



M320 Multiservice Edge Router Interface Module Reference



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M320 Multiservice Edge Router Interface Module Reference
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About the Documentation

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Documentation and Release Notes

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Documentation Conventions

Table 1 on page xii defines notice icons used in this guide.

Table 1: Notice Icons







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

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

Table 2: Text and Syntax Conventions

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

Table 2: Text and Syntax Conventions (continued)

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

Documentation Feedback

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Requesting Technical Support

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Self-Help Online Tools and Resources

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- Find product documentation: <https://www.juniper.net/documentation/>
- Find solutions and answer questions using our Knowledge Base: <https://kb.juniper.net/>
- Download the latest versions of software and review release notes: <https://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum: <https://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <https://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://entitlementsearch.juniper.net/entitlementsearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <https://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

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

PART 1

Overview

- [M320 Interface Modules Support on page 3](#)
- [Network Interface Specifications on page 23](#)
- [Cable Pinouts on page 35](#)

CHAPTER 1

M320 Interface Modules Support

- [M320 PICs Supported on page 3](#)
- [M320 End-of-Life PICs Supported on page 12](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PIC/FPC Compatibility on page 15](#)

M320 PICs Supported

The following tables list the PICs supported by the M320 router. The PICs are listed alphabetically by PIC family.



NOTE: The M320 router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The [“M320 End-of-Life PICs Supported” on page 12](#) topic lists PICs that moved to end-of-life before the M320 router itself moved to end-of-life.

- [Table 3 on page 4](#) lists the ATM IQ PICs.
- [Table 4 on page 4](#) lists the ATM2 IQ PICs.
- [Table 5 on page 5](#) lists the Channelized PICs.
- [Table 6 on page 5](#) lists the Channelized IQ PICs.
- [Table 7 on page 5](#) lists the Channelized IQE PICs.
- [Table 8 on page 6](#) lists the Circuit Emulation PICs.
- [Table 9 on page 6](#) lists the DS3, E1, E3, and T1 PICs.
- [Table 10 on page 7](#) lists the EIA-530 PIC.
- [Table 11 on page 7](#) lists the Fast Ethernet PICs.
- [Table 12 on page 8](#) lists the Gigabit Ethernet PICs.
- [Table 13 on page 10](#) lists the 10-Gigabit Ethernet PICs.
- [Table 14 on page 11](#) lists the Services PICs.
- [Table 15 on page 11](#) lists the SONET/SDH PICs.

Table 3: ATM IQ PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"ATM OC3 EOL PIC (M320 Router)" on page 178	2	PB-2OC3-ATM-MM PB-2OC3-ATM-SMIR	<ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) 	6.3
"ATM OC12 EOL PIC (M320 Router)" on page 179	1	PB-1OC12-ATM-MM PB-1OC12-ATM-SMIR	<ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) 	6.3

Table 4: ATM2 IQ PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"ATM2 DS3 IQ PIC (M320 Router)" on page 43	4	PB-4DS3-ATM2	Coaxial: <ul style="list-style-type: none"> 10 ft (3.05 m) posilock SMB to BNC (provided) Four pairs of Rx and Tx coaxial cables 	6.4
"ATM2 E3 IQ PIC (M320 Router)" on page 45	4	PB-4E3-ATM2	Coaxial: <ul style="list-style-type: none"> 10 ft (3.05 m) posilock SMB to BNC cable (provided) Four pairs of Rx and Tx coaxial cables 	6.3
"ATM2 OC3/STM1 IQ PIC (M320 Router)" on page 47	2	PB-2OC3-ATM2-MM PB-2OC3-ATM2-SMIR	<ul style="list-style-type: none"> Optical: SC/PC 	6.2
"ATM2 OC12/STM4 IQ PICs (M320 Router)" on page 50				
<ul style="list-style-type: none"> ATM2 OC12/STM4 IQ PIC 	1	PB-1OC12-ATM2-MM PB-1OC12-ATM2-SMIR	<ul style="list-style-type: none"> Optical: SC/PC 	6.2
<ul style="list-style-type: none"> ATM2 OC12/STM4 IQ PIC 	2	PB-2OC12-ATM2-MM PB-2OC12-ATM2-SMIR	<ul style="list-style-type: none"> Optical: SC/PC 	6.2
"ATM2 OC48/STM16 IQ PIC with SFP (M320 Router)" on page 53	1	PB-1OC48-ATM2-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	7.3

Table 5: Channelized PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized DS3 EOL PIC (M320 Router)" on page 181	4	PB-4CHDS3	<ul style="list-style-type: none"> Custom 10-ft (3.05-m) posilock to BNC male cable, separate RX and TX 	6.3
"Channelized OC12 EOL PIC (M320 Router)" on page 182	1	PB-1CHOC12DS3-SMIR	<ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) 	6.3
"Multichannel DS3 EOL PIC (M320 Router)" on page 184	2	PB-2MCDS3	<ul style="list-style-type: none"> Custom 10 ft/3.05 m posilock to BNC male cable, separate Rx and Tx 	6.2

Table 6: Channelized IQ PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized DS3 IQ PIC (M320 Router)" on page 57	4	PB-4CHDS3-QPP	Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces 	6.2
"Channelized E1 IQ PIC (M320 Router)" on page 59	10	PB-10CHE1-RJ48-QPP-N	<ul style="list-style-type: none"> 120-ohm RJ-48C 	9.1R4 9.2R3 9.3R1
"Channelized OC3 IQ PIC (M320 Router)" on page 61	1	PB-1CHOC3-SMIR-QPP	<ul style="list-style-type: none"> Optical: SC/PC 	7.1
"Channelized OC12 IQ EOL PIC (M320 Router)" on page 187	1	PB-1CHOC12SMIR-QPP	<ul style="list-style-type: none"> Duplex SC/PC connector (Rx and Tx); single-mode fiber 	6.2
"Channelized STM1 IQ PIC (M320 Router)" on page 64	1	PB-1CHSTM1-SMIR-QPP	<ul style="list-style-type: none"> Optical: SC/PC 	6.2
"Channelized T1 IQ PIC (M320 Router)" on page 66	10	PB-10CHT1-RJ48-QPP	<ul style="list-style-type: none"> 120-ohm RJ-48C connector (female) 	7.4

Table 7: Channelized IQE PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)" on page 70	4	PB-4CHDS3-E3-IQE-BNC	Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces 	9.3

Table 7: Channelized IQE PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router)" on page 73	10	PB-10CHE1-T1-IQE-RJ48	<ul style="list-style-type: none"> 120-ohm RJ-48C connector (female) 	9.5
"Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 76	2	PB-2CHOC3-STM1-IQE-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	9.3
"Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 80				
<ul style="list-style-type: none"> Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP 	1	PB-1CHOC12-STM4-IQE-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	9.3
<ul style="list-style-type: none"> Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP 	4	PB-4CHOC12-STM4-IQE-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	9.4
"Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 85	1	PB-1CHOC48-STM16-IQE-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	9.4

Table 8: Circuit Emulation PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router)" on page 91	4	PB-4CHOC3-CE-SFP	<ul style="list-style-type: none"> Optical: LC/PC 	9.4
"E1/T1 Circuit Emulation PIC (M320 Router)" on page 94	12	PB-12T1E1-CE-TELCO	<ul style="list-style-type: none"> RJ-21 connector Cables are rated for intra-building connections only. 	9.4

Table 9: DS3, E1, E3, and T1 PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)" on page 100	4	PB-4DS3-E3-IQE-BNC	Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces 	9.3R2

Table 9: DS3, E1, E3, and T1 PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"DS3 EOL PIC (M320 Router)" on page 190	4	PB-2DS3	<ul style="list-style-type: none"> Custom 10-ft (3.05-m) posilock SMB to BNC male cable, separate Rx and Tx (provided) 	6.2
"E1 PICs (M320 Router)" on page 103	4	PB-4E1-COAX PB-4E1-RJ48	<ul style="list-style-type: none"> Four RJ-48 connectors (one per port) Four coaxial connectors Custom 10-ft (3.05-m) posilock to BNC male cable, separate Rx and Tx 	6.4
"E3 PIC (M320 Router)" on page 105	4	PB-4E3-QPP	<ul style="list-style-type: none"> Custom 10 ft (3.05 m) posilock to BNC male cable, separate RX and TX 	6.3
"E3 IQ PIC (M320 Router)" on page 106	4	PB-4E3-QPP	Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces 	6.2
"T1 PIC (M320 Router)" on page 108	4	PB-4T1-RJ48	<ul style="list-style-type: none"> 100-ohm RJ-48 connector 	6.4

Table 10: EIA-530 PIC Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"EIA-530 PIC (M320 Router)" on page 111	2	PB-2EIA530	<ul style="list-style-type: none"> Two DB-25 male connectors (one per port, included with PIC) V.35 requires an EIA-530 to V.35 cable and connects to a V.35 DTE 34-pin Winchester type male cable (one per port) X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable 	6.2

Table 11: Fast Ethernet PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Fast Ethernet PICs (M320 Router)" on page 115				

Table 11: Fast Ethernet PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
• Fast Ethernet PIC	4	PB-4FE-TX	<ul style="list-style-type: none"> RJ-45 Two-pair, Category 5 unshielded twisted-pair Pinout: MDI noncrossover 	6.2
• Fast Ethernet PIC	8	PB-8FE-FX	<ul style="list-style-type: none"> MT-RJ female 	6.3
• Fast Ethernet PIC	12	PB-12FE-TX-MDI PB-12FE-TX-MDIX	<ul style="list-style-type: none"> One very high density connector interface (VHDCI) to RJ-21 cable that connects to an RJ-45 patch panel 	6.2
• Fast Ethernet PIC	48	PB-48FE-TX	<ul style="list-style-type: none"> Four VHDCI connectors VHDCI-to-RJ-21 cables that connect to an RJ-45 patch panel 	6.4

Table 12: Gigabit Ethernet PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
Gigabit Ethernet				
"Gigabit Ethernet PICs with SFP (M320 Router)" on page 120				
• Gigabit Ethernet PIC with SFP	1	PB-1GE-SFP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity Pinout: MDI crossover 	6.4
• Gigabit Ethernet PIC with SFP	2	PB-2GE-SFP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity 	6.4
• Gigabit Ethernet PIC with SFP	4	PB-4GE-SFP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity 	7.0

Table 12: Gigabit Ethernet PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
<ul style="list-style-type: none"> Gigabit Ethernet PIC with SFP 	10	PC-10GE-SFP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity 	6.2
Gigabit Ethernet IQ				
"Gigabit Ethernet IQ PICs with SFP (M320 Router)" on page 123				
<ul style="list-style-type: none"> Gigabit Ethernet IQ PIC with SFP 	1	PB-1GE-SFP-QPP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity Pinout: MDI crossover 	6.2
<ul style="list-style-type: none"> Gigabit Ethernet IQ PIC with SFP 	2	PB-2GE-SFP-QPP	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity Pinout: MDI crossover 	6.2
Gigabit Ethernet IQ2				
"Gigabit Ethernet IQ2 PICs with SFP (M320 Router)" on page 125				
<ul style="list-style-type: none"> Gigabit Ethernet IQ2 PIC with SFP 	4	PB-4GE-TYPE1-SFP-IQ2	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity 	7.6R3
<ul style="list-style-type: none"> Gigabit Ethernet IQ2 PIC with SFP 	8	PB-8GE-TYPE2-SFP-IQ2	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity 	7.6R2

Table 12: Gigabit Ethernet PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
<ul style="list-style-type: none"> Gigabit Ethernet IQ2 PIC with SFP 	8	PC-8GE-TYPE3-SFP-IQ2	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 Four-pair, Category 5 shielded twisted-pair connectivity 	8.2
Gigabit Ethernet IQ2E				
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)" on page 129				
<ul style="list-style-type: none"> Type 1 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP 	4	PB-4GE-TYPE1-SFP-IQ2E	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 Four-pair, Category 5 shielded twisted-pair connectivity 	9.4
<ul style="list-style-type: none"> Type 2 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP 	8	PB-8GE-TYPE2-SFP-IQ2E	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 Four-pair, Category 5 shielded twisted-pair connectivity 	9.4
<ul style="list-style-type: none"> Type 3 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP 	8	PC-8GE-TYPE3-SFP-IQ2E	<ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 Four-pair, Category 5 shielded twisted-pair connectivity 	9.4

Table 13: 10-Gigabit Ethernet PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"10-Gigabit Ethernet PIC with XENPAK (M320 Router)" on page 133	1	PC-1XGE-XENPAK	<ul style="list-style-type: none"> XENPAK 	6.2
"10-Gigabit Ethernet DWDM PIC (M320 Router)" on page 135	1	PC-1XGE-DWDM-CBAND	<ul style="list-style-type: none"> Optical: SC/PC 	7.5
"10-Gigabit Ethernet IQ2 PIC with XFP (M320 Router)" on page 136	1	PC-1XGE-TYPE3-XFP-IQ2	<ul style="list-style-type: none"> Optical: LC/PC 	8.0R3

Table 13: 10-Gigabit Ethernet PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router)" on page 138	1	PC-1XGE-TYPE3-XFP-IQ2E	• Optical: LC/PC	9.4

Table 14: Service PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Multiservices PICs (M320 Router)" on page 141				
• 100 Multiservices PIC	0	PB-MS-100-1	• None	8.1
• 400 Multiservices PIC	0	PB-MS-400-2	• None	8.1R2
• 500 Multiservices PIC	0	PB-MS-500-3	• None	8.3
"Tunnel Services PIC (M320 Router)" on page 145				
• Type 1 Tunnel Services PIC	0	PB-TUNNEL-1	• None	6.2
• Type 2 Tunnel Services PIC	0	PB-TUNNEL	• None	6.2
• Type 3 Tunnel Services PIC	0	PC-TUNNEL	• None	6.3

Table 15: SONET/SDH PICs Supported by the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
SONET/SDH				
"SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 148	4	PB-4OC3-STM1-IQE-SFP	• Optical: LC/PC	9.3R2
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router)" on page 151				
• SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP	4	PB-4OC3-1OC12-SON-SFP	• Optical: LC/PC	8.4
• SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP	4	PB-4OC3-1OC12-SON2-SFP	• Optical: LC/PC	8.3
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 154	1	PB-1OC12-STM4-IQE-SFP	• Optical: LC/PC	9.3

Table 15: SONET/SDH PICs Supported by the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router)" on page 157				
• SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP	1	PB-1OC12-SON-SFP	• Optical: LC/PC	8.4
• SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP	4	PB-4OC3-4OC12-SON-SFP	• Optical: LC/PC	8.3
"SONET/SDH OC48c/STM16 PICs with SFP (M320 Router)" on page 160				
"SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 163	4	PC-4OC48-STM16-IQE-SFP	• Optical: LC/PC	10.4R2
"SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router)" on page 167				
"SONET/SDH OC192c/STM64 PIC (M320 Router)" on page 170	1	PC-1OC192-SON-VSR	• 12-ribbon multimode fiber with MTP connector	6.2
"SONET/SDH OC192/STM64 PIC with XFP (M320 Router)" on page 173				
	1	PC-1OC192-SON-XFP	• Optical: LC/PC	8.1

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 FPCs Supported](#)
 - [M320 PIC/FPC Compatibility on page 15](#)

M320 End-of-Life PICs Supported

Table 16 on page 13 lists the end-of-life PICs supported by the M320 router. The PICs are listed alphabetically by PIC family.



NOTE: The M320 router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The "[M320 PICs Supported](#)" on page 3 topic lists PICs that had not moved to end-of-life before the M320 router itself moved to end-of-life.

