
  - Tunable by configuring the **wavelength** statement at the **[edit interfaces *interface-name* optics-options]** hierarchy level (see "wavelength")
  - NEBS compliant

LEDs

The **STATUS** LED is located above the **ONLINE OFFLINE** button. The **LINK** and **ACT** LEDs are located next to each port. Table 14 on page 46 describes the functions of these LEDs.

Table 14: 10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is operating normally.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
LINK (for each port)	Green	On steadily	Port is on with no alarms or errors.
	Red	On steadily	Port has detected an alarm or error.
	–	Off	Port is off.
ACT (for each port)	Green	Flashing	Link has activity.
	–	Off	No activity.

Alarms, Errors, and Events

Chassis and PIC:

- PIC (FRU) inserted or removed
- PIC (FRU) Admin InService/OutOfService, Oper Unequipped/Init/Normal/Mismatch/Fault/Upgrade
- Mismatch equipment
- Temperature alarm
- Fan alarm

Port (interface):

- Interface Admin InService/OutOfService/ServiceMA/OutOfServiceMA, Oper Init/Normal/Fault/Degraded

OTN (optical transport network):

- LOS (loss of signal)
- LOF (loss of frame)
- LOM (loss of multiframe)
- SSF (server signal failure)
- TSF (trail signal fail)

OTU (optical channel transport unit):

- OTU-FEC-DEG (forward error correction degraded)
- OTU-FEC-EXE (excessive errors, FEC_FAIL from the transponder)
- OTU-AIS (alarm indication signal or all ones signal)
- OTU-BDI (backward defect identification)
- OTU-IAE (incoming alignment error)
- OTU-BIAE (backward incoming alignment error)
- OTU-TTIM (destination access point identifier [DAPI], source access point identifier [SAPI], or both mismatch from expected to received)
- OTU-SD (signal degrade)
- OTU-SF (signal fail)

ODU (optical channel data unit):

- CSF (client signal failure)
- ODU-LCK (ODU lock triggers for PM [path monitoring] and TCM levels 1 through 6)
- ODU-AIS (alarm indication signal or all ones signal)
- ODU-OCI (open connection error)
- ODU-BDI (backward defect indication)
- ODU-IAE (incoming alignment error)
- ODU-DAPI-TTIM (DAPI or DAPI/SAPI mismatch from expected to receive)

- ODU-SAPI-TTIM (SAPI or DAPI/SAPI mismatch from expected to receive)
- ODU-BEI (backward error indication)
- ODU-SSF (server signal fail)
- ODU-TSF (trail signal fail)
- ODU-SD (signal degrade)
- ODU-SF (signal fail)

OPU (optical channel payload):

- OPU-PTM (payload type mismatch)

Card-related status:

- Transceiver temperature high alarm
- Transceiver temperature high warning
- Transceiver temperature low alarm
- Transceiver temperature low warning
- Transceiver voltage high alarm
- Transceiver voltage high warning
- Transceiver voltage low alarm
- Transceiver voltage low warning
- Transceiver temperature monitor A/D value
- Transceiver power supply monitor A/D value (voltage)
- Transceiver minimum temperature over PM interval
- Transceiver average temperature over PM interval
- Transceiver maximum temperature over PM interval

Network lane transmit–related status:

- TX laser current bias high alarm
- TX laser current bias high warning
- TX laser current bias low alarm

- TX laser current bias low warning
- TX current laser output power
- TX minimum laser output power over PM interval
- TX average laser output power over PM interval
- TX maximum laser output power over PM interval
- TX laser bias current value
- TX output optical power high alarm
- TX output optical power high warning
- TX output optical power low alarm
- TX output optical power low warning
- TX minimum laser bias current over PM interval
- TX average laser bias current over PM interval
- TX maximum laser bias current over PM interval

Network lane receive–related status:

- RX input optical power high alarm
- RX input optical power high warning
- RX input optical power low alarm
- RX input optical power low warning
- RX LOS
- RX Laser wavelength unlocked fault
- RX laser TEC fault
- RX input optical power
- RX minimum input optical power over PM interval
- RX average input optical power over PM interval
- RX maximum input optical power over PM interval

RELATED DOCUMENTATION

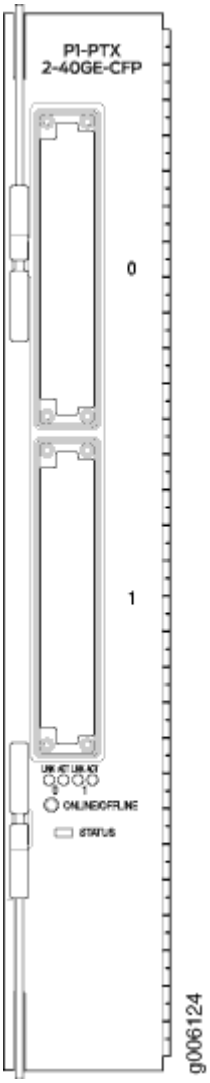
PICs Supported on the PTX Series | 2

PTX3000 PIC Description | 0

PTX5000 PIC Description | 0

40-Gigabit Ethernet PIC with CFP (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 13.2R2 and later
- PTX5000: Junos OS Release 12.1X48 and later, Junos OS Release 12.3R1 and later, and Junos OS Release 13.2R1 and later

> **NOTE**: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

For information on which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Two 40-Gigabit Ethernet CFP ports
- Model number P1-PTX-2-40GE-CFP
- Name in the CLI: **2x 40GE CFP**
- Power requirements: 0.7 A @ –48 V (35 W)
- Large maximum transmission units (MTUs):
  - Junos OS Release 12.1X48: up to 9192 bytes
  - Junos OS Release 12.1X48R2 and later 12.1X48 releases: up to 9500 bytes
  - Junos OS Release 12.3R1 and later releases: up to 9500 bytes

Software Features

Table 15 on page 52 shows the first supported release for each software feature.

Table 15: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible-ethernet-services encapsulation	13.2R2	12.1X48 12.3R1 13.2R1
Flexible VLAN tagging	13.2R2	12.1X48 12.3R1 13.2R1

Table 15: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
IFINFO / IFMON	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.1 ag OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3 ah OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3ad link aggregation	13.2R2	12.1X48 12.3R1 13.2R1
Interrupt-driven link-down detection for MPLS FRR	13.2R2	12.1X48 12.3R1 13.2R1
MAC accounting per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1

Table 15: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
MAC filter per port for destination addresses and source addresses	13.2R2	12.1X48 12.3R1 13.2R1
MAC filter per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1
SNMP	13.2R2	12.1X48 12.3R1 13.2R1
Up to 8000 logical interfaces share across all ports on a single PFE	13.2R2	12.1X48 12.3R1 13.2R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

LEDs

The **STATUS** LED is located above the **ONLINE OFFLINE** button. The **LINK** and **ACT** LEDs are located next to each port. Table 16 on page 55 describes the functions of these LEDs.

Table 16: 40-Gigabit Ethernet PIC with CFP LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline or not enabled.
LINK for each port:	Green	On steadily	Port is online with no alarms or failures, and the link is up.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure with alarms.
	–	Off	Port is off or not enabled.
ACT for each port	Green	Flashing	Activity detected. Port is sending or receiving packets.
	–	Off	No packet activity detected on the port.

Alarms, Errors, and Events

- Alarm indication signal (AIS)
- Laser bias current high/low alarms and warnings
- Laser Rx power high/low alarms and warnings
- Module not ready alarm
- Module power down alarm
- Module temperature high/low alarms and warnings

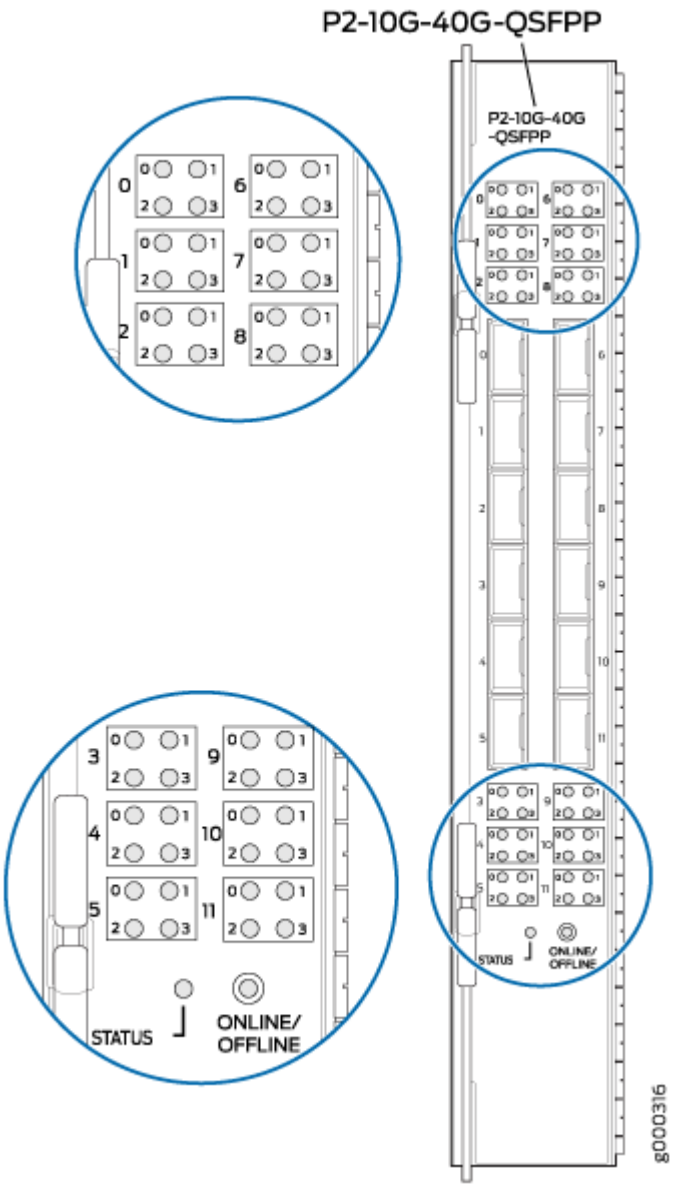
- Rx CDR loss of lock alarm
- Rx loss of signal alarm
- Rx not ready alarm
- Tx CDR loss of lock alarm
- Tx data not ready alarm
- Tx laser fault alarm
- Tx not ready alarm