Table 16: End-of-Life PICs Supported in the M320 Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
ATM				
"ATM OC3 EOL PIC (M320 Router)" on page 178	2	PB-2OC3-ATM-MM PB-2OC3-ATM-SMIR		6.3
"ATM OC12 EOL PIC (M320 Router)" on page 179	1	PB-1OC12-ATM-MM PB-1OC12-ATM-SMIR		6.3
Channelized				
"Channelized DS3 EOL PIC (M320 Router)" on page 181	4	PB-4CHDS3		6.3
"Channelized OC12 EOL PIC (M320 Router)" on page 182	1	PB-1CHOC12DS3-SMIR		6.3
"Multichannel DS3 EOL PIC (M320 Router)" on page 184	2	PB-2MCDS3		6.2
Channelized IQ				
"Channelized E1 IQ EOL PIC (M320 Router)" on page 186	10	PB-10CHE1-RJ48-QPP		6.2
"Channelized OC12 IQ EOL PIC (M320 Router)" on page 187	1	PB-1CHOC12SMIR-QPP		6.2
DS3				
"DS3 EOL PIC (M320 Router)" on page 190	4	PB-2DS3		6.2
Ethernet				
"Gigabit Ethernet EOL PICs (M320 Router)" on page 191	1	PB-1GE-LH PB-1GE-LX PB-1GE-SX		6.2
"Gigabit Ethernet EOL PICs (M320 Router)" on page 191				
• Gigabit Ethernet PIC	2	PB-2GE-LX PB-2GE-SX		6.2
• Gigabit Ethernet PIC	4	PB-4GE-SX		6.2
"10-Gigabit Ethernet EOL PIC (M320 Router)" on page 193	1	PC-1XGE-LR		6.2
Services				

Table 16: End-of-Life PICs Supported in the M320 Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Adaptive Services II EOL PIC (M320 Router)" on page 195	0	PB-AS2	• None	6.4
"Adaptive Services II Layer 2 Services EOL PIC (M320 Router)" on page 197	0	PB-AS2-LAYER2SERVICES	• None	7.5
"Adaptive Services II FIPS EOL PIC (M320 Router)" on page 200	0	PB-AS2-FIPS	• None	7.2
"ES EOL PIC (M320 Router)" on page 202	0	PB-ES-800	• None	6.2
"Link Services EOL PIC (M320 Router)" on page 203	0	PB-LS-4 PB-LS-32 PB-LS-128	• None	6.2
"Monitoring Services II EOL PIC (M320 Router)" on page 205	0	PB-PM2	• None	6.0
"Monitoring Services III EOL PIC (M320 Router)" on page 206	0	PB-PM3	• None	7.4
SONET/SDH				
"SONET/SDH OC3c/STM1 EOL PICs (M320 Router)" on page 208	4	PB-4OC3-SON-MM PB-4OC3-SON-SMIR		6.2
"SONET/SDH OC12c/STM4 EOL PICs (M320 Router)" on page 211				
• SONET/SDH OC12c/STM4 PIC	1	PB-1OC12-SON-MM		6.2
• SONET/SDH OC12c/STM4 PIC	4	PB-4OC12-SON-MM PB-4OC12-SON-SMIR		6.2
"SONET/SDH OC48c/STM16 EOL PICs (M320 Router)" on page 214				
• SONET/SDH OC48c/STM16 PIC	1	PB-1OC48-SON-SMLR PB-1OC48-SON-SMSR		6.2
• SONET/SDH OC48c/STM16 PIC	4	PC-4OC48-SON-SMSR		6.2
"SONET/SDH OC48c/STM16 EOL PIC with SFP (M320 Router)" on page 217	1	PB-1OC48-SON-SFP		6.2
"SONET/SDH OC192c/STM64 EOL PICs (M320 Router)" on page 219	1	PC-1OC192-SON-LR PC-1OC192-SON-SR2		5.4

Related Documentation • [M320 PIC Description](#)

M320 PIC Combination Limitations

In most cases, you can install PICs of different media types on the same FPC as long as the FPC and the router support those PICs. However, configuration rules might limit certain combinations of PICs on some platforms.

Newer Junos OS services for some PICs can require significant Internet Processor ASIC memory. Ethernet and SONET PICs typically do not use large amounts of memory. Gigabit Ethernet, ATM2, IQ serial PICs, and Multiservices PICs use more. To conserve memory, you can group PICs in the same family together on the same FPC.

If you have different PIC families on a single FPC, review the configuration rules to plan which PICs to install on the FPCs for your router. Consult technical bulletin [PSN-2007-01-023](#) for information about configuration rules for PIC combinations on the Juniper Networks Support site at <https://www.juniper.net/alerts/>.

When you upgrade to Junos OS Release 7.5 or later, a warning appears if any configuration rules affect your PIC combinations. If you continue the installation, one or more PICs might appear to be online (the LEDs are on), but the Junos OS cannot enable them and they cannot pass traffic. As a workaround, you can:

- Install a Junos OS release that supports the combination.
- Install PICs on a different FPC.
- Remove PICs from the affected FPC.

Related Documentation • [M320 PIC Description](#)
 • [M320 PICs Supported on page 3](#)
 • [M320 FPCs Supported](#)
 • [M320 PIC/FPC Compatibility on page 15](#)

M320 PIC/FPC Compatibility

The PIC/FPC compatibility matrixes list the first Junos OS Release in which an FPC supports each PIC currently supported for the M320 router. For example, Junos OS Release 7.5 is the first release in which the E-II-FPC1 supports the ATM2 OC3/STM1 IQ, 2-port PIC.



NOTE: A – indicates that the PIC is not supported by the FPC.

- [PIC/FPC Compatibility \(Type 1 FPCs and Type 1 PICs\) on page 16](#)
- [PIC/FPC Compatibility \(Type 2 FPCs and Type 2 PICs\) on page 19](#)
- [PIC/FPC Compatibility \(Type 3 FPCs and Type 3 PICs\) on page 21](#)

PIC/FPC Compatibility (Type 1 FPCs and Type 1 PICs)

Table 17 on page 16 provides a PIC/FPC compatibility matrix for the current Type 1 PICs for the M320 router and Type 1 FPCs. A link to the PIC description is included in the table.

Table 17: M320 PIC/FPC Compatibility Type 1

PIC	PIC Model Number	FPC1	E-II FPC1	E-III FPC1
ATM2 IQ PICs				
"ATM2 DS3 IQ PIC (M320 Router)" on page 43 4-port	PB-4DS3-ATM2	6.4	7.5	8.4
"ATM2 E3 IQ PIC (M320 Router)" on page 45 4-port	PB-4E3-ATM2	6.3	7.5	8.4
"ATM2 OC3/STM1 IQ PIC (M320 Router)" on page 47 2-port	PB-2OC3-ATM2-MM	6.2	7.5	8.4
	PB-2OC3-ATM2-SMIR	6.2	7.5	8.4
"ATM2 OC12/STM4 IQ PICs (M320 Router)" on page 50 1-port	PB-1OC12-ATM2-MM	6.2	7.5	8.4
	PB-1OC12-ATM2-SMIR	6.2	7.5	8.4
	PB-1OC12-ATM2-MM	6.2	7.5	8.4
Channelized Circuit Emulation PICs				
"Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router)" on page 91	PB-4CHOC3-CE-SFP	–	–	9.4
Channelized IQ PICs				
"Channelized DS3 IQ PIC (M320 Router)" on page 57 4-port	PB-4CHDS3-QPP	6.2	7.5	8.4
"Channelized E1 IQ PIC (M320 Router)" on page 59 10-port	PB-1OCHE1-RJ48-QPP-N	9.1R4	9.1R4	9.1R4
		9.2R3	9.2R3	9.2R3
		9.3R1	9.3R1	9.3R1
"Channelized OC3 IQ PIC (M320 Router)" on page 61 1-port	PB-1CHOC3-SMIR-QPP	7.1	7.5	8.4
"Channelized STM1 IQ PIC (M320 Router)" on page 64 1-port	PB-1CHSTM1-SMIR-QPP	6.2	7.5	8.4

Table 17: M320 PIC/FPC Compatibility Type 1 (continued)

PIC	PIC Model Number	FPC1	E-II FPC1	E-III FPC1
"Channelized T1 IQ PIC (M320 Router)" on page 66 10-port	PB-1OCHT1-RJ48-QPP	7.4	7.5	8.4
Channelized Enhanced IQ (IQE) PICs				
"Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)" on page 70 4-port	PB-4CHDS3-E3-IQE-BNC	–	9.3	9.3
"Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router)" on page 73 10-port	PB-10CHE1-T1-IQE-RJ48	–	9.5	9.5
"Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 76 2-port	PB-2CHOC3-STM1-IQE-SFP	–	9.3	9.3
"Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 80 IQE, 1-port	PB-1CHOC12-STM4-IQE-SFP	–	9.3	9.3
T1, DS3, E1, E3 PICs				
"DS3 EOL PIC (M320 Router)" on page 190, 4-port	PB-4DS3	–	6.2	–
"DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)" on page 100 4-port	PB-4DS3-E3-IQE-BNC	–	9.3R2	9.3R2
"E1 PICs (M320 Router)" on page 103, 4-port	PB-4E1-COAX	6.4	7.5	8.4
	PB-4E1-RJ48	6.4	7.5	8.4
"E1/T1 Circuit Emulation PIC (M320 Router)" on page 94, 12-port	PB-12T1E1-CE-TELCO	–	–	9.4
"E3 PIC (M320 Router)" on page 105, 4-port	PB-4E3	6.3	7.5	–
"T1 PIC (M320 Router)" on page 108, 4-port	PB-4T1-RJ48	6.4	7.5	8.4
E3 IQ PIC				
"E3 IQ PIC (M320 Router)" on page 106, 4-port	PB-4E3-QPP	6.2	7.5	8.4

Table 17: M320 PIC/FPC Compatibility Type 1 (continued)

PIC	PIC Model Number	FPC1	E-II FPC1	E-III FPC1
EIA-530 PIC				
"EIA-530 PIC (M320 Router)" on page 111, 2-port	PB-2EIA530	6.2	7.5	8.4
Ethernet PICs				
"Fast Ethernet PICs (M320 Router)" on page 115, 4-port	PB-4FE-TX	6.2	7.5	8.4
"Fast Ethernet PICs (M320 Router)" on page 115, 8-port	PB-8FE-FX	6.3	7.5	8.4
"Fast Ethernet PICs (M320 Router)" on page 115, 12-port	PB-12FE-TX	6.2	7.5	8.4
"Gigabit Ethernet PICs with SFP (M320 Router)" on page 120, 1-port SFP	PB-1GE-SFP	6.4	7.5	8.4
Ethernet IQ PICs				
"Gigabit Ethernet IQ PICs with SFP (M320 Router)" on page 123, 1-port SFP	PB-1GE-SFP-QPP	6.2	7.5	8.4
Ethernet IQ2 PICs				
"Gigabit Ethernet IQ2 PICs with SFP (M320 Router)" on page 125, 4-port SFP	PB-4GE-TYPE1-SFP-IQ2	7.6R3	7.6R3	8.4
Ethernet Enhanced IQ2 (IQ2E) PICs				
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)" on page 129, 4-port SFP	PB-4GE-TYPE1-SFP-IQ2E	9.4	9.4	9.4
Services PICs				
"Multiservices PICs (M320 Router)" on page 141 100	PB-MS-100-1	8.1	8.1	8.4
"Tunnel Services PIC (M320 Router)" on page 145	PB-TUNNEL-1	6.2	7.5	8.4

Table 17: M320 PIC/FPC Compatibility Type 1 (continued)

PIC	PIC Model Number	FPC1	E-II FPC1	E-III FPC1
SONET/SDH PICs				
"SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 148 4-port, SFP	PB-4OC3-STM1-IQE-SFP	–	9.3R2	9.3R2
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router)" on page 151, 4-port, SFP (Type 1)	PB-4OC3-1OC12-SON-SFP	8.4	8.4	8.4
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 154, 1-port, SFP	PB-1OC12-STM4-IQE-SFP	–	9.3	9.3
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router)" on page 157), 1-port, SFP	PB-1OC12-SON-SFP	8.4	8.4	8.4

PIC/FPC Compatibility (Type 2 FPCs and Type 2 PICs)

Table 18 on page 19 provides a PIC/FPC compatibility matrix for the current Type 2 PICs for the M320 router and Type 2 FPCs. A link to the PIC description is included in the table.

Table 18: M320 PIC/FPC Compatibility Type 2

PIC	Model Number	FPC2	E-II FPC2	E-III-FPC2
ATM2 IQ PICs				
"ATM2 OC12/STM4 IQ PICs (M320 Router)" on page 50 2-port	PB-2OC12-ATM2-MM	6.2	7.5	8.4
	PB-2OC12-ATM2-SMIR	6.2	7.5	8.4
	"ATM2 OC12/STM4 IQ PICs (M320 Router)" on page 50			
"ATM2 OC48/STM16 IQ PIC with SFP (M320 Router)" on page 53 1-port	PB-1OC48-ATM2-SFP	7.3	7.5	8.4
Channelized Enhanced IQ (IQE) PICs				
"Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 80 4-port	PB-4CHOC12-STM4-IQE-SFP	–	–	9.4

Table 18: M320 PIC/FPC Compatibility Type 2 (continued)

PIC	Model Number	FPC2	E-II FPC2	E-III-FPC2
"Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 85 1-port	PB-1CHOC48-STM16-IQE	–	–	9.4
Ethernet PICs				
"Fast Ethernet PICs (M320 Router)" on page 115 48-port	PB-48FE-TX	6.4	7.5	8.4
"Gigabit Ethernet PICs with SFP (M320 Router)" on page 120 2-port	PB-2GE-SFP	6.4	7.5	8.4
"Gigabit Ethernet PICs with SFP (M320 Router)" on page 120 4-port	PB-4GE-SFP	7.0	7.5	8.4
Ethernet IQ PICs				
"Gigabit Ethernet IQ PICs with SFP (M320 Router)" on page 123 2-port	PB-2GE-SFP-QPP	6.2	7.5	8.4
Ethernet IQ2 PICs				
"Gigabit Ethernet IQ2 PICs with SFP (M320 Router)" on page 125 8-port	PB-8GE-TYPE2-SFP-IQ2	7.6R2	7.6R2	8.4
Ethernet Enhanced IQ2 (IQ2E) PICs				
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)" on page 129 8-port	PB-8GE-TYPE2-SFP-IQ2E	9.4	9.4	9.4
Services PICs				
"Multiservices PICs (M320 Router)" on page 141 400	PB-MS-400-2	8.1R2	8.1R2	8.4
"Tunnel Services PIC (M320 Router)" on page 145	PB-TUNNEL	6.3	7.5	8.4
SONET/SDH PICs				
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router)" on page 151 4-port	PB-4OC3-1OC12-SON2-SFP	8.3	8.3	8.4
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router)" on page 157 4-port	PB-4OC3-4OC12-SON-SFP	8.3	8.3	8.4

Table 18: M320 PIC/FPC Compatibility Type 2 (continued)

PIC	Model Number	FPC2	E-II FPC2	E-III-FPC2
"SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router)" on page 167 1-port	PB-10C48-SON-B-SFP	8.3	8.3	8.4

PIC/FPC Compatibility (Type 3 FPCs and Type 3 PICs)

Table 19 on page 21 provides a PIC/FPC compatibility matrix for the current Type 3 PICs for the M320 router and Type 3 FPCs. A link to the PIC description is included in the table.