RELATED DOCUMENTATION

PICs Supported on the PTX Series | 2
PTX3000 PIC Description | 0
PTX5000 PIC Description | 0

10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP + (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 15.1F6, Junos OS Release 16.1R2 and later, Junos OS Release 17.1R1 and later
- PTX5000: Junos OS Release 14.1R2 and later

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Twelve ports (**0** through **11**) configurable as either 10-Gigabit Ethernet ports (in LAN, WAN, or OTU2) or 40-Gigabit Ethernet ports (in Ethernet or OTU3).

  NOTE: The PIC supports either 10-Gigabit Ethernet or 40-Gigabit Ethernet ports. You cannot configure both 10-Gigabit Ethernet and 40-Gigabit Ethernet ports on the same PIC. You can, however, have PICs with 10-Gigabit Ethernet and 40-Gigabit Ethernet ports in the same FPC.

- Model number: P2-10G-40G-QSFPP
- Name in the CLI: **48x10G/12x40G(LWO)QSFP+**
- Independent per-port configuration of:
  - LAN-PHY, WAN-PHY, or OTN framing for ports configured in 10-Gigabit Ethernet mode
  - LAN/WAN or OTN framing for 40-Gigabit Ethernet mode
- Power requirements:
  - 10-Gigabit Ethernet LAN/WAN mode (with QSFP+ transceivers on all ports)—9.09 A @–12.1 V (110 W)
  - 40-Gigabit Ethernet LAN mode (with QSFP+ on all ports)—8.26 A @–12.1 V (100 W)
- High-performance throughput:
  - 10-Gigabit Ethernet LAN mode at 10.3 Gbps
  - 10-Gigabit Ethernet WAN mode at 9.9 Gbps
  - 40-Gigabit Ethernet LAN mode at 41.2 Gbps (10.3 Gbps per lane)
- Configurable modes:
  - LAN-PHY—10-Gigabit Ethernet and 40-Gigabit Ethernet
  - WAN-PHY—10-Gigabit Ethernet
- Full-duplex mode
- Large maximum transmission units (MTUs): up to 9192 bytes

Software Features

Table 17 on page 59 shows the first supported Junos OS release for each software feature.

Table 17: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible-ethernet-services encapsulation	15.1F6 16.1R2 17.1R1	14.1R2
Flexible VLAN tagging	15.1F6 16.1R2 17.1R1	14.1R2
IFINFO / IFMON	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.1 ag OAM	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.3 ah OAM	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.3ad link aggregation	15.1F6 16.1R2 17.1R1	14.1R2

Table 17: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Interrupt-driven link-down detection for MPLS FRR	15.1F6 16.1R2 17.1R1	14.1R2
MAC accounting per logical interface for source addresses	15.1F6 16.1R2 17.1R1	14.1R2
MAC filter per port for destination addresses and source addresses	15.1F6 16.1R2 17.1R1	14.1R2
MAC filter per logical interface for source addresses	15.1F6 16.1R2 17.1R1	14.1R2
SNMP	15.1F6 16.1R2 17.1R1	14.1R2
Up to 8000 logical interfaces share across all ports on a single Packet Forwarding Engine	15.1F6 16.1R2 17.1R1	14.1R2

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

LEDs

The **STATUS** LED is located next to the **ONLINE/OFFLINE** button. The port LEDs are grouped into 12 and each group has four LEDs labeled **0**, **1**, **2**, and **3**. The groups have labels **0** through **11**. The LEDs located next to each port indicate the link, status, and alarms, if any. Table 18 on page 61 describes the functions of these LEDs.

NOTE: If the PIC is configured for 40-Gigabit Ethernet, only the LED labeled **0** in a group of LEDs is lit and if the PIC is configured for 10-Gigabit Ethernet, then all four LEDs in a group are lit. You can use the following command to change the mode:

[edit chassis]

user@host# set fpc fpc-slot pic pic-slot pic-mode (10G | 40G)

Table 18: 10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
LEDs **0** through **11** and each group of LEDs are labeled **0**, **1**, **2**, and **3**.	Green	On steadily	Port is online with no alarms or errors, and the link is up

Table 18: 10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ LEDs *(Continued)*

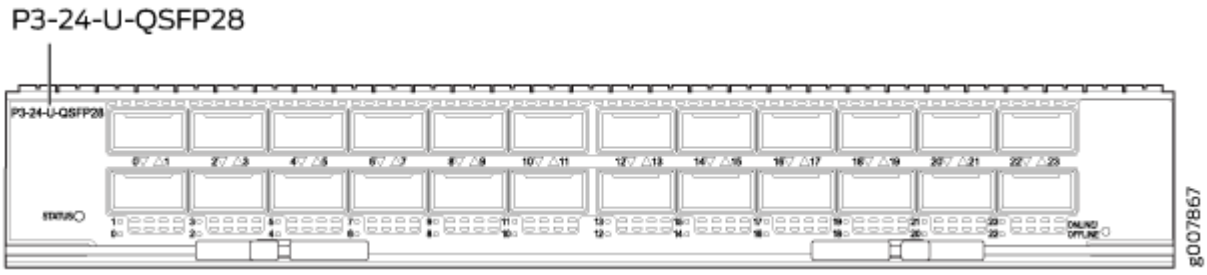
Label	Color	State	Description
		Blinking	There is link activity on the port.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure.
	–	Off	Port is off or not enabled.

RELATED DOCUMENTATION

- PICs Supported on the PTX Series | **2**
- PTX3000 PIC Description | **0**
- PTX5000 PIC Description | **0**

24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 15.1F6, Junos OS Release 16.1R2 and later, Junos OS Release 17.1R1 and later
- PTX5000: Junos OS Release 15.1F3 and later, Junos OS Release 16.1R2 and later, Junos OS Release 17.1R1 and later

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Twenty-four ports (**0** through **23**) configurable as 10-Gigabit Ethernet ports or 40-Gigabit Ethernet ports. If the port speed is not configured, the default port speed on all ports on the PIC is 10 Gbps.

  NOTE: You can use the following command to change the mode:
  [edit chassis]

  user@host# set fpc *slot-number* pic *pic-number* port *port-number* `speed` **(10G | 40G)**

  The interface speeds are configured by port group. There are eight port groups on the 24-port PIC—each port group consists of three ports. The port groups are:

  - **0** through **2**
  - **3** through **5**
  - **6** through **11**
  - **12** through **14**
  - **15** through **17**
  - **18** through **20**

- **21** through **23**

  When you configure the first port in a group the remaining ports in the group are configured with the same port speed. For example, if you configure the **port-speed** of port **0** to be **10G**, then ports **0**, **1**, and **2** operate at 10 Gbps. If you later change the **port-speed** configuration of port **0** to **40G**, then ports **0**, **1**, and **2** operate at 40 Gbps. Only the first port in each port group can be configured.

- Model number: P3-24-U-QSFP28
- Name in the CLI: **96x10/24x40GE**
- Power requirements:
  - 10-Gigabit Ethernet LAN mode (with QSFP+ transceivers on all ports)—4.1 A @ –48 V (195.6 W)
  - 40-Gigabit Ethernet LAN mode (with QSFP+ on all ports)—4.1 A @ –48 V (195.6 W)
- High-performance throughput:
  - 10-Gigabit Ethernet LAN mode at 10.3 Gbps
  - 40-Gigabit Ethernet LAN mode at 41.2 Gbps (10.3 Gbps per lane)
- Configurable modes:
  - LAN-PHY—10-Gigabit Ethernet or 40-Gigabit Ethernet
- Full-duplex mode
- Large maximum transmission units (MTUs): up to 9500 bytes

Software Features

Table 19 on page 64 shows the first supported Junos OS release for each software feature.