Table 19: M320 PIC/FPC Compatibility Type 3

PIC	Model Number	FPC3	E-II-FPC3	E-III-FPC3
Ethernet PICs				
"Gigabit Ethernet PICs with SFP (M320 Router)" on page 120 10-port	PC-10GE-SFP	6.2	7.5	8.4
10-Gigabit Ethernet PICs				
"10-Gigabit Ethernet PIC with XENPAK (M320 Router)" on page 133 1-port	PC-1XGE-XENPAK	6.2	7.5	8.4
"10-Gigabit Ethernet DWDM PIC (M320 Router)" on page 135 1-port	PC-1XGE-DWDM-CBAND	7.5	7.5	8.4
Ethernet IQ2 PICs				
"Gigabit Ethernet IQ2 PICs with SFP (M320 Router)" on page 125 8-port	PC-8GE-TYPE3-SFP-IQ2	8.2	8.2	8.4
"Gigabit Ethernet IQ2 PICs with SFP (M320 Router)" on page 125 1-port	PC-1GE-TYPE3-XFP-IQ2	8.0R3	8.0R3	8.4
Ethernet Enhanced IQ2 (IQ2E) PICs				
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)" on page 129 8-port	PC-8GE-TYPE3-SFP-IQ2E	9.4	9.4	9.4
"10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router)" on page 138 1-port	PC-1XGE-TYPE3-XFP-IQ2E	9.4	9.4	9.4
Services PICs				
"Multiservices PICs (M320 Router)" on page 141 500	PC-MS-500-3	8.3	8.3	8.4

Table 19: M320 PIC/FPC Compatibility Type 3 (continued)

PIC	Model Number	FPC3	E-II-FPC3	E-III-FPC3
"Tunnel Services PIC (M320 Router)" on page 145	PC-TUNNEL	6.3	7.5	8.4
SONET/SDH PICs				
"SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)" on page 163 4-port	PC-4OC48-STM16-IQE-SFP	–	–	10.4R2
"SONET/SDH OC48c/STM16 PICs with SFP (M320 Router)" on page 160 4-port	PC-4OC48-SON-SFP	6.2	7.5	8.4
"SONET/SDH OC192c/STM64 PIC (M320 Router)" on page 170 1-port	PC-1OC192-SON-VSR	6.2	7.5	8.4
"SONET/SDH OC192/STM64 PIC with XFP (M320 Router)" on page 173 1-port	PC-1OC192-SON-SFP	8.1	8.1	8.4

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)
 - [M320 FPCs Supported](#)

CHAPTER 2

Network Interface Specifications

- Determining Transceiver Support and Specifications for M Series and T Series Routers on page 23
- Fast Ethernet 100BASE-FX Optical Interface Specifications on page 24
- 10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND) Optical Interface Specifications on page 24
- SONET/SDH OC3/STM1 Optical Interface Specifications on page 25
- SONET/SDH OC12/STM4 Optical Interface Specifications on page 26
- SONET/SDH OC48/STM16 Optical Interface Specifications on page 28
- SONET/SDH OC192/STM64 Optical Interface Specifications on page 30

Determining Transceiver Support and Specifications for M Series and T Series Routers

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.

Fast Ethernet 100BASE-FX Optical Interface Specifications

Table 20 on page 24 shows the optical interface specifications for the 100BASE-FX standard.

Table 20: Fast Ethernet 100BASE-FX Optical Interface Specifications

Parameter	100BASE-FX
Rate	100 Mbps
Optical interface	Multimode
Maximum distance	50/125 MMF cable: 1640 ft (500 m) 62.5/125 MMF cable: 6562 ft (2 km)
Transmitter wavelength	1270 through 1380 nm
Average launch power	-19 through -14 dBm
Average receive power	-31 through -14 dBm
Receiver saturation	-14 dBm
Receiver sensitivity	-31 dBm

10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND) Optical Interface Specifications

Table 21 on page 24 shows the optical interface specifications for the 10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND).

Table 21: 10-Gigabit Ethernet DWDM LAN Rate Optical Interface Specifications

Parameter	Extra-Long Wavelength Serial DWDM, LAN Rate
Optical interface	Single-mode
Transceiver type	Dense wavelength division multiplexing (DWDM)
Standard	ITU-T G.694.1
Maximum distance	9/125 SMF cable: 49.6 miles (80 km)
Transmitter wavelength	1528.77 through 1563.86 nm, 100-GHz ITU grid
Average launch power	0 through 4.0 dBm

Table 21: 10-Gigabit Ethernet DWDM LAN Rate Optical Interface Specifications (continued)

Parameter	Extra-Long Wavelength Serial DWDM, LAN Rate
Transmit extinction ratio	9.0 dBm
Average receive power	-24.0 through -7.0 dBm
Receiver saturation	-7.0 dBm
Receiver sensitivity	-24.0 dBm

SONET/SDH OC3/STM1 Optical Interface Specifications

- [SONET/SDH OC3/STM1 Specifications on page 25](#)
- [SONET/SDH OC3/STM1 Intermediate Reach \(IR-1\) Specifications on page 25](#)
- [SONET/SDH OC3/STM1 Long Reach \(LR-1\) Specifications on page 26](#)

SONET/SDH OC3/STM1 Specifications

Table 22 on page 25 shows the multimode SONET/SDH OC3/STM1 optical interface specifications.

Table 22: SONET/SDH OC3/STM1 Multimode Optical Interface Specifications

Parameter	Multimode
Optical interface	Multimode
Maximum distance	MMF cable: 1.2 miles (2 km)
Standard	Multivendor agreement
Transmitter wavelength	1270 through 1380 nm
Average launch power	-20 through -14 dBm
Receiver saturation	-14 dBm
Receiver sensitivity	-30 dBm

SONET/SDH OC3/STM1 Intermediate Reach (IR-1) Specifications

Table 23 on page 26 shows the SONET/SDH OC3/STM1 intermediate reach (IR-1) optical interface specifications.

Table 23: SONET/SDH OC3/STM1 Intermediate Reach Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)
Standard	Telcordia GR-253
Transmitter wavelength	1261 through 1360 nm
Average launch power	-15 through -8 dBm
Receiver saturation	-8 dBm
Receiver sensitivity	-28 dBm

SONET/SDH OC3/STM1 Long Reach (LR-1) Specifications

Table 24 on page 26 shows the SONET/SDH OC3/STM1 long reach (LR-1) optical interface specifications.

Table 24: SONET/SDH OC3/STM1 Long Reach -1 Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 24.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1263 through 1360 nm
Average launch power	-5 through 0 dBm
Receiver saturation	-10 dBm
Receiver sensitivity	-34 dBm

SONET/SDH OC12/STM4 Optical Interface Specifications

- SONET/SDH OC12/STM4 Short Reach (SR-1) Specifications on page 27
- SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Specifications on page 27
- SONET/SDH OC12/STM4 Long Reach (LR-1) Specifications on page 27
- SONET/SDH OC12/STM4 Long Reach (LR-2) Specifications on page 28

SONET/SDH OC12/STM4 Short Reach (SR-1) Specifications

Table 25 on page 27 shows the SONET/SDH OC12/STM4 short reach (SR-1) optical interface specifications.

Table 25: SONET/SDH OC12/STM4 Short Reach (SR-1) Optical Interface Specifications

Parameter	Short Reach (SR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 1.24 miles (2 km)
Standard	Telcordia GR-253
Transmitter wavelength	1261 through 1360 nm
Average launch power	-15 through -8 dBm
Receiver saturation	-8 dBm
Receiver sensitivity	-23 dBm

SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Specifications

Table 26 on page 27 shows the SONET/SDH OC12/STM4 short reach (IR-1) optical interface specifications.

Table 26: SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)
Standard	Telcordia GR-253
Transmitter wavelength	1274 through 1356 nm
Average launch power	-15 through -8 dBm
Receiver saturation	-8 dBm
Receiver sensitivity	-28 dBm

SONET/SDH OC12/STM4 Long Reach (LR-1) Specifications

Table 27 on page 28 shows the SONET/SDH OC12/STM4 short reach (LR-1) optical interface specifications.

Table 27: SONET/SDH OC12/STM4 Long Reach (LR-1) Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 24.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1280 through 1335 nm
Average launch power	-3 through +2 dBm
Receiver saturation	-8 dBm
Receiver sensitivity	-28 dBm

SONET/SDH OC12/STM4 Long Reach (LR-2) Specifications

Table 28 on page 28 shows the SONET/SDH OC12/STM4 short reach (LR-2) optical interface specifications.

Table 28: SONET/SDH OC12/STM4 Long Reach (LR-2) Optical Interface Specifications

Parameter	Long Reach (LR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.70 miles (80 km)
Standard	Telcordia GR-253
Transmitter wavelength	1480 through 1580 nm
Average launch power	-3 through 2 dBm
Receiver saturation	-8 dBm
Receiver sensitivity	-28 through -8 dBm

SONET/SDH OC48/STM16 Optical Interface Specifications

- SONET/SDH OC48/STM16 Short Reach (SR-1) Specifications on page 29
- SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Specifications on page 29
- SONET/SDH OC48/STM16 Long Reach (LR-1) Specifications on page 29
- SONET/SDH OC48/STM16 Long Reach (LR-2) Specifications on page 30

SONET/SDH OC48/STM16 Short Reach (SR-1) Specifications

Table 29 on page 29 shows the SONET/SDH OC48/STM16 short reach (SR-1) optical interface specifications.

Table 29: SONET/SDH OC48/STM16 Short Reach (SR-1) Optical Interface Specifications

Parameter	Short Reach (SR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 1.24 miles (2 km)
Standard	Telcordia GR-253
Transmitter wavelength	1266 through 1360 nm
Average launch power	-10 through -3 dBm
Receiver saturation	-3 dBm
Receiver sensitivity	-18 dBm

SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Specifications

Table 30 on page 29 shows the SONET/SDH OC48/STM16 intermediate reach (IR-1) optical interface specifications.

Table 30: SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)
Standard	Telcordia GR-253
Transmitter wavelength	1260 through 1360 nm
Average launch power	-5 through 0 dBm
Receiver saturation	0 dBm
Receiver sensitivity	-18 dBm

SONET/SDH OC48/STM16 Long Reach (LR-1) Specifications

Table 31 on page 30 shows the SONET/SDH OC48/STM16 long reach (LR-1) optical interface specifications.

Table 31: SONET/SDH OC48/STM16 Long Reach (LR-1) Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 28.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1280 through 1335 nm
Average launch power	-2 through +3 dBm
Receiver saturation	-9 dBm
Receiver sensitivity	-28 dBm

SONET/SDH OC48/STM16 Long Reach (LR-2) Specifications

Table 32 on page 30 shows the SONET/SDH OC48/STM16 long reach (LR-2) optical interface specifications.

Table 32: SONET/SDH OC48/STM16 Long Reach (LR-2) Optical Interface Specifications

Parameter	Long Reach (LR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.71 miles (80 km)
Standard	Telcordia GR-253
Transmitter wavelength	1500 through 1580 nm
Average launch power	-2 through +3 dBm
Receiver saturation	-9 dBm
Receiver sensitivity	-28 dBm

SONET/SDH OC192/STM64 Optical Interface Specifications

- SONET/SDH OC192/STM64 Very Short Reach (VSR) on page 31
- SONET/SDH OC192/STM64 Short Reach (SR-1) on page 31
- SONET/SDH OC192/STM64 Short Reach (SR-2) on page 32
- SONET/SDH OC192/STM64 Intermediate Reach (IR-2) on page 32
- SONET/SDH OC192/STM64 Long reach (LR-1) on page 33
- SONET/SDH OC192/STM64 Long reach (LR-2) on page 33

SONET/SDH OC192/STM64 Very Short Reach (VSR)

Table 33 on page 31 shows the SONET/SDH OC192/STM64 very short reach (VSR) optical interface specifications.

Table 33: SONET/SDH OC192/STM64 Very Short Reach (VSR 1) Optical Interface Specifications

Parameter	Very Short Reach (VSR)
Optical interface	Multimode
Maximum distance	MMF cable: 984.25 feet (300 m)
Standard	OIF VSR4-1
Transmitter wavelength	830 through 860 nm
Average launch power	-10 through -3 dBm
Receiver saturation	-3 dBm
Receiver sensitivity	-16 dBm

SONET/SDH OC192/STM64 Short Reach (SR-1)

Table 34 on page 31 shows the SONET/SDH OC192/STM64 short reach (SR-1) optical interface specifications.

Table 34: SONET/SDH OC192/STM64 Short Reach (SR-1) Optical Interface Specifications

Parameter	Short Reach (SR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 6.21 miles (10 km)
Standard	Telcordia GR-253 OC192 SR1
Transmitter wavelength	1290 nm through 1330 nm
Average launch power	-6 through -1 dBm
Receiver saturation	-1.0 dBm
Receiver sensitivity	-11 dBm

SONET/SDH OC192/STM64 Short Reach (SR-2)

Table 35 on page 32 shows the SONET/SDH OC192/STM64 short reach (SR-2) optical interface specifications.

Table 35: SONET/SDH OC192/STM64 Short Reach (SR-2) Optical Interface Specifications

Parameter	Short Reach (SR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 15.5 miles (25 km)
Standard	Telcordia GR-253 OC192 SR2
Transmitter wavelength	1530 through 1565 nm
Average launch power	-4 through 0 dBm
Receiver saturation	-3 dBm
Receiver sensitivity	-14 dBm

SONET/SDH OC192/STM64 Intermediate Reach (IR-2)

Table 36 on page 32 shows the SONET/SDH OC192/STM64 Intermediate reach (IR-2) optical interface specifications.

Table 36: SONET/SDH OC192/STM64 Intermediate Reach (IR-2) Optical Interface Specifications

Parameter	Intermediate Reach (IR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 24.8 miles (40 km) <i>NOTE:</i> Distances greater than 30 km are considered to be engineered links.
Standard	Telcordia GR-253 OC192 IR2
Transmitter wavelength	1530 nm through 1565 nm
Average launch power	-1.0. through 2 dBm
Receiver saturation	-1.0 dBm
Receiver sensitivity	-14 dBm

SONET/SDH OC192/STM64 Long reach (LR-1)

Table 37 on page 33 shows the SONET/SDH OC192/STM64 long reach (LR-1) optical interface specifications.

Table 37: SONET/SDH OC192/STM64 Long Reach (LR-1) Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.71 miles (80 km)
Standard	Telcordia GR-253 OC192 LR2
Transmitter wavelength	1530 nm through 1565 nm
Average launch power	6 through 8 dBm
Receiver saturation	-10 dBm
Receiver sensitivity	-22 dBm

SONET/SDH OC192/STM64 Long reach (LR-2)

Table 38 on page 33 shows the SONET/SDH OC192/STM64 long reach (LR-2) optical interface specifications.

Table 38: SONET/SDH OC192/STM64 Long Reach (LR-2) Optical Interface Specifications

Parameter	Long Reach (LR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.71 miles (80 km)
Standard	Telcordia GR-253 OC192 LR2
Transmitter wavelength	1530 nm through 1565 nm
Average launch power	0 through 4 dBm
Receiver saturation	-7 dBm
Receiver sensitivity	-24 dBm

Cable Pinouts

- M320 Fast Ethernet 48-port Cable Pinouts on page 35
- M320 RJ-48 Cable Pinouts for E1 and T1 PICs on page 36

M320 Fast Ethernet 48-port Cable Pinouts

The Fast Ethernet 48-port PIC has four VHDCI connector ports on its faceplate (see [Figure 1 on page 35](#)), each of which accepts one of the four RJ-21 cables supplied with the PIC (see [Figure 2 on page 35](#)). Each VHDCI connector port supports 12 Ethernet ports.

Figure 1: Fast Ethernet 48-port PIC

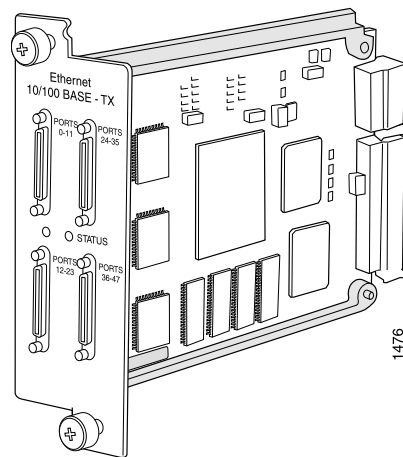
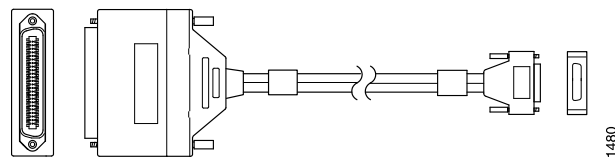


Figure 2: VHDCI to RJ-21 Cable



NOTE: RJ-21 pin numbers 25 and 50 do not appear in the table because they are ground connectors.

Table 39: RJ-21 Pin Assignments

Ethernet Port Numbers	RJ-21 Pin Assignment			
	TX -	TX +	RX -	RX +
0, 12, 24, 36	2	27	1	26
1, 13, 25, 37	4	29	3	28
2, 14, 26, 38	6	31	5	30
3, 15, 27, 39	8	33	7	32
4, 16, 28, 40	10	35	9	34
5, 17, 29, 41	12	37	11	36
6, 18, 30, 42	14	39	13	38
7, 19, 31, 43	16	41	15	40
8, 20, 32, 44	18	43	17	42
9, 21, 33, 45	20	45	19	44
10, 22, 34, 46	22	47	21	46
11, 23, 35, 47	24	49	23	48

- Related Documentation**
- *M320 Chassis Description*
 - *M320 Site Preparation Checklist Requirements*

M320 RJ-48 Cable Pinouts for E1 and T1 PICs

The E1 and T1 PICs use an RJ-48 cable, which is not supplied with the PIC.



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

Table 40 on page 37, Table 41 on page 37, Table 42 on page 38, and Table 43 on page 39 describe the RJ-48 connector pinouts.

Table 40: RJ-48 Connector to RJ-48 Connector (Straight) Pinouts

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	1	RX, Ring, –
2	2	RX, Tip, +
4	4	TX, Ring, –
5	5	TX, Tip, +
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Table 41: RJ-48 Connector to RJ-48 Connector (Crossover) Pinouts

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	4	RX/Ring/– <--->TX/Ring/–
2	5	RX/Tip/+ <--->TX/Tip/+
4	1	TX/Ring/– <--->RX/Ring/–
5	2	TX/Tip/+ <--->RX/Tip/+

Table 41: RJ-48 Connector to RJ-48 Connector (Crossover) Pinouts (continued)

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Table 42: RJ-48 Connector to DB-15 Connector (Straight) Pinouts

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	11	RX/Ring/- <--->RX/Ring/-
2	3	RX/Tip/+ <--->RX/Tip/+
4	9	TX/Ring/- <--->TX/Ring/-
5	1	TX/Tip/+ <--->TX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect

Table 42: RJ-48 Connector to DB-15 Connector (Straight) Pinouts (continued)

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Table 43: RJ-48 Connector to DB-15 Connector (Crossover) Pinouts

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	9	RX/Ring/- <--->TX/Ring/-
2	1	RX/Tip/+ <--->TX/Tip/+
4	11	TX/Ring/- <--->RX/Ring/-
5	3	TX/Tip/+ <--->RX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect

Table 43: RJ-48 Connector to DB-15 Connector (Crossover) Pinouts (continued)

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

- Related Documentation**
- *M320 Chassis Description*
 - *M320 Connector Interface Panel (CIP) Description*
 - *M320 Site Preparation Checklist Requirements*

PART 2

PIC Descriptions

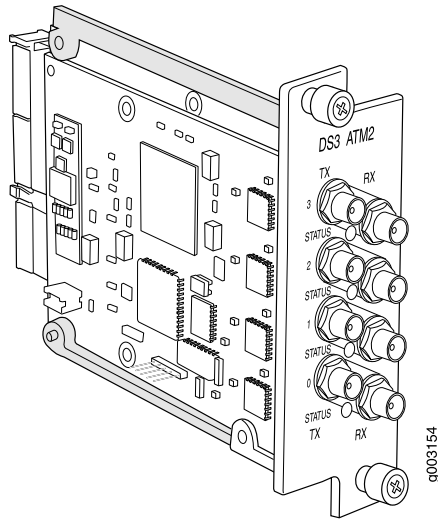
- [ATM2 IQ PIC Descriptions on page 43](#)
- [Channelized IQ PIC Descriptions on page 57](#)
- [Channelized Enhanced IQ \(IQE\) PIC Descriptions on page 69](#)
- [Circuit Emulation PIC Descriptions on page 91](#)
- [DS3, E1, E3, and T1 Pic Descriptions on page 99](#)
- [EIA-530 PIC Descriptions on page 111](#)
- [Fast Ethernet PIC Descriptions on page 115](#)
- [Gigabit Ethernet PIC Descriptions on page 119](#)
- [10-Gigabit Ethernet PIC Descriptions on page 133](#)
- [Services PIC Descriptions on page 141](#)
- [SONET/SDH PIC Descriptions on page 147](#)
- [End-of-Life PIC Descriptions on page 177](#)

CHAPTER 4

ATM2 IQ PIC Descriptions

- ATM2 DS3 IQ PIC (M320 Router) on page 43
- ATM2 E3 IQ PIC (M320 Router) on page 45
- ATM2 OC3/STM1 IQ PIC (M320 Router) on page 47
- ATM2 OC12/STM4 IQ PICs (M320 Router) on page 50
- ATM2 OC48/STM16 IQ PIC with SFP (M320 Router) on page 53

ATM2 DS3 IQ PIC (M320 Router)

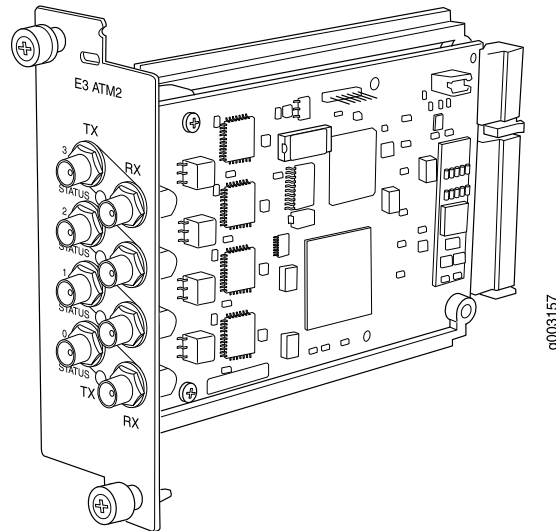


Software release	<ul style="list-style-type: none">• Junos OS Release 6.4 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none">• Four DS3 ports• Power requirement: 0.41 A @ 48 V (20.0 W)• Fine-grained queuing per logical interface• ATM standards compliant• Model number: PB-4DS3-ATM2

Hardware features	<ul style="list-style-type: none">• 16-MB SDRAM memory for ATM segmentation and reassembly (SAR)• ATM switch ID• Configurable framing options:<ul style="list-style-type: none">• C-bit with ATM direct mapping• C-bit with Physical Layer Convergence Protocol (PLCP) framing (default)• M23 ATM direct mapping• M23 with PLCP framing• Internal and loop timing
Software features	<ul style="list-style-type: none">• Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping• Unspecified bit rate (UBR) traffic shaping• Fine-grained variable bit rate (VBR) traffic shaping• Circuit cross-connect (CCC)• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)• Simple Network Management Protocol (SNMP):<ul style="list-style-type: none">• Management Information Base (MIB) 2 (RFC 1213)• ATM MIB (RFC 1695)• SONET MIB• AAL5 encapsulations:<ul style="list-style-type: none">• ATM-VC-MUX• ATM-NLPID• ATM-Cisco-LLPID• ATM-SNAP• ATM-CCC-VC-MUX
Cables and connectors	<ul style="list-style-type: none">• 10 ft (3.05 m) posilock SMB to BNC (provided)• Four pairs of Rx and Tx coaxial cables
LEDs	One tricolor per port: <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none">• Alarm indication signal (AIS)• Far-end block error (FEBE)• Frame error• Idle code• Idle received• Local and remote loopback• Loss of signal (LOS)• Out of frame (OOF)• Path parity error• Yellow alarm

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

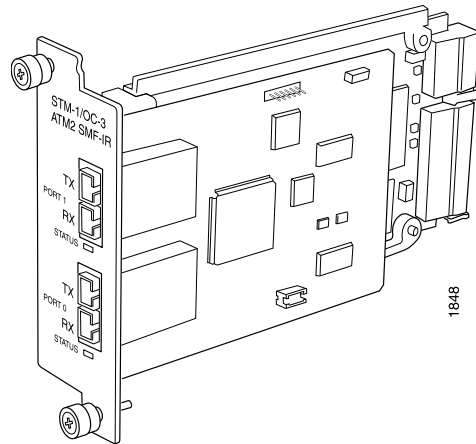
ATM2 E3 IQ PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 6.3 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Four E3 ports • Power requirement: 0.41 A @ 48 V (20 W) • Fine-grained queuing per logical interface • ATM standards compliant • Model number: PB-2E3-ATM2
Hardware features	<ul style="list-style-type: none"> • 16-MB SDRAM memory for ATM segmentation and reassembly (SAR) • ATM switch ID • Configurable framing options: <ul style="list-style-type: none"> • G.751 direct mapping • G.751 with PLCP encapsulation (default) • G.832 ATM direct mapping • Internal and loop timing

Software features	<ul style="list-style-type: none"> • Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping • Unspecified bit rate (UBR) traffic shaping • Fine-grained variable bit rate (VBR) traffic shaping • Circuit cross-connect (CCC) • ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC) • Simple Network Management Protocol (SNMP): <ul style="list-style-type: none"> • Management Information Base (MIB) 2 (RFC 1213) • ATM MIB (RFC 1695) • SONET MIB • AAL5 encapsulations: <ul style="list-style-type: none"> • ATM-VC-MUX • ATM-NLPID • ATM-Cisco-LLPID • ATM-SNAP • ATM-CCC-VC-MUX
Cables and connectors	<ul style="list-style-type: none"> • 10 ft (3.05 m) posilock SMB to BNC (provided) • Four pairs of Rx and Tx coaxial cables
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS) • Frame error • Line code violation • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm
Related Documentation	<ul style="list-style-type: none"> • M320 PIC Description • M320 PIC Combination Limitations on page 15 • M320 PICs Supported on page 3

ATM2 OC3/STM1 IQ PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> Two OC3 ports Power requirement: 0.41 A @ 48 V (20 W) Fine-grained queuing per logical interface Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 ATM and SONET/SDH standards compliant Alarm and event counting and detection Compatible with well-known ATM switches ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches Model number: PB-2OC3-ATM2-MM PB-2OC3-ATM2-SMIR
Hardware features	<ul style="list-style-type: none"> Single 3010 SAR for segmentation and reassembly into 53 byte ATM cells High-performance parsing of SONET/SDH frames ASIC-based packet segmentation and reassembly (SAR) management and output port queuing 64 MB SDRAM memory for ATM SAR Packet buffering, Layer 2 parsing

Software features	<ul style="list-style-type: none">• Circuit cross-connect (CCC) for leveraging ATM access networks• User-configurable virtual circuit (VC) and virtual path (VP) support• Support for idle cell or unassigned cell transmission• OAM fault management processes alarm indication signal (AIS), remote defect indication (RDI) cells, and loop cells• Point-to-point and point-to-multipoint mode Layer 2 counters per VC and per VP• Local and remote loopback• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)• Simple Network Management Protocol (SNMP):<ul style="list-style-type: none">• Management Information Base (MIB) 2 (RFC 1213)• ATM MIB (RFC 1695)• SONET MIB• Unspecified bit rate (UBR), non-real-time variable bit rate (VBR), and constant bit rate (CBR) traffic shaping• Per-VC or per-VP traffic shaping• Support for F4 OAM cells• Support for 16 bit VCI range
Cables and connectors	<ul style="list-style-type: none">• Duplex SC/PC connector (RX and TX)• SONET/SDH OC3/STM1 fixed transceivers:<ul style="list-style-type: none">• Multimode• Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Loss of cell delineation (LOC)
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Error detection:
 - Bit interleaved parity errors B1, B2, B3
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

ATM2 OC12/STM4 IQ PICs (M320 Router)

Figure 3: 1-Port ATM2 OC12/STM4 IQ PIC

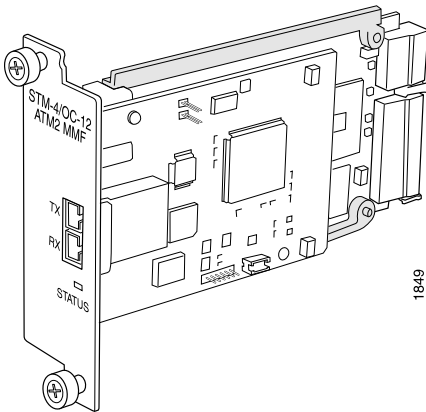
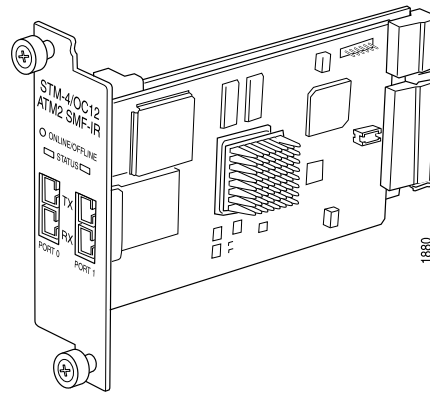


Figure 4: 2-Port ATM2 OC12/STM4 IQ PIC



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1 and Type 2) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One or two OC12 ports Power requirement: <ul style="list-style-type: none"> 1-port: 0.41 A @ 48 V (20 W) 2-port: 0.52 A @ 48 V (25 W) Fine-grained queuing per logical interface Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 Complies with ATM and SONET/SDH standards Alarm and event counting and detection Compatible with well-known ATM switches ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches Model number for 1-Port ATM2 OC12/STM4 IQ PIC: PB-1OC12-ATM2-MM PB-1OC12-ATM2-SMIR Model number for 2-Port ATM2 OC12/STM4 IQ PIC: PB-2OC12-ATM2-MM PB-2OC12-ATM2-SMIR
Hardware features	<ul style="list-style-type: none"> ATM2 IQ 1-port OC12 PICs have one 3010 SAR for segmentation and reassembly into 53-byte ATM cells; ATM2 IQ 2-port OC12 PICs have dual 3010 SAR High-performance parsing of SONET/SDH frames ASIC-based packet segmentation and reassembly (SAR) management and output port queuing 64 MB SDRAM memory for ATM SAR Packet buffering, Layer 2 parsing

Software features	<ul style="list-style-type: none"> • Circuit cross-connect for leveraging ATM access networks • User-configurable virtual circuit (VC) and virtual path (VP) support • Support for idle cell or unassigned cell transmission • OAM fault management processes alarm indication signal (AIS), remote defect indication (RDI), and loop cells • Point-to-point and point-to-multipoint mode Layer 2 counters per VC and per VP • Local and remote loopback • ATM Inverse ARP, which enables routers to automatically learn the IP address of the router on the far end of an ATM PVC • Simple Network Management Protocol (SNMP): <ul style="list-style-type: none"> • Management Information Base (MIB) 2 (RFC 1213) • ATM MIB (RFC 1695) • SONET MIB • Unspecified bit rate (UBR), non-real-time variable bit rate (VBR), and constant bit rate (CBR) traffic shaping • Per-VC or per-VP traffic shaping • Support for F4 OAM cells • Support for 16-bit VCI range
Cables and connectors	<ul style="list-style-type: none"> • Duplex SC/PC connector (Rx and Tx) • SONET/SDH OC12/STM4 fixed transceivers: <ul style="list-style-type: none"> • Multimode • Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