Table 19: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible Ethernet services encapsulation	15.1F6 16.1R2	15.1F3 16.1R2

Table 19: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible VLAN tagging	15.1F6 16.1R2	15.1F3 16.1R2
IFINFO / IFMON	15.1F6 16.1R2	15.1F3 16.1R2
IEEE 802.1 ag OAM	15.1F6 16.1R2	15.1F3 16.1R2
IEEE 802.3 ah OAM	15.1F6 16.1R2	15.1F3 16.1R2
IEEE 802.3ad link aggregation	15.1F6 16.1R2	15.1F3 16.1R2
Interrupt-driven link-down detection for MPLS FRR	15.1F6 16.1R2	15.1F3 16.1R2
LLDP	15.1F6 16.1R2	15.1F3 16.1R2
MAC accounting per logical interface for source addresses	15.1F6 16.1R2	15.1F3 16.1R2
MAC filter per port for destination addresses and source addresses	15.1F6 16.1R2	15.1F3 16.1R2

Table 19: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
MAC filter per logical interface for source addresses	15.1F6 16.1R2	15.1F3 16.1R2
SNMP	15.1F6 16.1R2	15.1F3 16.1R2
Up to 8192 logical interfaces share across all ports on a single Packet Forwarding Engine	15.1F6 16.1R2	15.1F3 16.1R2

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

LEDs

The **STATUS** LED is located on the left side of the PIC, the opposite end of the **ONLINE/OFFLINE** button. There are 24 port LEDs grouped in pairs below each set of ports. The LED located below the port pairs indicates the status of the port. Table 20 on page 66 describes the functions of these LEDs.

Table 20: 24 Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.

Table 20: 24 Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC LEDs *(Continued)*

Label	Color	State	Description
	Amber	On steadily	• The PIC is initializing. • The PIC offline process has been initiated. Once the PIC goes offline, the LED turns off.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
LEDs **0** through **23**	Green	On steadily	Port is online with no alarms or errors, and the link is up
		Blinking	There is a problem on the port.
	Amber	On steadily	Port is on but not all subchannels are up.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure.
	–	Off	Port is off or not enabled.

RELATED DOCUMENTATION

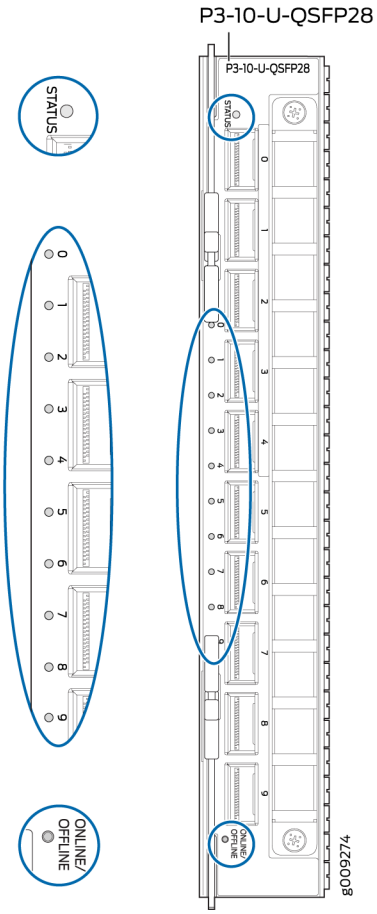
PICs Supported on the PTX Series | **2**

PTX3000 PIC Description | **0**

PTX5000 PIC Description | **0**

10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 16.1R3 and later, Junos OS Release 17.1R1 and later

  NOTE: The P3-10-U-QSFP28 PIC is supported on PTX3000 on a service release version of Junos OS 15.1F6-S2.

- PTX5000: Junos OS Release 17.1R1 and later

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Ten ports (labeled **0** through **9**) configurable as 10-Gigabit Ethernet ports, 40-Gigabit Ethernet ports, or 100-Gigabit Ethernet ports. If port speed is not configured, the default port speed on all ports on the PIC is 100 Gbps.

  NOTE: You can use the following command to change the mode:
  [edit chassis]

  user@host# set fpc *slot-number* pic *pic-number* port *port-number* `speed` **(10G | 40G | 100G)**

  The interface speeds are configured by port group. There are two port groups on the 10-port PIC. The first port group includes ports **0** through **4**, and the second port group includes ports **5** through **9**. When you configure the first port in a group—either port **0** or port **5**—the remaining ports in the group are configured with the same port speed. For example, if you configure the **port-speed** of port **0** to be **10G**, then ports **0** through **4** will operate at 10 Gbps. Only the first port in each port group can be configured.

- Model number: P3-10-U-QSFP28
- Name in the CLI: **10x100/10x40/40x10GE**
- Power requirements:
  - 10-gigabit QSFP+ transceivers on all ports—1.9 A @ –48 V (91 W)
  - 40-gigabit QSFP+ transceivers on all ports—1.9 A @ –48 V (91 W)
  - 100-gigabit QSFP28 transceivers on all ports—2.3 A @ –48 V (111 W)

- High-performance throughput:
  - 10-Gigabit Ethernet LAN mode at 10.3 Gbps
  - 40-Gigabit Ethernet LAN mode at 41.2 Gbps (10.3 Gbps per lane)
  - 100-Gigabit Ethernet LAN mode at 103.1 Gbps (25.8 Gbps per lane)
- Configurable modes:
  - LAN-PHY—10-Gigabit Ethernet, 40-Gigabit Ethernet, or 100-Gigabit Ethernet
- Full-duplex mode
- Large maximum transmission units (MTUs)—up to 9500 bytes

NOTE: The P3-10-U-QSFP28 PIC has a field-replaceable air filter on the faceplate. See the hardware guide for your router for information about replacing the air filter.

Software Features

Table 21 on page 70 shows the first supported Junos OS release for each software feature.

Table 21: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible Ethernet services encapsulation	16.1R3 17.1R1	17.1R1
Flexible VLAN tagging	16.1R3 17.1R1	17.1R1
Interface information (IFINFO) Interface monitor (IFMON)	16.1R3 17.1R1	17.1R1

Table 21: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
IEEE 802.1 ag OAM	16.1R3 17.1R1	17.1R1
IEEE 802.3 ah OAM	16.1R3 17.1R1	17.1R1
IEEE 802.3ad link aggregation	16.1R3 17.1R1	17.1R1
Interrupt-driven link-down detection for MPLS FRR	16.1R3 17.1R1	17.1R1
LLDP	16.1R3 17.1R1	17.1R1
MAC accounting per logical interface for source addresses	16.1R3 17.1R1	17.1R1
MAC filter per port for destination addresses and source addresses	16.1R3 17.1R1	17.1R1
MAC filter per logical interface for source addresses	16.1R3 17.1R1	17.1R1

Table 21: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
SNMP	16.1R3 17.1R1	17.1R1
Up to 8192 logical interfaces shared across all ports on a single Packet Forwarding Engine	16.1R3 17.1R1	17.1R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

LEDs

The **STATUS** LED is located next to port **0** on the PIC faceplate. There are 10 port LEDs labeled **0** through **9**. The LED located next to the port number indicates the link activity of the port. Table 22 on page 72 describes the functions of these LEDs.

Table 22: 10-Port 10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet PIC with QSFP28 LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Amber	On steadily	• The PIC is initializing. • The PIC offline process has been initiated. Once the PIC goes offline, the LED turns off.

Table 22: 10-Port 10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet PIC with QSFP28 LEDs *(Continued)*

Label	Color	State	Description
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
Port LEDs (**0** through **9**)	Green	On steadily	Port is online with no alarms or errors, and the link is up
		Blinking	LED beacon mode is enabled for this port in the configuration. **NOTE**: To set the LED beacon mode, include the `led-beacon` configuration statement for the port at the **[edit interfaces *interface-name:channel*]** hierarchy level.
	Amber	On steadily	One or more channels in the port are down. Only appears for 10-Gigabit Ethernet ports.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure.

RELATED DOCUMENTATION

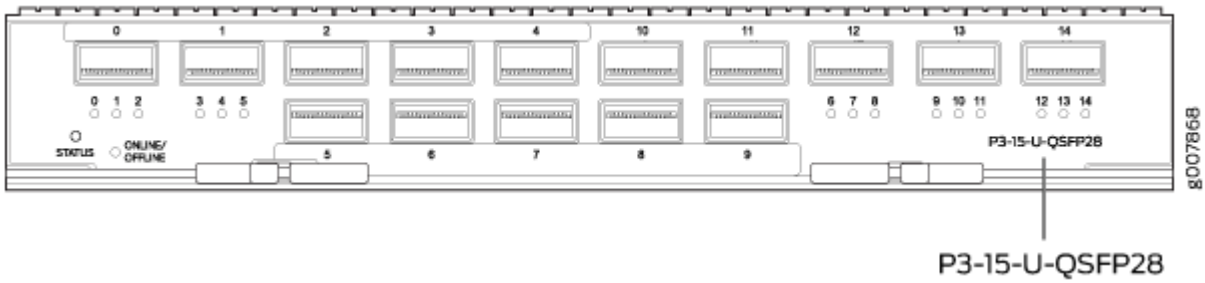
PICs Supported on the PTX Series | **2**

PTX3000 PIC Description | **0**

PTX5000 PIC Description | **0**

15-Port 10-Gigabit, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)

IN THIS SECTION



Software Release

- PTX5000: Junos OS Release 15.1F5 and later, Junos OS Release 16.1R2 and later, Junos OS Release 17.1R1 and later

For information about which FPCs support these PICs, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Fifteen ports (**0** through **14**) configurable as 10-Gigabit Ethernet ports, 40-Gigabit Ethernet ports, or 100-Gigabit Ethernet ports. If the port speed is not configured, the port speed on all ports on the interface module will be 100 Gbps.