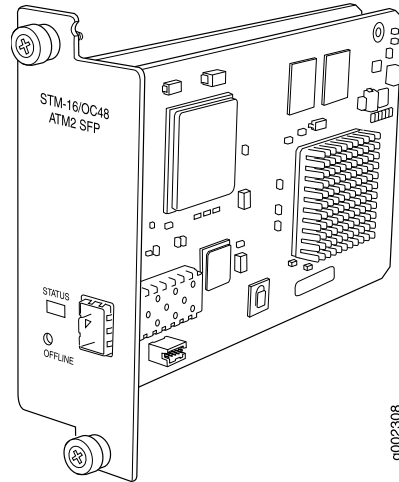
Alarms, errors, and events

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate— signal fail (BERR-SF)
- Loss of cell delineation (LOC)
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Error detection:
 - Bit interleaved parity errors B1, B2, B3
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

ATM2 OC48/STM16 IQ PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 7.3 and later (Type 2) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One OC48 port Power requirement: 0.41 A @ 48 V (20 W) Fine-grained queuing per logical interface Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 Complies with ATM and SONET/SDH standards Alarm and event counting and detection Compatible with well-known ATM switches ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches
Hardware features	<ul style="list-style-type: none"> ATM2 IQ 1-port OC48 PICs have one 3010 SAR for segmentation and reassembly into 53-byte ATM cells. High-performance parsing of SONET/SDH frames ASIC-based packet segmentation and reassembly (SAR) management and output port queuing 64-MB SDRAM memory for ATM SAR Packet buffering, Layer 2 parsing Model number: PB-1OC48-ATM2-SFP

Software features	<ul style="list-style-type: none">• Multiprotocol Label Switching (MPLS) circuit cross-connect for leveraging ATM access networks• User-configurable virtual circuit (VC) and virtual path (VP) support• Support for idle cell or unassigned cell transmission• OAM fault management processes alarm indication signal (AIS), remote defect indication (RDI), and loop cells• Point-to-point and point-to-multipoint mode Layer 2 counters per VC and per VP• Local and remote loopback• ATM Inverse ARP, which enables routers to automatically learn the IP address of the router on the far end of an ATM PVC• Simple Network Management Protocol (SNMP):<ul style="list-style-type: none">• Management Information Base (MIB) 2 (RFC 1213)• ATM MIB (RFC 1695)• SONET MIB• Unspecified bit rate (UBR), non-real-time variable bit rate (VBR), and constant bit rate (CBR) traffic shaping• Per-VC or per-VP traffic shaping• Support for F4 OAM cells• Support for 16-bit VCI range
Cables and connectors	<ul style="list-style-type: none">• Duplex LC/PC connector (RX and TX)• SONET/SDH OC48/STM16 fiber-optic SFPs:<ul style="list-style-type: none">• Intermediate reach (IR-1) (model number: SFP-1OC48-IR)Optical interface specifications—see “SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28
LEDs	One tricolor per port: <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate— signal fail (BERR-SF)
- Loss of cell delineation (LOC)
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Error detection:
 - Bit interleaved parity errors B1, B2, B3
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

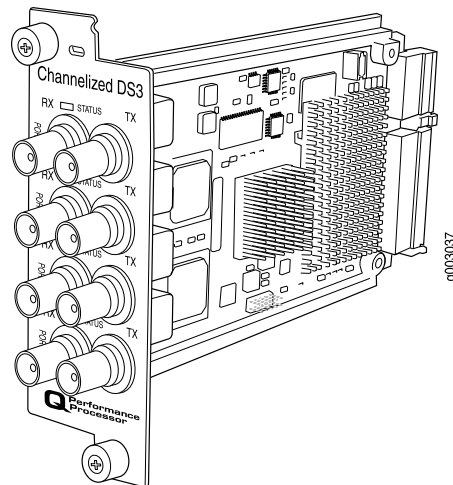
- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 5

Channelized IQ PIC Descriptions

- Channelized DS3 IQ PIC (M320 Router) on page 57
- Channelized E1 IQ PIC (M320 Router) on page 59
- Channelized OC3 IQ PIC (M320 Router) on page 61
- Channelized STM1 IQ PIC (M320 Router) on page 64
- Channelized T1 IQ PIC (M320 Router) on page 66

Channelized DS3 IQ PIC (M320 Router)

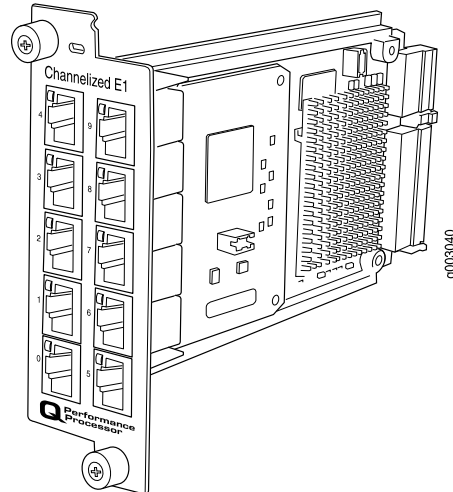


Software release	<ul style="list-style-type: none">• Junos OS Release 6.2 and later (Type 1) For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.
Description	<ul style="list-style-type: none">• Four DS3 ports• Power requirement: 0.32 A @ 48 V (15.6 W)• Fine-grained queuing per logical interface• Channelization: DS3, DS1, DS0• Model number: PB-4CHDS3-QPP

Hardware features	<ul style="list-style-type: none">• Data service unit (DSU) functionality• Subrate and scrambling:<ul style="list-style-type: none">• Digital Link/Quick Eagle• Kentrox• Larscom• ADTRAN• Verilink• B3ZS line encoding• M13 or C-bit parity• Full bit error rate test (BERT)• Local and remote loopback testing
Software features	<ul style="list-style-type: none">• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)• Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB• Dynamic, arbitrary channel configuration• Encapsulations:<ul style="list-style-type: none">• Circuit cross-connect (CCC)• Translational cross-connect (TCC)• Frame Relay• High-Level Data Link Control (HDLC)• Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none">• Standard DS3 BNC coaxial cable interfaces
LEDs	One tricolor per port: <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none">• Alarm indication signal (AIS)• Excessive zeros (EXZ)• Far-end block error (FEBE)• Frame error• Idle code, Idle received• Line code violation (LCV)• Loss of signal (LOS)• Out of frame (OOF)• Parity bit (P-bit) disagreements• Path parity error• Yellow alarm bit (X-bit) disagreements
Instrumentation (counters)	<ul style="list-style-type: none">• Layer 2 per-queue and per-channel packet and byte counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Channelized E1 IQ PIC (M320 Router)

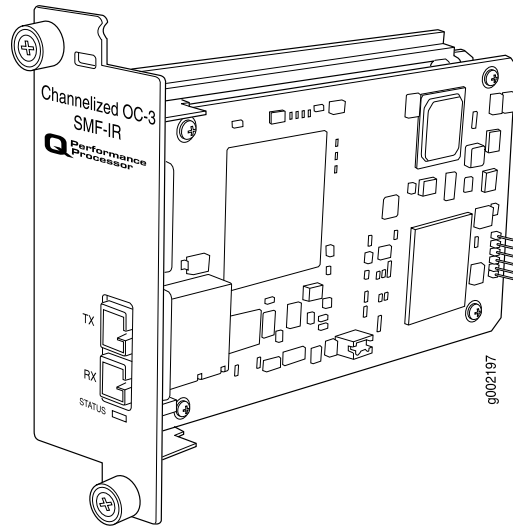


Software release	<ul style="list-style-type: none"> • PB-10CHE1-RJ48-QPP-N: Junos OS Release 9.1R4, 9.2R3, 9.3R1 and later For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15. • PB-10CHE1-RJ48-QPP: Junos OS Release 6.2 and later Type 1 End-of-life (see notification PSN-2013-03-892)
Description	<ul style="list-style-type: none"> • Ten E1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Fine-grained queuing per logical interface • Channelization: E1, DS0 • Model number: PB-10CHE1-RJ48-QPP-N • EOL Model number: PB-10CHE1-RJ48-QPP
Hardware features	<ul style="list-style-type: none"> • Data service unit (DSU) functionality • Ports configurable as clear channel E1 interfaces with 2.048-Mbps connectivity • Supports unframed E1 G.703 and G.704 framing modes • Supports HDB3 line coding • CRC4 configurable • Local and remote loopback testing

Software features	<ul style="list-style-type: none"> Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) Simple Network Management Protocol (SNMP): E1 MIB, DSO MIB Dynamic, arbitrary channel configuration Full bit error rate test (BERT) Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Frame Relay High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> 120-ohm RJ-48C
LEDs	<p>One bicolor per E1 port:</p> <ul style="list-style-type: none"> Off—Port not enabled Green—Physical E1 link is up; individual subchannels can be down Red—Physical E1 link is down
Alarms, errors, and events	<ul style="list-style-type: none"> Alarm indication signal (AIS) Loss of frame (LOF) Out of frame (OOF) Failed signal rate (FSR)
Instrumentation (counters)	<ul style="list-style-type: none"> Layer 2 per-queue and per-channel packet and byte counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Channelized OC3 IQ PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 7.1 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One OC3 port Power requirement: 0.39 A @ 48 V (18.6 W) Fine-grained queuing per logical interface Channelization: DS3, DS1, DS0 Model number: PB-1CHOC3-SMIR-QPP
Hardware features	<ul style="list-style-type: none"> Subrate and scrambling: <ul style="list-style-type: none"> Digital Link/Quick Eagle Kentrox Larscom ADTRAN Verilink Packet buffering, Layer 2 parsing M13/C-bit parity encoding DS3 far-end alarm and control (FEAC) channel support Local and remote loopback testing

- Software features
- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
 - Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
 - Dynamic, arbitrary channel configuration
 - Full bit error rate test (BERT)
 - Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Frame Relay
 - High-Level Data Link Control (HDLC)
 - Point-to-Point Protocol (PPP)

- Cables and connectors
- Duplex SC/PC connector (Rx and Tx); single-mode fiber intermediate-reach fiber
 - SONET/SDH OC3/STMI fiber-optic SFPs:
 - Multimode (model number: SFP-OC3-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC3-IR)
 - Long reach (IR-1) (model number: SFP-OC3-LR)
- Optical interface specifications—see [“SONET/SDH OC3/STMI Optical Interface Specifications” on page 25](#)

- LEDs
- One tricolor per port:
- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure
-

Alarms, errors, and events

Alarms:

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate signal degrade (BERR-SD)
- Bit error rate signal fail (BERR-SF)
- Idle code, idle received
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Out of frame (OOF)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Parity bit (P-bit) disagreements
- Path parity error
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Yellow alarm bit (X-bit) disagreements

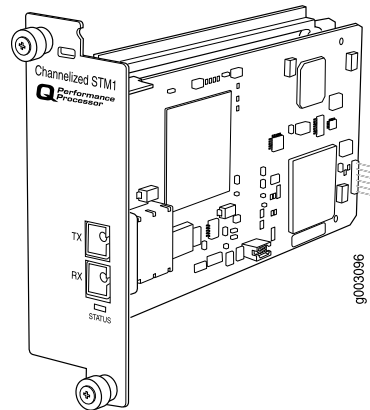
Error detection:

- Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)
- Errored seconds (ES-S, ES-L, ES-P)
- Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
- Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
- Far-end block error (FEBE)
- Far-end errored seconds (ES-LFE, ES-PFE)
- Far-end severely errored seconds (SES-LFE, SES-PFE)
- Far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Frame error
- Severely errored frames (SEF)
- Severely errored framing seconds (SEFS-S)
- Severely errored seconds (SES-S, SES-L, SES-P)
- Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Channelized STM1 IQ PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One STM1 port Power requirement: 0.39 A @ 48 V (18.6 W) Fine-grained queuing per logical interface Channelization: STM1c, fractional E1, framed and unframed DS0 Model number: PB-1CHSTM1-SMIR-QPP
Hardware features	<ul style="list-style-type: none"> Packet buffering, Layer 2 parsing Local and remote loopback testing
Software features	<ul style="list-style-type: none"> Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) SNMP: SONET/SDH MIB, T1/E1 MIB Dynamic, arbitrary channel configuration Full bit error rate test (BERT) patterns at E1 and DS0 levels Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> Duplex SC/PC connector (Rx and Tx); single-mode intermediate-reach fiber
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> Off—Not enabled Green—Online with no alarms or failures Yellow—Online with alarms for remote failures Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)

Error detection:

- Errored seconds (ES-S, ES-L, ES-P)
- Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
- Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
- Far-end errored seconds (ES-LFE, ES-PFE)
- Far-end severely errored seconds (SES-LFE, SES-PFE)
- Far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored frames (SEF)
- Severely errored framing seconds (SEFS-S)
- Severely errored seconds (SES-S, SES-L, SES-P)
- Unavailable seconds (UAS-L, UAS-P)

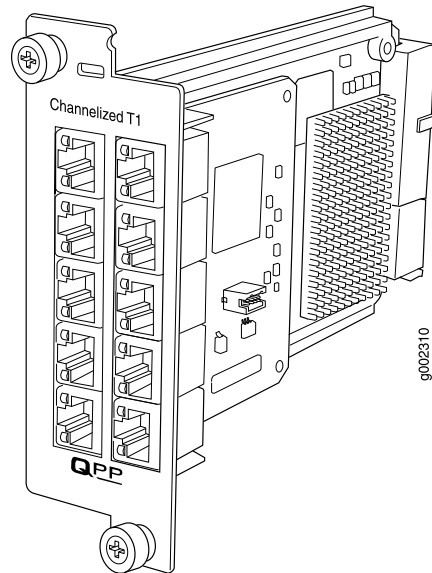
Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Channelized T1 IQ PIC (M320 Router)



Software release	<ul style="list-style-type: none">• Junos OS Release 7.4 and later (Type 1) For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.
Description	<ul style="list-style-type: none">• Ten T1 ports• Power requirement: 0.15 A @ 48 V (7.2 W)• Fine-grained queuing per logical interface• Channelization: T1, FT1, NxDS0• Model number: PB-10CHST1-RJ48-QPP

Hardware features	<ul style="list-style-type: none"> • Data service unit (DSU) and channel service unit (CSU) functionality • Ports configurable as clear channel T1 interfaces with 1.544-Mbps connectivity • Framing: Superframe (SF or D4) and Extended Superframe (ESF) • Supports B8ZS (bipolar 8-zero substitution) and AMI (alternate mark inversion) line coding • Local, remote, and payload loopback testing • ANSI T1.403 loopback support: <ul style="list-style-type: none"> • Responds to embedded loopback commands upon receipt of an FDL command from remote end with loopup and loopdown at both line and payload level • Insertion of loopback commands enables remote CSU/NIU/Smartjack to enter loopback and loopdown at both the line and payload level (ANSI and Telcordia) • Inband loopback support: <ul style="list-style-type: none"> • Responds to inband loopback commands at both the line and payload level (ANSI and Telcordia) • Insertion of inband loopback commands at both the line and payload level (ANSI and Telcordia) • Clocking support of external (line) and internal • Buildout support of the following ranges: <ul style="list-style-type: none"> • 0 through 132 (Line buildout is from 1 through 132 feet) • 133 through 265 (Line buildout is from 133 through 265 feet) • 266 through 398 (Line buildout is from 266 through 398 feet) • 399 through 531 (Line buildout is from 399 through 531 feet) • 532 through 655 (Line buildout is from 532 through 655 feet)
Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • SNMP: T1 MIB and DS0 MIB • Dynamic, arbitrary channel configuration • Full bit error rate test (BERT) patterns at T1 and DS0 levels • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> • 120-ohm RJ-48C connector (female)
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events**Alarms:**

- Alarm indication signal (AIS)
- Bipolar violation (BPV)
- Excessive zero (EXZ)
- Line code violation (LCV)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Remote defect indication (RDI)

Error detection:

- Error seconds (ES)
- Severely errored seconds (SES)
- Severely errored frames (SEF)
- Bit error event (BEE)

Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters
 - 24-hour history or error counter updated at 15-minute intervals
-

Related Documentation

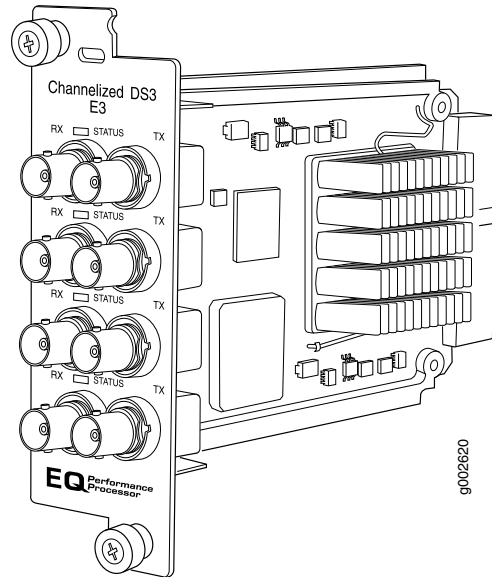
- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 6

Channelized Enhanced IQ (IQE) PIC Descriptions

- Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router) on page 70
- Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router) on page 73
- Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 76
- Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 80
- Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 85

Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.3 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Four E3 or Channelized DS3 ports E3 or Channelized DS3 is configurable on a per-port granularity DS3 channelization: <ul style="list-style-type: none"> 4 DS3 channels 112 DS1 channels 1011 DS0 channels Power requirement: 0.53 A @ 48 V (25.4 W) Model number: PB-4CHDS3-E3-IQE-BNC
Hardware features	<ul style="list-style-type: none"> Ports are numbered 0 through 3 top to bottom
Software features	<ul style="list-style-type: none"> Maximum transmission units (MTUs) of up to 9000 bytes Dynamic, arbitrary channel configuration Subrate and scrambling: <p>NOTE: Only DS3 supports subrate and scrambling.</p> <ul style="list-style-type: none"> Digital Link/Quick Eagle Kentrox Larscom ADTRAN Verilink (subrate: only port A mode) <p>NOTE: For DS3 interfaces, Verilink does not function if an IQE interface is paired with an IQ interface.</p>

- Data service unit (DSU) functionality
- B3ZS line encoding
- Framing: M13, C-bit parity, framed clear channel
- Full bit error rate test (BERT) for DS0, DS1, and DS3
- ANSI T1.403 FDL
- Internal and loop clocking for DS3 and DS1
- DS3 far end alarm and control (FEAC) channel
- Local line, remote line, and remote playback loopback testing for each DS3 and DS1 channel
- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
- Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
- Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB
- Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Extended Frame Relay for CCC and TCC
 - Flexible Frame Relay
 - Frame Relay
 - Frame Relay for CCC
 - Frame Relay for TCC
 - Frame Relay port CCC
 - High-Level Data Link Control (HDLC)
 - HDLC framing for CCC
 - HDLC framing for TCC
 - MPLS CCC
 - MPLS TCC
 - Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
 - Point-to-Point Protocol (PPP)
 - PPP for CCC
 - PPP for TCC

Cables and connectors	<ul style="list-style-type: none"> • Standard DS3 BNC coaxial cable interfaces
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LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
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Alarms, errors, and events

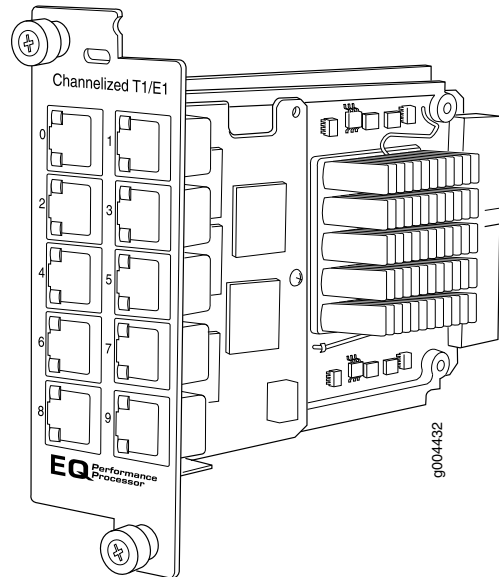
- Alarm reporting for error statistics and failure counts
- DS1 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Remote alarm indication signal (RAIS)
- DS1 error detection:
 - Bursty errored seconds (BES)
 - CRC errors
 - Errored seconds (ES)
 - Line errored seconds (LES)
 - Loss of framing seconds (LOFS)
 - Loss of signal seconds (LOS)
 - Severely errored seconds (SES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)
- DS3 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Phase lock loop (PLL)
 - Yellow alarm
- DS3 error detection:
 - When running bit error rate test (BERT) on 4-port CHDS3/E3 IQE PICs, where DS3/E3 is not SONET/SDH mapped, the LOF is reported and errors can be seen on the remote side. Both local and remote ends are C-bit framed and do not show errors when the bit error rate test is not running. When the bit error rate test is begun, framing mode on the local interface is set to unframed while the remote interface is still set to C-bit. This behavior is expected the 4-port CHDS3/E3 IQE PICs since Amur Framing does not support framed bit error rate testing.
 - C-bit code violations (CCV)
 - C-bit errored seconds (CES)
 - C-bit severely errored framing seconds (CEFS)
 - CRC errors
 - Excessive zeros (EXZ)
 - Far-end block error (FEBE)
Upon initiation of the FEAC loop from the local port to the remote port, far-end block errors (FEBEs) are detected in the remote port statistics, this is expected behavior and these errors should be suppressed.
 - Far-end receive failure (FERF)
 - Line errored seconds (LES)
 - Parity bit (P-bit) code violations (PCV)
 - Parity bit (P-bit) errored seconds (PES)
 - Parity bit (P-bit) severely errored framing seconds (PSES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)

Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 9.5 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Ten E1 or T1 ports • DS1 and E1 interfaces are selectable on a per-port granularity • E1 channelization per PIC: <ul style="list-style-type: none"> • 10 E1 channels • 310 DS0 channels • T1 channelization per PIC: <ul style="list-style-type: none"> • 10 T1 channels • 240 DS0 channels • Power requirement: 0.52 A @ 48 V (24.73 W) • Model number: PB-10CHE1-T1-IQE-RJ48

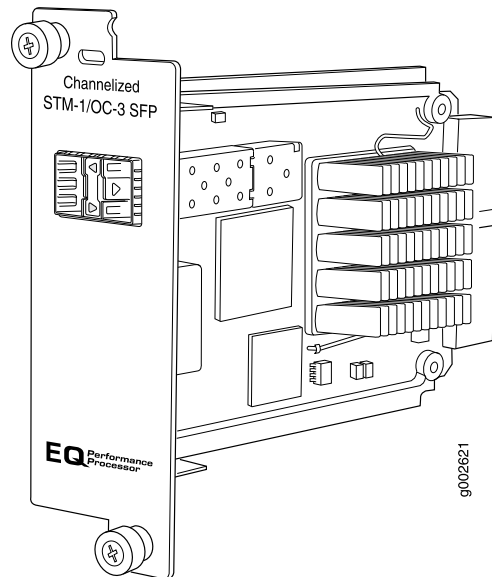
Hardware features	<p>Ports are numbered:</p> <ul style="list-style-type: none">• Top row: 0 and 1 from left to right• Second row: 2 and 3 from left to right• Third row: 3 and 4 from left to right• Bottom row: 5 and 6 from left to right
Software features	<ul style="list-style-type: none">• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)• Enhanced fine-grained queuing per logical interface. See the <i>Class of Service Feature Guide for Routing Devices and EX9200 Switches</i> for more information about class of service features.• Support sending and receiving in-band loopback codes in both framed and unframed mode:<ul style="list-style-type: none">• Framed in-band loopback at CSU• Framed in-band loopback at Smartjack (ANSI)• Unframed in-band loopback at CSU• Unframed in-band loopback at Smartjack (ANSI)• You can configure the following framing modes using the CLI:<ul style="list-style-type: none">• T1—SF (D4/superframe), ESF (extended superframe)• E1—G704, G704—no-crc4, unframed• Packet buffering, Layer 2 parsing• Local line, remote line, and remote payload loopback testing; each channel can be looped individually and independently of other channels (DS1/E1 channels)• Simple Network Management Protocol (SNMP): T1 MIB (RFC 1406)• Dynamic, arbitrary channel configuration• Full bit error rate test (BERT)• Clocking: internal and loop (clock recovered from network and use for transmit). Internal timing is the default for channelized T1 ports. The external master clock can be a multiple of 2.048 MHz or 1.544 MHz for E1 or T1 operation.• Line coding:<ul style="list-style-type: none">• T1—CLI configurable as AMI or B8ZS• E1—HDB3• Encapsulations:<ul style="list-style-type: none">• Circuit cross-connect (CCC)• Translational cross-connect (TCC)• Extended Frame Relay for CCC and TCC• Flexible Frame Relay• Frame Relay• Frame Relay for CCC• Frame Relay for TCC• Frame Relay port CCC• High-Level Data Link Control (HDLC)• HDLC framing for CCC• HDLC framing for TCC• MPLS CCC• MPLS TCC• Point-to-Point Protocol (PPP)• PPP for CCC• PPP for TCC

- Encapsulations available only for DS0 and DS1:
 - Multilink Frame Relay end-to-end (MLFR FRF.15)
 - Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
 - Multilink PPP (MLPPP)
- Encapsulations available only for DS1:
 - PPP over Frame Relay

Cables and connectors	<ul style="list-style-type: none"> • 120-ohm RJ-48C connector (female)
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • DS1 alarms: <ul style="list-style-type: none"> • Alarm indication signal (AIS) • Loss of frame (LOF) • Remote alarm indication signal (RAIS) • 24-hour alarm reporting history maintained for error statistics and failure counts, 15-minute intervals on all errors • DS1 error detection: <ul style="list-style-type: none"> • Bursty errored seconds (BES) • CRC errors • Errored seconds (ES) • Line errored seconds (LES) • Loss of framing seconds (LOFS) • Loss of signal seconds (LOSS) • Severely errored seconds (SES) • Severely errored framing seconds (SEFS) • Unavailable seconds (UAS)
Instrumentation (counters)	<ul style="list-style-type: none"> • Layer 2 per-queue and per-channel packet and byte counters • Layer 2 per-queue and per-channel packet and byte drop counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.3 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Two OC3 or STM1 ports SONET or SDH is configurable on a per-port granularity Channelization: OC3, DS3, DS1, DS0, E3, E1 SONET channelization: <ul style="list-style-type: none"> 2 OC3 channels 6 DS3 channels 168 DS1 channels 1011 DS0 channels SDH channelization: <ul style="list-style-type: none"> 2 STM1 channels (non-concatenated) 6 E3 channels 126 E1 channels 6 DS3 channels (Junos OS Release 10.1 and later) 168 DS1 channels (Junos OS Release 10.1 and later) 1011 DS0 channels Power requirement: 0.56 A @ 48 V (27.1 W) Model number: PB-2CHOC3-STM1-IQE-SFP
Hardware features	<ul style="list-style-type: none"> Ports are numbered 0 and 1 from left to right

- Software features
- Dynamic, arbitrary channel configuration
 - Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
 - Enhanced fine-grained queuing per logical interface. See the *Junos Class of Service Configuration Guide* for more information about class of service features.
 - Subrate and scrambling:
 - Digital Link/Quick Eagle
 - Kentrox
 - Larscom
 - ADTRAN
 - Verilink
 - Packet buffering, Layer 2 parsing
 - M13/C-bit parity encoding
 - DS3 far-end alarm and control (FEAC) channel support
 - Local line, remote line, and remote payload loopback testing
 - Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
 - Full bit error rate test (BERT)
 - Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Extended Frame Relay for CCC and TCC
 - Flexible Frame Relay
 - Frame Relay
 - Frame Relay for CCC
 - Frame Relay for TCC
 - Frame Relay port CCC
 - High-Level Data Link Control (HDLC)
 - HDLC framing for CCC
 - HDLC framing for TCC
 - MPLS CCC
 - MPLS TCC
 - Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
 - Point-to-Point Protocol (PPP)
 - PPP for CCC
 - PPP for TCC
 - Encapsulations available only for DSI:
 - Multilink Frame Relay end-to-end (MLFR FRF.15)
 - Multilink PPP (MLPPP)
 - PPP over Frame Relay

- Cables and connectors
- Duplex LC/PC connector (Rx and Tx)
 - SONET/SDH OC3/STM1 fiber-optic SFPs:
 - Multimode (model number: SFP-OC3-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC3-IR)
 - Long reach (IR-1) (model number: SFP-OC3-LR)
- Optical interface specifications—see “[SONET/SDH OC3/STM1 Optical Interface Specifications](#)” on page 25

LEDs

One tricolor Status LED per port:

- Off—Not enabled.
- Green—Online with no alarms or failures.
- Yellow—Online with alarms for remote failures.
- Red—Active with a local alarm; router has detected a failure.

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of pointer (LOP)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
 - Remote error indication (REI)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Virtual container—alarm indication signal (VAIS)
 - Virtual container—loss of pointer (VLOP)
 - Virtual container—mismatch (VMIS)
 - Virtual container—remote defect indication (VRDI)
 - Virtual container—unequipped (VUNEQ)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—alarm indication signal (HP-AIS)
 - Higher order path—far-end receive failure (HP-FERF)
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—far-end receive failure (MS-FERF)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
 - Phase lock loop (PLL)
 - Remote error indication (REI)
 - Severely errored frames (SEF)

- Tributary unit—alarm indication signal (TU-AIS)
- Tributary unit—loss of clock (TU-LOC)
- Tributary unit—loss of pointer (TU-LOP)
- Tributary unit—mismatch (TU-MIS)
- Tributary unit—remote defect indication (TU-RD1)
- Tributary unit—unequipped (TU-UNEQ)
- DS1 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Remote alarm indication signal (RAIS)
- DS1 error detection:
 - Bursty errored seconds (BES)
 - CRC errors
 - Errored seconds (ES)
 - Line errored seconds (LES)
 - Loss of framing seconds (LOFS)
 - Loss of signal seconds (LOS)
 - Severely errored seconds (SES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)
- DS3 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Yellow alarm
- DS3 error detection:
 - C-bit code violations (CCV)
 - C-bit errored seconds (CES)
 - C-bit severely errored framing seconds (CEFS)
 - CRC errors
 - Excessive zeros (EXZ)
 - Far-end block error (FEBE)
 - Far-end receive failure (FERF)
 - Line errored seconds (LES)
 - Parity bit (P-bit) code violations (PCV)
 - Parity bit (P-bit) errored seconds (PES)
 - Parity bit (P-bit) severely errored framing seconds (PSES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Channelized OC12/STM4 Enhanced IQE (IQE) PIC with SFP (M320 Router)

Figure 5: 1-Port IQE PIC

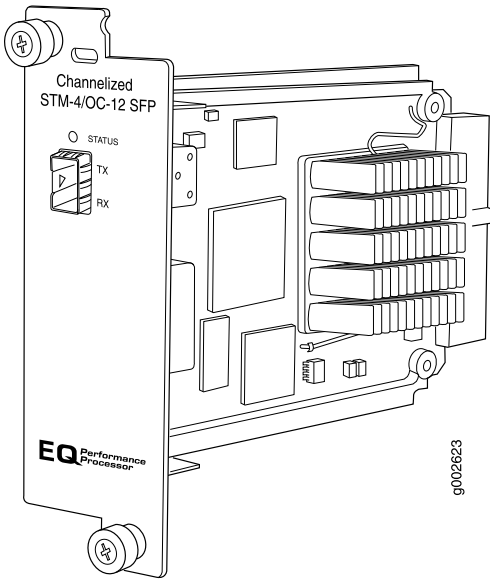
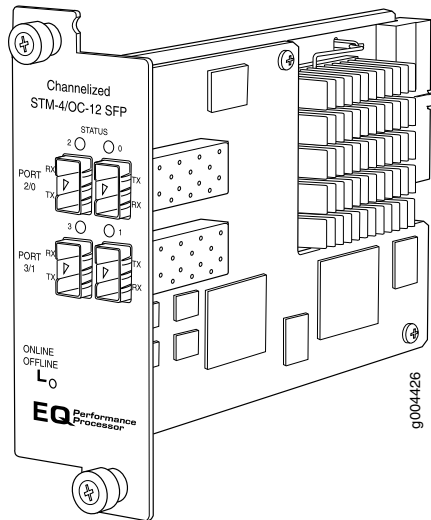


Figure 6: 4-Port IQE PIC



Software release

- 1-port: Junos OS Release 9.3 and later (Type 1)
- 4-port: Junos OS Release 9.4 and later (Type 2)

For information on which FPCs support these PICs, see [“M320 PIC/FPC Compatibility”](#) on page 15.