  NOTE: You can use the following command to change the mode:

[edit chassis]

user@host# set fpc *slot-number* pic *pic-number* port *port-number* speed (10G | 40G | 100G)

- Model number: P3-15-U-QSFP28
- Name in the CLI: **15x100/15x40/60x10G QSFP+**
- Independent per-port configuration of:
  - LAN-PHY for ports configured in 10-Gigabit Ethernet mode—Can be configured only on port numbers 0, 5, or, 10. The subsequent four ports are also configured in 10-Gigabit Ethernet mode.
  - LAN-PHY for ports configured in 40-Gigabit Ethernet mode—Can be configured only on port numbers 0, 5, or, 10. The subsequent four ports are also configured in 40-Gigabit Ethernet mode.
  - LAN-PHY for ports configured in 100-Gigabit Ethernet mode—Can be configured only on port numbers 0, 5, or, 10. The subsequent four ports are also configured in 100-Gigabit Ethernet mode.

  NOTE: To install the P3-15-U-QSFP28 PIC, you must have a third-generation FPC installed on your system.

  Following is the available port configuration for each FPC:

  - FPC3-PTX-U2-L and FPC3-PTX-U2-R—10 ports configurable as 10-Gigabit Ethernet ports (using a 4x breakout cable), 40-Gigabit Ethernet ports, or 100-Gigabit Ethernet ports. Only ports 0 through 9 can be used. Ports 10 through 14 cannot be used.
  - FPC3-PTX-U3-L and FPC3-PTX-U3-R—15 ports configurable as 10-Gigabit Ethernet ports (using a 4x breakout cable), 40-Gigabit Ethernet ports, or 100-Gigabit Ethernet ports.

- Power requirements:
  - 10-Gigabit Ethernet LAN mode (with QSFP+ transceivers on all ports)—9.1 A @ –12 V (110 W)
  - 40-Gigabit Ethernet LAN mode (with QSFP+ on all ports)—9.1 A @ –12 V (110 W)
  - 100-Gigabit Ethernet LAN mode (with QSFP28 on all ports)—10.8 A @ –12 V (130 W)
- High-performance throughput:
  - 10-Gigabit Ethernet LAN mode at 10.3 Gbps
  - 40-Gigabit Ethernet LAN mode at 41.2 Gbps (10.3 Gbps per lane)
  - 100-Gigabit Ethernet LAN mode at 103.1 Gbps (25.8 Gbps per lane)

- Configurable modes:
  - LAN-PHY—10-Gigabit Ethernet, 40-Gigabit Ethernet, or 100-Gigabit Ethernet
- Full-duplex mode
- Large maximum transmission units (MTUs): up to 9500 bytes

Software Features

Table 23 on page 76 shows the first supported Junos OS release for each software feature.

Table 23: Software Features Supported

Software Feature	PTX5000 First Supported Junos OS Release
Flexible Ethernet services encapsulation	15.1F5 16.1R2 17.1R1
Flexible VLAN tagging	15.1F5 16.1R2 17.1R1
IFINFO / IFMON	15.1F5 16.1R2 17.1R1
IEEE 802.1 ag OAM	15.1F5 16.1R2 17.1R1

Table 23: Software Features Supported *(Continued)*

Software Feature	PTX5000 First Supported Junos OS Release
IEEE 802.3 ah OAM	15.1F5 16.1R2 17.1R1
IEEE 802.3ad link aggregation	15.1F5 16.1R2 17.1R1
Interrupt-driven link-down detection for MPLS FRR	15.1F5 16.1R2 17.1R1
LLDP	15.1F5 16.1R2 17.1R1
MAC accounting per logical interface for source addresses	15.1F5 16.1R2 17.1R1
MAC filter per port for destination addresses and source addresses	15.1F5 16.1R2 17.1R1

Table 23: Software Features Supported *(Continued)*

Software Feature	PTX5000 First Supported Junos OS Release
MAC filter per logical interface for source addresses	15.1F5 16.1R2 17.1R1
SNMP	15.1F5 16.1R2 17.1R1
Up to 8192 logical interfaces share across all ports on a single Packet Forwarding Engine	15.1F5 16.1R2 17.1R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

LEDs

The **STATUS** LED is located on the front of the PIC next to the **ONLINE/OFFLINE** button. There are 15 port LEDs labeled **0** through **14**. The LED located next to the port number indicates the link activity of the port. Table 24 on page 78describes the functions of these LEDs.

Table 24: 15 Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.

Table 24: 15 Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC LEDs *(Continued)*

Label	Color	State	Description
	Amber	On steadily	• The PIC is initializing. • The PIC offline process has been initiated. Once the PIC goes offline, the LED turns off.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline and safe to remove from the router.
LEDs **0** through **14**.	Green	On steadily	Port is online with no alarms or errors, and the link is up
	Amber	On steadily	One or more channels in the port are down. Only appears for 10-Gigabit Ethernet ports.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure.

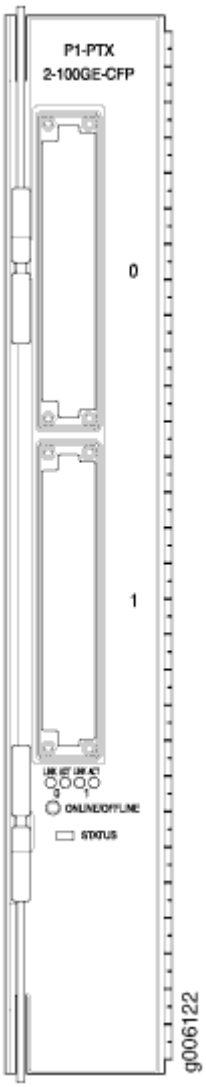
RELATED DOCUMENTATION

PICs Supported on the PTX Series | 2

PTX5000 PIC Description | 0

100-Gigabit Ethernet PIC with CFP (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 13.2R2 and later

- PTX5000: Junos OS Release 12.1X48 and later, Junos OS Release 12.3R1 and later, and Junos OS Release 13.2R1 and later

> **NOTE**: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

For information on which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Two 100-Gigabit Ethernet CFP ports
- Model number P1-PTX-2-100GE-CFP
- Name in the CLI: **2x 100GE CFP**
- Power requirements: 1.6 A @ –48 V (75 W)
- Large maximum transmission units (MTUs):
  - Junos OS Release 12.1X48: up to 9192 bytes
  - Junos OS Release 12.1X48R2 and later 12.1X48 releases: up to 9500 bytes
  - Junos OS Release 12.3 and later 12.3 releases: up to 9500 bytes

Software Features

Table 25 on page 81 shows the first supported release for each software feature.

Table 25: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible-ethernet-services encapsulation	13.2R2	12.1X48 12.3R1 13.2R1

Table 25: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Flexible VLAN tagging	13.2R2	12.1X48 12.3R1 13.2R1
IFINFO / IFMON	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.1 ag OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3 ah OAM	13.2R2	12.1X48 12.3R1 13.2R1
IEEE 802.3ad link aggregation	13.2R2	12.1X48 12.3R1 13.2R1
Interrupt-driven link-down detection for MPLS FRR	13.2R2	12.1X48 12.3R1 13.2R1

Table 25: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
MAC accounting per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1
MAC filter per port for destination addresses and source addresses	13.2R2	12.1X48 12.3R1 13.2R1
MAC filter per logical interface for source addresses	13.2R2	12.1X48 12.3R1 13.2R1
SNMP	13.2R2	12.1X48 12.3R1 13.2R1
Up to 8000 logical interfaces share across all ports on a single PFE	13.2R2	12.1X48 12.3R1 13.2R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

This PIC supports the following transceivers:

- 100GBASE-ER4 (model number: CFP-100GBASE-ER4)
  - Supported in Junos OS Release 12.1X48R4, 12.3R1, and 13.2R1, and later
- 100GBASE-ER4 (model number: CFP-GEN2-CGE-ER4 and part number: 740-049763)
  - Supported in Junos OS Release 12.3R5, 13.2R3, and 13.3R1, and later

  NOTE: The “GEN2” optics have been redesigned with newer versions of internal components for reduced power consumption.

- 100GBASE-LR4 (model number: CFP-100GBASE-LR4)
  - Supported in Junos OS Release 12.1X48, 12.3R1, and 13.2R1, and later

  100GBASE-LR4 (model number: CFP-GEN2-100GBASE-LR4 and part number: 740-047682)
  - Supported in Junos OS Release 12.3R5, 13.2R3, and 13.3R1, and later

  NOTE: The “GEN2” optics have been redesigned with newer versions of internal components for reduced power consumption.

- 100GBASE-SR10 (model number: CFP-100GBASE-SR10)
  - Supported in Junos OS Release 12.1X48R3, 12.3R1, and 13.2R1, and later
- 100GBASE-ZR (model number: CFP-100GBASE-ZR)
  - Supported in Junos OS Release 13.3R6, 14.1R4, 14.2R3, and 15.1R1, and later
  - Provides advanced dual polarization-quadrature phase shift keying (DP-QPSK) coherent digital signal processing (DSP) and forward error correction (FEC)-enabled robust tolerance to optical impairments and supports 80 km reach over single mode fiber
  - The transceiver is not specified as part of IEEE 802.3 but is built according to Juniper Networks specifications.