Description

- One or four OC12/STM4 ports
- SONET or SDH is configurable on a per-port granularity
- SONET channelization (1-port PIC):
 - 1 OC12 channel
 - 4 OC3 channels
 - 12 DS3 channels
 - 336 DS1 channels
 - 1011 DS0 channels
- SDH channelization (1-port PIC):
 - 1 STM4 channel
 - 4 STM1 channels
 - 12 E3 channels
 - 252 E1 channels
 - 12 DS3 channels (Junos OS Release 10.1 and later)
 - 336 DS1 channels (Junos OS Release 10.1 and later)
 - 1011 DS0 channels
- SONET channelization (4-port PIC):
 - 4 OC12 channel
 - 16 OC3 channels

- 48 DS3 channels
- 672 DS1 channels
- 974 DS0 channels
- SDH channelization (4-port PIC):
 - 4 STM4 channel
 - 16 STM1 channels
 - 48 E3 channels
 - 504 E1 channels
 - 48 DS3 channels (Junos OS Release 10.1 and later)
 - 672 DS1 channels (Junos OS Release 10.1 and later)
 - 974 DS0 channels
- Power requirement:
 - 1-port: 0.64 A @ -48 V (30.7 W)
 - 4-port: 1.08 A @ -48V (52 W)
- Model number for 1-Port IQE PIC: PB-1CHOC12-STM4-IQE-SFP
Model number for 4-Port IQE PIC: PB-4CHOC12-STM4-IQE-SFP

Hardware features	<ul style="list-style-type: none"> • 1-port: Port is numbered 0. • 4-port: Ports are numbered: <ul style="list-style-type: none"> • Top row: 2 and 0 from left to right • Bottom row: 3 and 1 from left to right
Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Enhanced fine-grained queuing per logical interface. See the <i>Class of Service Feature Guide for Routing Devices and EX9200 Switches</i> for more information about class of service features. • Subrate and scrambling: <ul style="list-style-type: none"> • Digital Link/Quick Eagle • Kentrox • Larscom • ADTRAN • Verilink • Packet buffering, Layer 2 parsing • M13/C-bit parity encoding • DS3 far-end alarm and control (FEAC) channel support • Local line, remote line, and remote payload loopback testing • Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB • Dynamic, arbitrary channel configuration • Full bit error rate test (BERT) • Encapsulations: <ul style="list-style-type: none"> • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Extended Frame Relay for CCC and TCC • Flexible Frame Relay • Frame Relay • Frame Relay for CCC • Frame Relay for TCC

- Frame Relay port CCC
- High-Level Data Link Control (HDLC)
- HDLC framing for CCC
- HDLC framing for TCC
- MPLS CCC
- MPLS TCC
- Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
- Point-to-Point Protocol (PPP)
- PPP for CCC
- PPP for TCC
- Encapsulations available only for DSI:
 - Multilink Frame Relay end-to-end (MLFR FRF.15)
 - Multilink PPP (MLPPP)
 - PPP over Frame Relay

Cables and connectors	<ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx); single-mode fiber • SONET/SDH OC12/STM4 fiber-optic SFP transceivers: <ul style="list-style-type: none"> • Short reach (model number: SFP-OC12-SR) • Intermediate reach (IR-1) (model number: SFP-OC12-IR) • Long reach (LR-1) (model number: SFP-OC12-LR) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
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LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
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Alarms, errors, and events	<ul style="list-style-type: none"> • SONET alarms: <ul style="list-style-type: none"> • Alarm indication signal—line (AIS-L) • Alarm indication signal—path (AIS-P) • Bit error rate—signal degrade (BERR-SD) • Bit error rate—signal fail (BERR-SF) • Loss of frame (LOF) • Loss of light (LOL) • Loss of pointer (LOP) • Loss of signal (LOS) • Payload label mismatch (PLM-P) • Remote defect indication—line (RDI-L) • Remote defect indication—path (RDI-P) • Remote error indication (REI) • Payload unequipped (unequipped STS at path level) (UNEQ-P) • Virtual container—alarm indication signal (VAIS) • Virtual container—loss of pointer (VLOP) • Virtual container—mismatch (VMIS)
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- Virtual container—remote defect indication (VRD1)
- Virtual container—unequipped (VUNEQ)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—alarm indication signal (HP-AIS)
 - Higher order path—far-end receive failure (HP-FERF)
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—far-end receive failure (MS-FERF)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
 - Phase lock loop (PLL)
 - Remote error indication (REI)
 - Severely errored frame (SEF)
 - Tributary unit—alarm indication signal (TU-AIS)
 - Tributary unit—loss of pointer (TU-LOP)
 - Tributary unit—mismatch (TU-MIS)
 - Tributary unit—remote defect indication (TU-RDI)
 - Tributary unit—unequipped (TU-UNEQ)
- DS1 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Remote alarm indication signal (RAIS)
- DS1 error detection:
 - Bursty errored seconds (BES)
 - CRC errors
 - Errored seconds (ES)
 - Line errored seconds (LES)
 - Loss of framing seconds (LOFS)
 - Severely errored seconds (SES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)
- DS3 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Yellow alarm

- DS3 error detection:
 - C-bit code violations (CCV)
 - C-bit errored seconds (CES)
 - C-bit severely errored framing seconds (CEFS)
 - CRC errors
 - Excessive zeros (EXZ)
 - Far-end block error (FEBE)
 - Far-end receive failure (FERF)
 - Line errored seconds (LES)
 - Parity bit (P-bit) code violations (PCV)
 - Parity bit (P-bit) errored seconds (PES)
 - Parity bit (P-bit) severely errored framing seconds (PSES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)

Instrumentation
(counters)

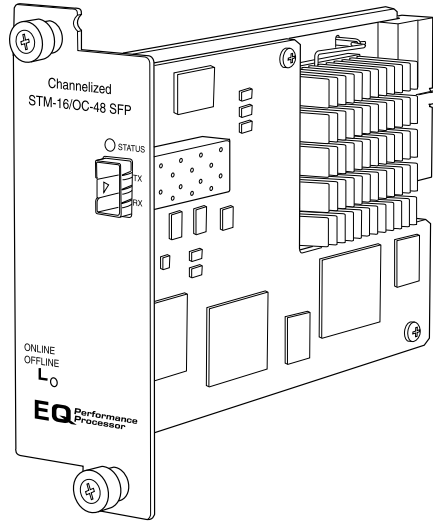
- Layer 2 per-queue and per-channel packet and byte counters

Table 44: PICs Supported in Fourth Slot of M320-FPC2-E2 and M320-FPC2-E3 with Type 2 IQE PICs on M320 Routers

PIC Name	PIC Model Number
Gigabit Ethernet, 2-port SFP	PB-2GE-SFP
Gigabit Ethernet, 4-port SFP	PB-4GE-SFP
Gigabit Ethernet IQ, 2-port SFP	PB-2GE-SFP-QPP
SONET/SDH OC12c/STM4, 4-port with multimode transceivers installed	PB-4OC12-SON-MM
SONET/SDH OC12c/STM4, 4-port with single-mode intermediate reach transceivers installed	PB-4OC12-SON-SMIR
SONET/SDH OC48/STM16, 1-port SFP	PB-1OC48-SON-SFP
Tunnel Services	PB-TUNNEL

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.4 and later (Type 2) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One OC48/STM16 port SONET or SDH is configurable on a per-port granularity SONET channelization: <ul style="list-style-type: none"> 4 OC12 channels 16 OC3 channels 48 DS3 channels 672 DS1 channels 975 DS0 channels SDH channelization: <ul style="list-style-type: none"> 4 STM4 channels 16 STM1 channels 48 E3 channels 504 E1 channels 48 DS3 channels 672 DS1 channels 975 DS0 channels Power requirement: 1.10 A @ 48V (53 W) Model number: PB-1CHOC48-STM16-IQE-SFP
Hardware features	<ul style="list-style-type: none"> Port is numbered 0.

- Software features
- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
 - Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
 - Subrate and scrambling:
 - Digital Link/Quick Eagle
 - Kentrox
 - Larscom
 - ADTRAN
 - Verilink
 - Packet buffering, Layer 2 parsing
 - M13/C-bit parity encoding
 - DS3 far-end alarm and control (FEAC) channel support
 - Local line, remote line, and remote payload loopback testing
 - Simple Network Management Protocol (SNMP): OC12, OC3 MIB, DS3 MIB, T1 MIB
 - Dynamic, arbitrary channel configuration
 - Full bit error rate test (BERT)
 - Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Extended Frame Relay for CCC and TCC
 - Flexible Frame Relay
 - Frame Relay
 - Frame Relay for CCC
 - Frame Relay for TCC
 - Frame Relay port CCC
 - High-Level Data Link Control (HDLC)
 - HDLC framing for CCC
 - HDLC framing for TCC
 - MPLS CCC
 - MPLS TCC
 - Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
 - Point-to-Point Protocol (PPP)
 - PPP for CCC
 - PPP for TCC
 - Encapsulations available only for DS1:
 - Multilink Frame Relay end-to-end (MLFR FRF.15)
 - Multilink PPP (MLPPP)
 - PPP over Frame Relay

- Cables and connectors
- Duplex LC connector (Rx and Tx); single-mode fiber
 - SONET/SDH OC48/STM16 fiber-optic SFP transceivers:
 - Short reach (SR-1) (model number: SFP-1OC48-SR)
 - Intermediate reach (IR-1) (model number: SFP-1OC48-IR)
 - Long reach (LR-1) (model number: SFP-1OC48-LR)
- Optical interface specifications—see [“SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28](#)

LEDs

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of pointer (LOP)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
 - Remote error indication (REI)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Virtual container—alarm indication signal (VAIS)
 - Virtual container—loss of pointer (VLOP)
 - Virtual container—mismatch (VMIS)
 - Virtual container—remote defect indication (VRDI)
 - Virtual container—unequipped (VUNEQ)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—alarm indication signal (HP-AIS)
 - Higher order path—far-end receive failure (HP-FERF)
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—far-end receive failure (MS-FERF)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
 - Phase lock loop (PLL)
 - Remote error indication (REI)
 - Severely errored frame (SEF)
 - Tributary unit—alarm indication signal (TU-AIS)

- Tributary unit—loss of pointer (TU-LOP)
- Tributary unit—mismatch (TU-MIS)
- Tributary unit—remote defect indication (TU-RD1)
- Tributary unit—unequipped (TU-UNEQ)
- DS1 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Remote alarm indication signal (RAIS)
- DS1 error detection:
 - Bursty errored seconds (BES)
 - CRC errors
 - Errored seconds (ES)
 - Line errored seconds (LES)
 - Loss of framing seconds (LOFS)
 - Severely errored seconds (SES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)
- DS3 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Yellow alarm
- DS3 error detection:
 - C-bit code violations (CCV)
 - C-bit errored seconds (CES)
 - C-bit severely errored framing seconds (CEFS)
 - CRC errors
 - Excessive zeros (EXZ)
 - Far-end block error (FEBE)
 - Far-end receive failure (FERF)
 - Line errored seconds (LES)
 - Parity bit (P-bit) code violations (PCV)
 - Parity bit (P-bit) errored seconds (PES)
 - Parity bit (P-bit) severely errored framing seconds (PSES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)

Instrumentation
(counters)

- Layer 2 per-queue and per-channel packet and byte counters

Table 45: PICs Supported in Fourth Slot of M320-FPC2-E2 and M320-FPC2-E3 with Type 2 IQE PICs on M320 Routers

PIC Name	PIC Model Number
Gigabit Ethernet, 2-port SFP	PB-2GE-SFP
Gigabit Ethernet, 4-port SFP	PB-4GE-SFP

Table 45: PICs Supported in Fourth Slot of M320-FPC2-E2 and M320-FPC2-E3 with Type 2 IQE PICs on M320 Routers (continued)

PIC Name	PIC Model Number
Gigabit Ethernet IQ, 2-port SFP	PB-2GE-SFP-QPP
SONET/SDH OC12c/STM4, 4-port with multimode transceivers installed	PB-4OC12-SON-MM
SONET/SDH OC12c/STM4, 4-port with single-mode intermediate reach transceivers installed	PB-4OC12-SON-SMIR
SONET/SDH OC48/STM16, 1-port SFP	PB-1OC48-SON-SFP
Tunnel Services	PB-TUNNEL

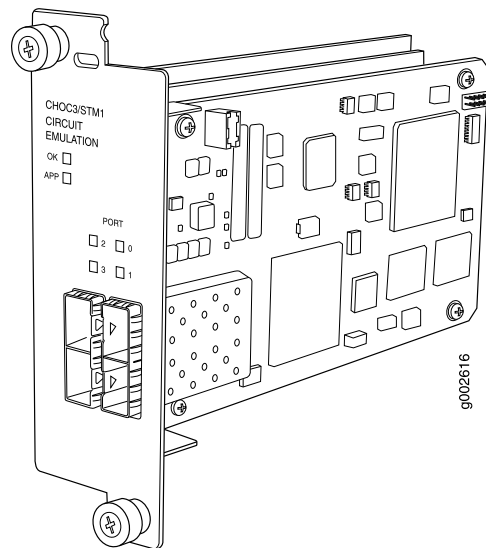
- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

CHAPTER 7

Circuit Emulation PIC Descriptions

- Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router) on page 91
- E1/T1 Circuit Emulation PIC (M320 Router) on page 94

Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none">• Junos OS Release 9.4 and later (Type 1) For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.
Description	<ul style="list-style-type: none">• Four OC3/STM1 ports• Power requirement: 0.52 A @ 48 V (25 W)• Channelization: DS1 Channelization down to E1/T1 Each port can be channelized as 84 T1 ports for a total of 336 T1 pseudowires or 63 E1 ports for a total of 252 pseudowires. <ul style="list-style-type: none">• Model number: PB-4CHOC3-CE-SFP

Hardware features	<ul style="list-style-type: none"> • Subrate and scrambling: <ul style="list-style-type: none"> • Digital Link/Quick Eagle • Kentrox • Larscom • ADTRAN • Verilink • M13/C-bit parity encoding • Local and remote loopback testing
Software features	<ul style="list-style-type: none"> • Loop timing and external timing • Optical diagnostics • AM1 or B8ZS line encoding • APS/SDH MSP • Fractional mode and framed clear channel mode • Superframe (D4/SF) and extended superframe (ESP) framing • Simple Network Management Protocol (SNMP): <ul style="list-style-type: none"> • OC3 MIB • T1 MIB • ATM MIB (Junos OS Release 10.2 and later) • Automatic protection switching (APS) • Dynamic, arbitrary channel configuration • Full bit error rate test (BERT) • Encapsulations: Structure-agnostic time-division multiplexing (TDM) over packet (SAToP) (RFC 4553) • Pseudowire emulation edge-to-edge (PWE3) for ATM (RFC 4717) (Junos OS Release 9.6 and later) • ATM Pseudowire emulation edge-to-edge via dynamic labels (LDP, RSVP-TE) (Junos OS Release 9.6 and later) • Inverse multiplexing (IMA) for ATM (Junos OS Release 10.0 and later) • ATM QoS for the Junos OS Release 10.2 and later: <ul style="list-style-type: none"> • Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping • Unspecified bit rate (UBR) traffic shaping • Fine-grained real-time variable bit rate (rtVBR) and real-time variable bit rate (nrtVBR) traffic shaping • Port-level egress shaping • Constant bit rate (CBR) • Policing on a per virtual circuit basis • Independent peak cell rate (PCR) and sustained cell rate (SCR) policing • Counting, tagging, or discard policing actions
Cables and connectors	<ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx) • SONET/SDH OC3/STM1 fiber-optic SFPs: <ul style="list-style-type: none"> • Multimode (model number: SFP-OC3-SR) • Intermediate reach (IR-1) (model number: SFP-OC3-IR) • Long reach (IR-1) (model number: SFP-OC3-LR) <p>Optical interface specifications—see “SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25</p>