LEDs

The **STATUS** LED is located above the **ONLINE OFFLINE** button. The **LINK** and **ACT** LEDs are located next to each port. Table 26 on page 85 describes the functions of these LEDs.

Table 26: 100-Gigabit Ethernet PIC with CFP LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC is online but has errors or alarms.
	–	Off	PIC is offline or not enabled.
LINK for each port:	Green	On steadily	Port is online with no alarms or failures, and the link is up.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure with alarms.
	–	Off	Port is off or not enabled.
ACT for each port	Green	Flashing	Activity detected. Port is sending or receiving packets.
	–	Off	No packet activity detected on the port.

Alarms, Errors, and Events

- Alarm indication signal (AIS)
- Laser bias current high/low alarms and warnings
- Laser Rx power high/low alarms and warnings
- Module not ready alarm
- Module power down alarm
- Module temperature high/low alarms and warnings

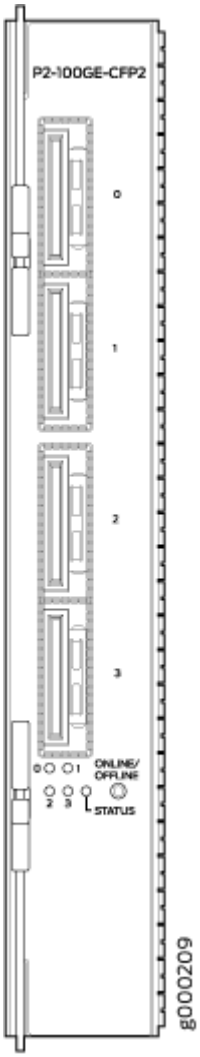
- Rx CDR loss of lock alarm
- Rx loss of signal alarm
- Rx not ready alarm
- Tx CDR loss of lock alarm
- Tx data not ready alarm
- Tx laser fault alarm
- Tx not ready alarm

RELATED DOCUMENTATION

PICs Supported on the PTX Series | 2
PTX3000 PIC Description | 0
PTX5000 PIC Description | 0

100-Gigabit Ethernet PIC with CFP2 (PTX Series)

IN THIS SECTION



Software Release

- PTX5000: Junos OS Release 14.1R1 and later

For information about which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Four 100-Gigabit Ethernet ports
- Model number: P2-100GE-CFP2
- Name in the CLI: **4x100GE CFP2**
- Power requirements: 1.66A@ –48 V (90W)

- Large maximum transmission units (MTUs): up to 9500 bytes

Software Features

Table 27 on page 88 shows the first supported release for each software feature.

Table 27: Software Features Supported

Software Feature	PTX5000 First Supported Junos OS Release
Flexible-ethernet-services encapsulation	14.1R1
Flexible VLAN tagging	14.1R1
IFINFO / IFMON	14.1R1
IEEE 802.1 ag OAM	14.1R1
IEEE 802.3 ah OAM	14.1R1
IEEE 802.3ad link aggregation	14.1R1
Interrupt-driven link-down detection for MPLS FRR	14.1R1
MAC accounting per logical interface for source addresses	14.1R1
MAC filter per port for destination addresses and source addresses	14.1R1
MAC filter per logical interface for source addresses	14.1R1
SNMP	14.1R1
Up to 4000 logical interfaces share across all ports on a single PFE	14.1R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

NOTE: The dual-rate transceiver (CFP2-100G-LR4-D) cannot be configured to use OTN framing when used in this PIC. The 100-Gigabit Ethernet OTN PIC with CFP2 (P2-100GE-OTN) supports OTN framing. See "100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)" on page 90.

LEDs

The **STATUS** LED is located to the left of the **ONLINE/OFFLINE** button. One LED is located next to each port to indicate the link activity of the port. Table 28 on page 89 describes the functions of these LEDs.

Table 28: 100-Gigabit Ethernet PIC with CFP2 LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC has an error or failure.
	–	Off	PIC is offline or not enabled and safe to remove from the router.
Single LED per port	Green	On steadily	Port is online with no alarms or errors, and the link is up.
		Blinking	There is link activity on the port.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure.

Table 28: 100-Gigabit Ethernet PIC with CFP2 LEDs *(Continued)*

Label	Color	State	Description
	–	Off	Port is off or not enabled.

Alarms, Errors, and Events

- Laser bias current high/low alarms and warnings
- Laser Rx power high/low alarms and warnings
- Module not ready alarm
- Module low power alarm
- Module temperature high/low alarms and warnings
- Rx CDR loss of lock alarm
- Rx loss of signal alarm
- Module not ready alarm
- Tx CDR loss of lock alarm

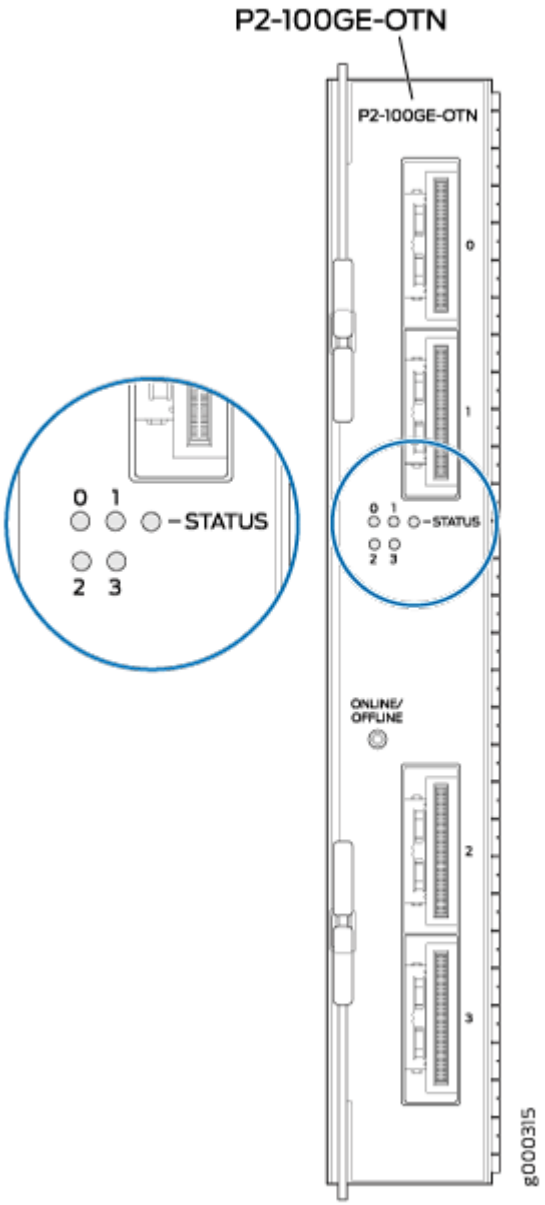
RELATED DOCUMENTATION

PICs Supported on the PTX Series | 2

PTX5000 PIC Description | 0

100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 15.1F6, Junos OS Release 16.1R2 and later, Junos OS Release 17.1R1 and later
- PTX5000: Junos OS Release 14.1R2 and later

For information about which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Four ports that can be configured as 100-Gigabit Ethernet, 100-Gigabit OTN, or a combination of 100-Gigabit Ethernet and 100-Gigabit Ethernet OTN interfaces.
- Model number: P2-100GE-OTN
- Name in the CLI: **4x100GE OTN CFP2**
- Power requirements: 14.50A@ –12 V (176 W)
- Large maximum transmission units (MTUs): up to 9500 bytes

Software Features

Table 29 on page 92 shows the first supported release for each software feature.

Table 29: Software Features Supported

Software Feature	First Supported Junos OS Release on PTX3000	First Supported Junos OS Release on PTX5000
Flexible Ethernet services encapsulation	15.1F6 16.1R2 17.1R1	14.1R2
Flexible VLAN tagging	15.1F6 16.1R2 17.1R1	14.1R2

Table 29: Software Features Supported *(Continued)*

Software Feature	First Supported Junos OS Release on PTX3000	First Supported Junos OS Release on PTX5000
IFINFO / IFMON	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.1 ag OAM	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.3 ah OAM	15.1F6 16.1R2 17.1R1	14.1R2
IEEE 802.3ad link aggregation	15.1F6 16.1R2 17.1R1	14.1R2
Interrupt-driven link-down detection for MPLS FRR	15.1F6 16.1R2 17.1R1	14.1R2
MAC accounting per logical interface for source addresses	15.1F6 16.1R2 17.1R1	14.1R2

Table 29: Software Features Supported *(Continued)*

Software Feature	First Supported Junos OS Release on PTX3000	First Supported Junos OS Release on PTX5000
MAC filter per port for destination addresses and source addresses	15.1F6 16.1R2 17.1R1	14.1R2
MAC filter per logical interface for source addresses	15.1F6 16.1R2 17.1R1	14.1R2
SNMP	15.1F6 16.1R2 17.1R1	14.1R2
Up to 4000 logical interfaces shared across all ports on a single PFE	15.1F6 16.1R2 17.1R1	14.1R2

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

The following transceivers are supported on this PIC:

- CFP2-100G-LR4-D—Supports both 100GBASE-LR4 and OTU4 4I1-9D1F
- CFP2-100G-SR10-D—Supports 100GBASE-SR10

NOTE: This transceiver supports Ethernet only, OTN is not supported.

- CFP2-100GBASE-LR4—Supports 100GBASE-LR4
- CFP2-100GBASE-SR10—Supports 100GBASE-SR10
- CFP2-100GBASE-SR10-D2—Supports 100GBASE-SR10

NOTE: This dual rate transceiver is supported in Junos OS 14.2R5 release.

- CFP2-100GBASE-ER4—Supports 100GBASE-ER4
- CFP2-DCO-T-WDM-1—Supports 100GBASE-LR4

NOTE: CFP2-DCO-T-WDM-1 is not NEBS compliant on the P2-100GE-OTN PIC. It can only work with an ambient temperature of up to 104° F (40° C) at altitudes up to 6,000 ft (1829 m).

LEDs

The **STATUS** LED is located to the left of the **ONLINE/OFFLINE** button. One LED is located next to each port to indicate the link activity of the port. Table 30 on page 95 describes the functions of these LEDs.

Table 30: 100-Gigabit Ethernet OTN PIC with CFP2 LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC is in failed state.
	–	Off	PIC is offline or not enabled.

Table 30: 100-Gigabit Ethernet OTN PIC with CFP2 LEDs *(Continued)*

Label	Color	State	Description
Single LED per port, labeled **0**, **1**, **2**, and **3**	Green	On steadily	Port is online with no alarms or failures, and the link is up.
		Blinking	Activity detected. Port is sending or receiving packets.
	Red	On steadily	Port is on but the link is down, and the port has detected a failure with alarms.
	–	Off	Port is off or not enabled.

RELATED DOCUMENTATION

- PICs Supported on the PTX Series | **2**
- PTX3000 PIC Description | **0**
- PTX5000 PIC Description | **0**

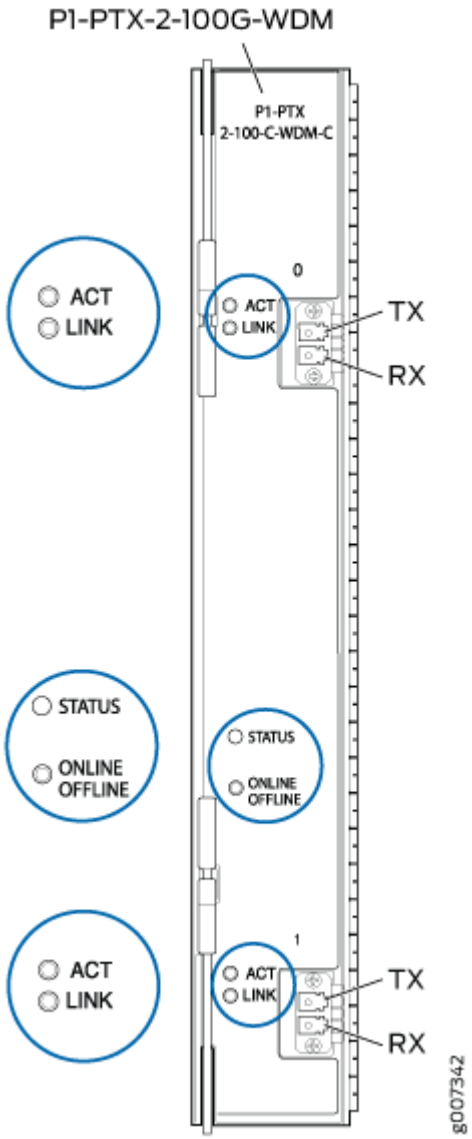
CHAPTER 4

DWDM OTN PIC Descriptions

IN THIS CHAPTER

100-Gigabit DWDM OTN PIC (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 13.3R1 and later
- PTX5000: Junos OS Release 13.2R1 and later

For information about which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Designed for metro, regional, or long-haul applications
- Model number: P1-PTX-2-100G-WDM

- Name in the CLI: **2x100G DWDM OTN**
- Two 100-Gigabit DWDM OTN ports
- Power requirements: 6.48 A @ –48 V (311 W)
- Transparent transport of two 100-Gigabit Ethernet signals with OTU4V framing
- ITU-standard OTN performance monitoring and alarm management
- Dual polarization-quadrature phase-shift keying (DP-QPSK) modulation and soft-decision forward error correction (SD-FEC) for long haul and metro applications
- 96 channels on C-band ITU grid with 50-GHz spacing
- Full-duplex mode
- Maximum transmission units (MTUs) up to 9500 bytes
- Latency: 32 µs (TX + RX)

NOTE: The 2-port 100-Gigabit DWDM OTN PIC is not directly interoperable with the 1-port 100-Gigabit DWDM OTN MIC or 5-port 100-Gigabit DWDM OTN PIC, but they can operate over the same DWDM line system.

NOTE: The 2-port 100-Gigabit DWDM OTN PIC is designed to comply with NEBS regulations on the PTX5000 router when used in typical configurations. The typical configuration for a PTX5000 router is up to eight FPCs, with one 2-port 100-Gigabit DWDM OTN PIC and one 100-Gigabit Ethernet PIC with CFP, 40-Gigabit Ethernet PIC with CFP, or 10-Gigabit Ethernet PIC with SFP+ installed in the same FPC.

The 2-port 100-Gigabit DWDM OTN PIC is designed to comply with NEBS regulations on the PTX3000 router when used in typical configurations at 40° C (104° F) at sea level. The typical configuration for a PTX3000 router is up to eight FPCs, with one 2-port 100-Gigabit DWDM OTN PIC next to each FPC in the top row only. The 100-Gigabit Ethernet PIC with CFP, 40-Gigabit Ethernet PIC with CFP, or 10-Gigabit Ethernet PIC with SFP+ are supported next to any FPC.

To comply with EMC regulations, you must also install front doors on the PTX5000 and PTX3000 chassis, see "Installing the Front Door on a PTX5000 in a Four-Post Rack" , "Installing the Front Door on a PTX5000 in an Open-Frame Rack", or "Installing the Front Doors on a PTX3000".

Software Features

Table 31 on page 100 shows the first supported release for each software feature.

Table 31: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Compliant with ITU G.709 and G.798	13.3R1	13.2R1
Provides a transport interface and state model (GR-1093)	13.3R1	13.2R1
Performance monitoring such as alarms, threshold crossing alerts, OTU/ODU error seconds and pre-FEC statistics	13.3R1	13.2R1
SNMP management of the PIC based on RFC 3591, Managed Objects for the Optical Interface Type • Set functionality • Juniper Networks Black-Link MIB • IFOTN MIB • Optics MIB • FRU MIB	13.3R1	13.2R1
IEEE 802.1ag OAM	13.3R1	13.2R1
IEEE 802.3ah OAM	13.3R1	13.2R1
IFINFO/IFMON	13.3R1	13.2R1
IEEE 802.3ad link aggregation	13.3R1	13.2R1

Table 31: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Pre-FEC BER monitoring provides interrupt-driven link-signal-degrade BER-based detection for MPLS fast reroute	13.3R1	13.2R1
Flexible Ethernet services encapsulation	13.3R1	13.2R1
Flexible VLAN tagging	13.3R1	13.2R1
Source address MAC accounting per logical interface	13.3R1	13.2R1
Source address MAC filter per port	13.3R1	13.2R1
Source address MAC filter per logical interface	13.3R1	13.2R1
Destination address MAC filter per port	13.3R1	13.2R1
Up to 8000 logical interfaces shared across all ports on a single PFE	13.3R1	13.2R1

Cables and Connectors

The optical interface specifications, cable and connector information, and supported wavelengths for the integrated transceiver are described in "100-Gigabit DWDM OTN PIC Integrated Transceiver Optical Interface Specifications" on page 20.

LEDs

The **STATUS** LED is located above the **ONLINE OFFLINE** button. The **LINK** and **ACT** LEDs are located next to each port. Table 32 on page 102 describes the functions of these LEDs.

Table 32: 100-Gigabit DWDM OTN PIC LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is online with no alarms or failures.
	Yellow	On steadily	PIC is initializing.
	Red	On steadily	PIC is online but has errors or alarms.
	–	Off	PIC is offline or not enabled.
LINK for each port:	Green	On steadily	Port is online with no alarms or failures, and the link is up.
	Yellow		Port has detected an alarm or failure.
	Red	On steadily	Port has detected a media alarm or failure.
	–	Off	Port is off or not enabled.
ACT for each port	Green	Flashing	Activity detected. Port is sending or receiving packets.
	–	Off	No packet activity detected on the port.

Alarms, Errors, and Events

Chassis and PIC:

- PIC (FRU) inserted or removed
- PIC (FRU) Admin InService/OutOfService, Oper Unequipped/Init/Normal/Mismatch/Fault/Upgrade
- Mismatch equipment
- Temperature alarm

- Fan alarm

Port (interface):

- Interface Admin InService/OutOfService/ServiceMA/OutOfServiceMA, Oper Init/Normal/Fault/Degraded

OTN (optical transport network):

- LOS (loss of signal)
- LOF (loss of frame)
- LOM (loss of multiframe)
- SSF (server signal failure)
- TSF (trail signal fail)

OTU (optical channel transport unit):

- OTU-FEC-DEG (forward error correction degraded)
- OTU-FEC-EXE (excessive errors, FEC_FAIL from the transponder)
- OTU-AIS (alarm indication signal or all ones signal)
- OTU-BDI (backward defect identification)
- OTU-IAE (incoming alignment error)
- OTU-BIAE (backward incoming alignment error)
- OTU-TTIM (destination access point identifier [DAPI], source access point identifier [SAPI], or both mismatch from expected to received)
- OTU-DEG (OTU degraded)

ODU (optical channel data unit):

- CSF (client signal failure)
- ODU-DM-TIMEOUT (DM timeout)
- ODU-LCK (ODU lock triggers for PM [path monitoring] and TCM levels 1 through 6)
- ODU-AIS (alarm indication signal or all ones signal)
- ODU-OCI (open connection error)
- ODU-BDI (backward defect indication)

- ODU-DEG (ODU degraded)
- ODU-IAE (incoming alignment error)
- ODU-DAPI-TTIM (DAPI or DAPI/SAPI mismatch from expected to receive)
- ODU-SAPI-TTIM (SAPI or DAPI/SAPI mismatch from expected to receive)
- ODU-BEI (backward error indication)
- ODU-BEI-ERR (backward error indication error)
- ODU-BIP8-ERR (bit interleaved parity 8 error)
- ODU-SSF (server signal fail)
- ODU-TSF (trail signal fail)
- ODU-SD (signal degrade)

OPU (optical channel payload):

- OPU-PTM (payload type mismatch)

Optics:

- TX output power

Card-related status:

- Transceiver temperature high alarm
- Transceiver temperature high warning
- Transceiver temperature low alarm
- Transceiver temperature low warning
- Transceiver voltage high alarm
- Transceiver voltage high warning
- Transceiver voltage low alarm
- Transceiver voltage low warning
- Transceiver temperature monitor A/D value
- Transceiver power supply monitor A/D value (voltage)

Network lane transmit–related status:

- TX laser current bias high alarm
- TX laser current bias high warning
- TX laser current bias low alarm
- TX laser current bias low warning
- TX laser temperature high alarm
- TX laser temperature high warning
- TX laser temperature low alarm
- TX laser temperature low warning
- TX output optical power high alarm
- TX output optical power high warning
- TX output optical power low alarm
- TX output optical power low warning
- TX laser TEC fault
- TX laser wavelength unlocked fault
- TX modulator bias high alarm
- TX modulator bias high warning
- TX modulator bias low alarm
- TX modulator bias low warning
- TX loss of signal fault
- TX current laser output power
- TX minimum laser output power over PM interval
- TX average laser output power over PM interval
- TX maximum laser output power over PM interval

Network lane receive–related status:

- RX laser bias current high alarm
- RX laser bias current high warning

- RX laser bias current low alarm
- RX laser bias current low warning
- RX input optical power high alarm
- RX input optical power high warning
- RX input optical power low alarm
- RX input optical power low warning
- RX laser output high alarm
- RX laser output high warning
- RX laser output low alarm
- RX laser output low warning
- RX laser temperature high alarm
- RX laser temperature high warning
- RX laser temperature low alarm
- RX laser temperature low warning
- RX LOS
- RX Laser wavelength unlocked fault
- RX laser TEC fault
- RX current chromatic dispersion
- RX average chromatic dispersion over PM interval
- RX minimum chromatic dispersion over PM interval
- RX maximum chromatic dispersion over PM interval
- RX current Q
- RX average Q over PM interval
- RX minimum Q over PM interval
- RX maximum Q over PM interval
- RX current carrier frequency offset

- RX average carrier frequency offset over PM interval
- RX minimum carrier frequency offset over PM interval
- RX maximum carrier frequency offset over PM interval
- RX current SNR (signal to noise ratio)
- RX average SNR
- RX minimum SNR
- RX maximum SNR
- RX modem sync detect fault occurred over PM interval
- RX modem lock fault occurred over PM interval
- RX loss of alignment occurred over PM interval
- RX out of alignment occurred over PM interval
- RX deskew lock fault occurred over PM interval
- RX LOS occurred over PM interval
- RX current laser output power
- RX minimum laser output power over PM interval
- RX average laser output power over PM interval
- RX maximum laser output power over PM interval

RELATED DOCUMENTATION

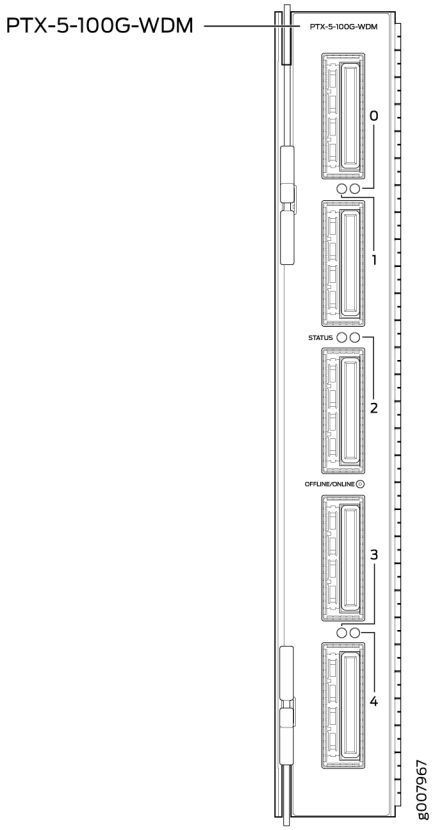
PICs Supported on the PTX Series | 2

PTX3000 PIC Description | 0

PTX5000 PIC Description | 0

100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)

IN THIS SECTION



Software Release

- PTX3000: Junos OS Release 15.1F6, Junos OS Release 17.1R1 and later

- PTX5000: Junos OS Release 15.1F6, Junos OS Release 17.1R1 and later

For information about which FPCs support this PIC, see "PTX Series PIC/FPC Compatibility" on page 5.

Hardware Features

- Model number: PTX-5-100G-WDM
- Name in the CLI: **5X100GE DWDM CFP2-ACO**
- Five 100-Gigabit DWDM OTN ports
- Power requirement (including transceiver):
  - Typical: 4.15 A @ –48 V (199 W)
  - Maximum: 4.73 A @ –48 V (227 W)
- Weight: 5.2 lb (2.4 kg)
- Supports CFP2-ACO pluggable optics
- Transparent transport of a 100-Gigabit Ethernet signal with OTU4V framing
- ITU-standard OTN performance monitoring and alarm management
- Dual polarization-quadrature phase-shift keying (DP-QPSK) modulation
- Supports two types of forward error correction (FEC):
  - Soft-decision FEC (SD-FEC)
  - G.709 FEC (GFEC)
- 100 channels on C-band ITU grid with 50-GHz spacing
- Latency:
  - SD-FEC: 14 µs (TX + RX)
  - GFEC: 6 µs (TX + RX)
- Interoperable with the CFP-100GBASE-ZR transceiver supported on the 100-Gigabit Ethernet MIC with CFP (MIC3-3D-1X100GE-CFP) on MX Series routers and the 100-Gigabit Ethernet PIC with CFP (P1-PTX-2-100GE-CFP) on PTX Series routers.
- Interoperable with the 100-Gigabit DWDM OTN MIC with CFP2 (MIC3-100G-DWDM) on MX Series routers when the 100-Gigabit DWDM OTN MIC is configured to use SD-FEC or GFEC.

NOTE: The 5-port 100-Gigabit DWDM OTN PIC is not directly interoperable with the 2-port 100-Gigabit DWDM OTN PIC (P1-PTX-2-100G-WDM), but they can both operate over the same DWDM line system.

NOTE: The 5-port 100-Gigabit DWDM OTN PIC is designed to comply with NEBS regulations on the PTX3000 and PTX5000 routers when these routers are used in typical configurations.

In a typical configuration, a PTX3000 router supports up to eight FPCs, with up to four 5-port 100-Gigabit DWDM OTN PICs installed next to any FPC. You can install other PICs next to any other FPC.

In a typical configuration, a PTX5000 router supports up to eight FPCs, with up to eight 5-port 100-Gigabit DWDM OTN PICs in any FPC slot. You can install other PICs in any FPC slot.

To comply with EMC regulations, you must also install front doors on the PTX3000 and PTX5000 chassis. See "Installing the Front Doors on a PTX3000", "Installing the Front Door on a PTX5000 in a Four-Post Rack", or "Installing the Front Door on a PTX5000 in an Open-Frame Rack".

Software Features

Table 33 on page 110 shows the first supported release for each software feature.

NOTE: For information about configuring the PIC, see Configuring OTN Interfaces on PTX-5-100G-WDM PIC. For information about upgrading the firmware on the PIC, see Upgrading Firmware on the 5-Port 100-Gigabit DWDM OTN PIC (PTX-5-100G-WDM).

Table 33: Software Features Supported

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Compliant with ITU G.709 and G.798	15.1F6 17.1R1	15.1F6 17.1R1

Table 33: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
Provides a transport interface and state model (GR-1093)	15.1F6 17.1R1	15.1F6 17.1R1
Performance monitoring features such as alarms, threshold-crossing alarms, OTU/ODU error seconds and pre-FEC statistics	15.1F6 17.1R1	15.1F6 17.1R1
SNMP management of the PIC based on *RFC 3591, Managed Objects for the Optical Interface Type*, including the following: • Set functionality • Black Link MIB • IFOTN MIB • Optics MIB • FRU MIB	15.1F6 17.1R1	15.1F6 17.1R1
IEEE 802.1ag OAM	15.1F6 17.1R1	15.1F6 17.1R1
IEEE 802.3ah OAM	15.1F6 17.1R1	15.1F6 17.1R1
Interface monitor (IFMON) and interface information (IFINFO)	15.1F6 17.1R1	15.1F6 17.1R1

Table 33: Software Features Supported *(Continued)*

Software Feature	PTX3000 First Supported Junos OS Release	PTX5000 First Supported Junos OS Release
IEEE 802.3ad link aggregation	15.1F6 17.1R1	15.1F6 17.1R1
Pre-FEC BER monitoring provides interrupt-driven BER-based detection of link signal degradation for MPLS fast reroute.	15.1F6 17.1R1	15.1F6 17.1R1
User-configurable optics options: • Transmit (TX) laser enable and disable • TX output power • Wavelength **NOTE**: See "100-Gigabit DWDM OTN CFP2-ACO Transceiver Wavelengths" on page 26 for the list of supported wavelengths that can be configured for this PIC. • Receive (RX) LOS warning or alarm thresholds • Threshold crossing alarms (TCAs)	15.1F6 17.1R1	15.1F6 17.1R1
User-configurable card options: • FEC mode (SD-FEC or GFEC) • Differential encoding mode • TCAs • Proactive protection (fast reroute) threshold and interval	15.1F6 17.1R1	15.1F6 17.1R1

Cables and Connectors

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

NOTE: When inserting a C form-factor pluggable 2 (CFP2) transceiver, ensure that the transceiver sits tightly in the port. You hear a distinct click sound when the latch locks into the corresponding port. The latch must be fully engaged in the corresponding port for the CFP2 transceiver to function properly. Failing to do so can result in loss of connection.

To verify that the CFP2 transceiver module is inserted properly, give a gentle pull by grasping the sides of the module. The module should sit tightly.

NOTE: The transceiver complies with the CFP Multi-Source Agreement (MSA) mechanical standard—transceiver weight does not exceed 210 g (7.41 oz).

LEDs

The **STATUS** LED is located in the center of the PIC faceplate adjacent to the link and activity LED for port **2**. The link and activity LEDs are located between the ports and are numbered **0** through **4**. Table 34 on page 113 describes the functions of these LEDs.

Table 34: 100-Gigabit DWDM OTN PIC with CFP2 LEDs

Label	Color	State	Description
STATUS	Green	On steadily	PIC is initialized and online with no alarms or failures.
	Red	On steadily	PIC is online but has errors or alarms.
	–	Off	PIC is offline or not enabled.

Table 34: 100-Gigabit DWDM OTN PIC with CFP2 LEDs *(Continued)*

Label	Color	State	Description
Link and activity LED for each port	Green	On steadily	Port is online with no alarms or failures, and the link is up.
		Blinking	Activity is detected on the link.
	Red	On steadily	Port has detected a media alarm or failure.
	–	Off	Port is offline or not enabled.

Alarms, Errors, and Events

NOTE: For OTN alarms, see Table 35 on page 118.

Chassis and PIC:

- PIC (FRU) inserted or removed
- PIC (FRU) Administrative State: In Service, Out Of Service
- PIC (FRU) Operational State: Unequipped, Init, Normal, Mismatch, Fault, Upgrade
- Mismatch equipment
- Temperature alarm

Port (interface):

- Interface Administrative State: In Service, Out Of Service, Service MA, Out of Service MA
- Interface Operational State: Init, Normal, Fault, Degraded

Optical channel transport unit (OTU) TCAs:

- OTU-TCA-BBE—15-minute background block error TCA
- OTU-TCA-ES—15-minute far-end errored seconds TCA

- OTU-TCA-SES—15-minute severely errored seconds TCA
- OTU-TCA-UAS—15-minute unavailable seconds TCA

Optical channel data unit (ODU) TCAs:

- ODU-TCA-BBE—15-minute background block error TCA
- ODU-TCA-ES—15-minute far-end errored seconds TCA
- ODU-TCA-SES—15-minute severely errored seconds TCA
- ODU-TCA-UAS—15-minute unavailable seconds TCA

TIP: You can view OTU and ODU TCAs by using the **show interfaces transport pm otn** operational-mode CLI command.

NOTE: If you insert an invalid CFP module, the CLI displays **unsupported module** and a syslog message is generated. You can verify whether the CFP module is invalid by using the **show chassis hardware** operational-mode CLI command.

Optics-related status:

- Module temperature
- Module voltage
- Module temperature alarm:
  - High alarm
  - Low alarm
  - High warning
  - Low warning
- Module voltage alarm:
  - High alarm
  - Low alarm
  - High warning
  - Low warning

- Module not ready alarm
- Module low power alarm
- Module initialization incomplete alarm
- Module fault alarm
- TX laser disabled alarm
- RX loss of signal alarm
- Modem lock state
- TX output power:
  - Current TX output power
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval
- TX power alarm:
  - High alarm
  - Low alarm
  - High warning
  - Low warning
- RX input power (signal)
- RX input power (total):
  - Current RX input power (total)
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval
- RX power alarm:
  - High alarm
  - Low alarm

  - High warning
  - Low warning
- RX loss of signal alarm
- Wavelength unlocked alarm

> **TIP**: You can view optics-related status by using the **show interfaces transport pm optics** and **show interfaces diagnostics optics** operational-mode CLI commands.

Network lane receive-related status:

- Chromatic dispersion:
  - Current chromatic dispersion
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval
- Differential group delay:
  - Current differential group delay
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval
- Q^2-factor:
  - Current Q^2-factor
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval
- Carrier frequency offset
  - Current carrier frequency offset
  - Minimum over PM interval

  - Maximum over PM interval
  - Average over PM interval
- Signal-to-noise ratio (SNR)
  - Current SNR
  - Minimum over PM interval
  - Maximum over PM interval
  - Average over PM interval

> **TIP**: You can view network lane receive-related status by using the **show interfaces transport pm optics** operational-mode CLI command.

FEC statistics:

- Corrected Errors—the number of bits received that were in error, but corrected.
- Uncorrected Words—the number of FEC codewords received that were uncorrectable.
- Corrected Error Ratio—the number of corrected bits divided by the number of bits received

> **TIP**: You can view FEC statistics by using the **show interfaces *interface-name* extensive** operational-mode CLI command.

Table 35 on page 118 describes the OTN alarms and defects that can occur on the PIC and the link status when the alarm or defect occurs.

> **TIP**: You can view OTN alarms and defects using the **show interfaces *interface-name* extensive** operational-mode CLI command.

Table 35: OTN Alarms and Defects

Category	Alarm	Description	Link Status
OTN	LOS	Loss of signal	Link down

Table 35: OTN Alarms and Defects *(Continued)*

Category	Alarm	Description	Link Status
	LOF	Loss of frame	Link down
	LOM	Loss of multiframe	Link down
OTN FEC	FEC Degrade (OTU-FEC-DEG)	Forward error correction degraded	Link down if signal degrade or backward FRR thresholds are met
	FEC Excessive (OTU-FEC-EXE)	There are uncorrected words and there are errors in the frame header	Possible link down
OTN OTU	OTU-AIS	Alarm indication signal or all ones signal	Link down
	OTU-BDI	Backward defect identification	Link down
	OTU-IAE	Incoming alignment error	Warning
	OTU-TTIM	Destination access point identifier (DAPI), source access point identifier (SAPI), or both mismatch from expected to received	Can cause the link to be down if **otu-ttim-act-enable** is configured at the **[edit interfaces *interface-name* otn-options]** hierarchy level
	OTU-BIAE	Backward incoming alignment error	Warning
	OTU-TSF	OTU trail signal fail	Warning
	OTU-SSF	OTU server signal fail	Warning

Table 35: OTN Alarms and Defects *(Continued)*

Category	Alarm	Description	Link Status
OTN ODU	ODU-AIS	Alarm indication signal or all ones signal	Link down
	ODU-OCI	Open connection error	Link down
	ODU-LCK	ODU lock triggers for path monitoring and TCM levels 1 through 6	Link down
	ODU-BDI	Backward defect indication	Link down
	ODU-TTIM	DAPI or SAPI mismatch from expected to received	Can cause the link to be down if **odu-ttim-act-enable** is configured at the **[edit interfaces *interface-name* otn-options]** hierarchy level
	ODU-IAE	Incoming alignment error	Warning
	ODU-LTC	Loss of tandem connection	Warning
	ODU-CSF	Client signal failure	Warning
	ODU-TSF	Trail signal fail	Warning
	ODU-SSF	Server signal fail	Warning
	ODU-PTIM	Payload type mismatch	Link down

RELATED DOCUMENTATION

- 100-Gigabit DWDM OTN CFP2-ACO Transceiver Wavelengths | **26**
- PICs Supported on the PTX Series | **2**
- PTX3000 PIC Description | **0**
- PTX5000 PIC Description | **0**
- Configuring OTN Interfaces on PTX-5-100G-WDM PIC
- Upgrading Firmware on the 5-Port 100-Gigabit DWDM OTN PIC (PTX-5-100G-WDM)
- show interfaces extensive | **0**
- show interfaces transport pm | **0**
- show interfaces diagnostics optics (Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet, and Virtual Chassis Port) | **0**