LEDs

OK LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one bicolor:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

Structure-agnostic alarms for T1 interface:

- Alarm indication signal (AIS-L, AIS-P)
- Loss of signal (LOS)
- Errored seconds (ES)
- Line-errored seconds (LES)
- Severely errored seconds (SES)
- Unavailable errored seconds (UAS)
- Bipolar violation (BPV)
- Controlled slip (CS)
- Line code violation (LCV)

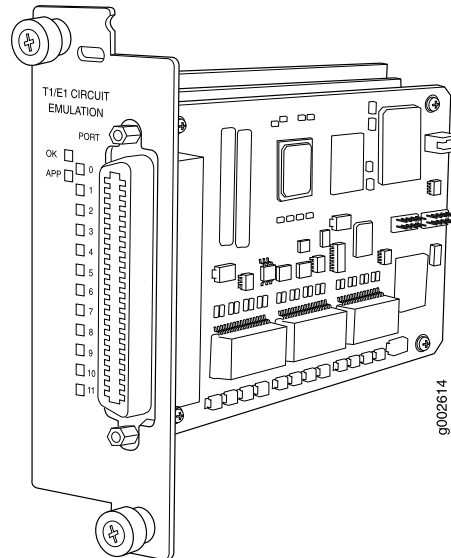
Structure-agnostic alarms for E1 interface:

- Alarm indication signal (AIS-L, AIS-P)
- Loss of signal (LOS)
- Errored seconds (ES)
- Line-errored seconds (LES)
- Severely errored seconds (SES)
- Unavailable errored seconds (UAS)
- Bipolar violation (BPV)
- Controlled slip (CS)
- Line code violation (LCV)

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

E1/T1 Circuit Emulation PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.4 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Configurable as either twelve E1 ports or twelve T1 ports <p>NOTE: Mixing E1 and T1 ports on the same PIC is not supported.</p> <ul style="list-style-type: none"> Power requirement: 0.52 A @ 48 V (25 W) Onboard DSU functionality for E1 connectivity Model number: PB-12T1E1-CE-TELCO
Hardware features	<ul style="list-style-type: none"> Maximum transmission units (MTUs) of up to 1024 bytes Per-interface diagnostics and loopback control Per-interface alarm and event counting and detection Framing <ul style="list-style-type: none"> 4-bit CRC for G.704 framed mode G.704 without CRC4 Unframed Balanced and unbalanced modes Full bit error rate test (BERT)

Software features	<ul style="list-style-type: none"> • PIC can be configured as twelve T1 ports or twelve E1 ports • Local and remote loopback diagnostics • E1 ports <ul style="list-style-type: none"> • High-performance throughput on each port at speeds up to 2048 Mbps, full duplex • HDB3 line encoding • Integrated support for G.704 framed mode with CRC; this feature is user-configurable <p style="margin-left: 40px;">NOTE: The G.704 implementation supports speeds slower than 2.048 Mbps; multiple channels within a single E1 interface are not supported.</p> • G.704 framed without CRC4 • Unframed • Framed clear channel mode • Unframed clear channel mode • Framed fractional mode • T1 ports <ul style="list-style-type: none"> • High-performance throughput on each port at speeds up to 1544 Mbps, full duplex • AMI and B8ZS line encoding • Framed clear channel mode • Fractional mode • Superframe (D4/SF) and extended superframe (ESF) framing • ESF CSU counters, WRT impairments, and CRC checking • Local DS1 line loopback, remote line loopback • Loop timing, PIC line timing, and external timing • Encapsulations: Structure-agnostic time-division multiplexing (TDM) over packet (SAToP) (RFC 4553) • Pseudowire emulation edge-to-edge (PWE3) for ATM (RFC 4717) (Junos OS Release 9.6 and later) • ATM Pseudowire emulation edge-to-edge via dynamic labels (LDP, RSVP-TE) (Junos OS Release 9.6 and later) • Inverse multiplexing (IMA) for ATM (Junos OS Release 10.0 and later) • Simple Network Management Protocol (SNMP): ATM MIB for the Junos OS Release 10.2 and later • ATM QoS for the Junos OS Release 10.2 and later: <ul style="list-style-type: none"> • Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping • Unspecified bit rate (UBR) traffic shaping • Fine-grained real-time variable bit rate (rtVBR) and real-time variable bit rate (nrtVBR) traffic shaping • Port-level egress shaping • Constant bit rate (CBR) • Policing on a per virtual circuit basis • Independent peak cell rate (PCR) and sustained cell rate (SCR) policing • Counting, tagging, or discard policing actions
Cables and connectors	<ul style="list-style-type: none"> • RJ-21 connector • Cables are rated for intra-building connections only.

LEDs

OK or Status LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one bicolor:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.

One tricolor per port:

- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure
-

Alarms, errors, and events

Structure-agnostic alarms for T1:

- Alarm indication signal (AIS)
- Loss of signal (LOS)
- Errored seconds (ES)
- Line code violation (LCV)
- Line errored seconds (LES)
- Severely errored seconds (SES)
- Unavailable seconds (UAS)

Structure-agnostic alarms for E1:

- Alarm indication signal (AIS)
- Errored seconds (ES)
- Line code violation (LCV)
- Line errored seconds (LES)
- Severely errored seconds (SES)
- Unavailable seconds (UAS)

Structure aware alarms for E1:

- Alarm indication signal (AIS)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Yellow alarm (remote alarm indication (RAI) (YLW)
- Far-end block error (FEBE)
- Cyclical Redundancy Check (CRC)
- CRC major
- CRC minor
- Line code violation (LCV)
- Path code violation (LCV)
- Errored seconds (ES)
- Bursty errored seconds (BES)
- Line errored seconds (LES)
- Severely errored seconds (SES)
- Severely errored frame seconds (SEFS)
- Unavailable seconds (UAS)

Related Documentation

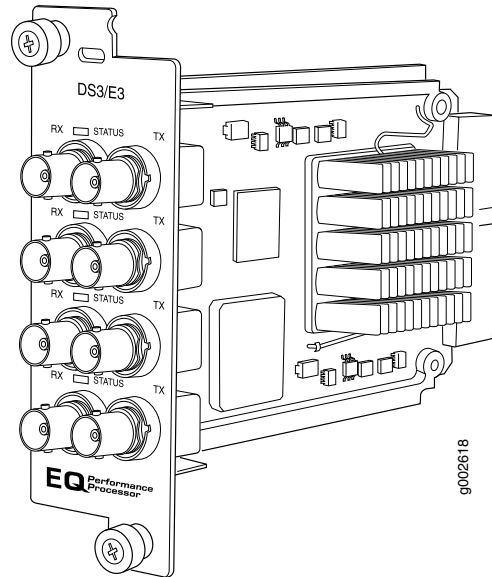
- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 8

DS3, E1, E3, and T1 Pic Descriptions

- DS3/E3 Enhanced IQ (IQE) PIC (M320 Router) on page 100
- E1 PICs (M320 Router) on page 103
- E3 PIC (M320 Router) on page 105
- E3 IQ PIC (M320 Router) on page 106
- T1 PIC (M320 Router) on page 108

DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.3R2 and later <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Four DS3 or E3 ports DS3 or E3 is configurable on a per-port granularity Power requirement: 0.51 A @ 48 V (24.7 W) Model number: PB-4DS3-E3-IQE-BNC
Hardware features	<ul style="list-style-type: none"> Ports are numbered 0 through 3 top to bottom
Software features	<ul style="list-style-type: none"> Maximum transmission units (MTUs) of up to 9192 bytes Subrate and scrambling: <ul style="list-style-type: none"> NOTE: Only DS3 interfaces support subrate and scrambling. Digital Link/Quick Eagle Kentrox Larscom ADTRAN Verilink (subrate: only port A mode) NOTE: For DS3 interfaces, Verilink does not function if an IQE interface is paired with an IQ interface. Data service unit (DSU) functionality B3ZS line encoding Framing: M13, C-bit parity, framed clear channel Full bit error rate test (BERT) ANSI T1.403 FDL

- Internal and loop clocking
- DS3 far end alarm and control (FEAC) channel
- Local line, remote line, and remote playback loopback testing
- Simple Network Management Protocol (SNMP): DS3 MIB
- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
- Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
- Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Extended Frame Relay for CCC and TCC
 - Flexible Frame Relay
 - Frame Relay
 - Frame Relay for CCC
 - Frame Relay for TCC
 - Frame Relay port CCC
 - High-Level Data Link Control (HDLC)
 - HDLC framing for CCC
 - HDLC framing for TCC
 - MPLS CCC
 - MPLS TCC
 - Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
 - Point-to-Point Protocol (PPP)
 - PPP for CCC
 - PPP for TCC

Cables and connectors	<ul style="list-style-type: none"> • Standard DS3 BNC coaxial cable interfaces
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LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
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Alarms, errors, and events

- DS3 alarms:
 - Alarm indication signal (AIS)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Phase lock loop (PLL)
 - Yellow alarm
- DS3 error detection:
 - C-bit code violations (CCV)
 - C-bit errored seconds (CES)
 - C-bit severely errored framing seconds (CEFS)
 - CRC errors
 - Excessive zeros (EXZ)
 - Far-end block error (FEBE)
 - Far-end receive failure (FERF)
 - Line errored seconds (LES)
 - Parity bit (P-bit) code violations (PCV)
 - Parity bit (P-bit) errored seconds (PES)
 - Parity bit (P-bit) severely errored framing seconds (PSES)
 - Severely errored framing seconds (SEFS)
 - Unavailable seconds (UAS)

Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

E1 PICs (M320 Router)

Figure 7: E1 RJ-48 PIC

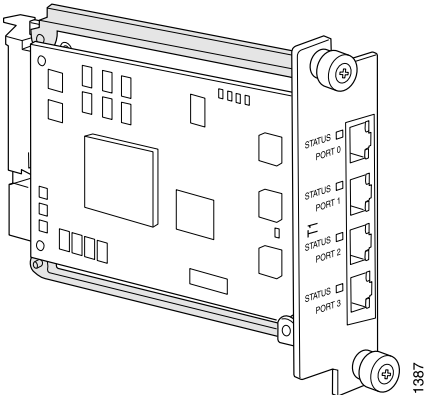
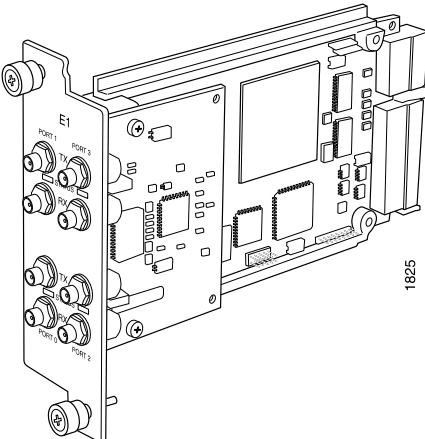


Figure 8: E1 Coaxial PIC



Software release	<ul style="list-style-type: none">Junos OS Release 6.4 and later (Type 1) For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.
Description	<ul style="list-style-type: none">Four E1 or coaxial portsPower requirement: 0.08 A @ 48 V (3.74 W)Two versions:<ul style="list-style-type: none">4-port, 120-ohm, RJ-484-port, 75-ohm, coaxialOnboard DSU functionality for E1 connectivityModel number: PB-4E1-COAX PB-4E1-RJ48
Hardware features	<ul style="list-style-type: none">High-performance throughput on each port at speeds up to 2.048 Mbps, full duplexMaximum transmission units (MTUs) of up to 4500 bytesPer-interface diagnostics and loopback controlPer-interface shaping on outputPer-interface alarm and event counting and detectionHDB3 line coding4-bit CRC for G.704 framed modePer-port loop timingBalanced and unbalanced modesPacket buffering, Layer 2 parsingFull bit error rate test (BERT)

- Software features
- Integrated support for G.703 unframed mode and G.704 framed mode with CRC; this feature is user-configurable
- NOTE:** The G.704 implementation supports speeds slower than 2.048 Mbps; multiple channels within a single E1 interface are not supported.
- Configurable clock source: Internal or loop
 - Encapsulations:
 - High-Level Data Link Control (HDLC)
 - Frame Relay
 - Circuit cross-connect (CCC)
 - Point-to-Point Protocol (PPP)

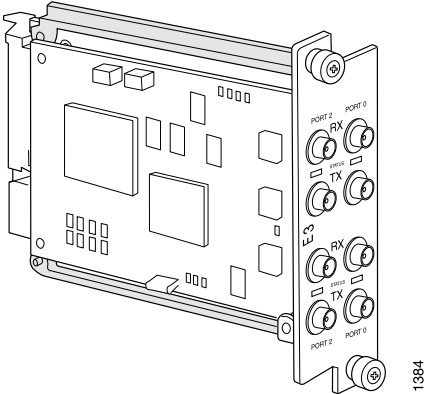
- Cables and connectors
- Two versions:
 - Four RJ-48 connectors (one per port)
 - Four coaxial connectors
 - Custom 10-ft (3.05-m) posilock to BNC male cable, separate Rx and Tx

- LEDs
- One tricolor per port:
- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure

- Alarms, errors, and events
- Alarm indication signal (AIS)
 - Bipolar violations
 - Excessive zeros
 - Far-end block errors (FEBE, E-bit errors)
 - Loss of frame (LOF), Loss of signal (LOS)
 - Local and remote loopback diagnostics
 - Yellow alarm bit (X-bit) disagreements

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

E3 PIC (M320 Router)



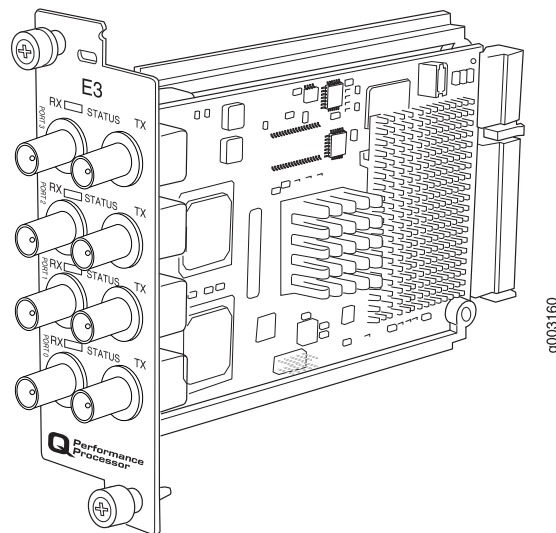
Software release	<ul style="list-style-type: none">Junos OS Release 6.3 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none">Four E3 portsPower requirement: 0.47 A @ 48 V (22.5 W)Integrated DSU interoperabilityModel number: PB-4E3-QPP
Hardware features	<ul style="list-style-type: none">High-density E3 (34.368-Mbps) connectivityHigh-performance throughput on each port at speeds up to 34.368 Mbps, full duplexScrambling supportSubrate clocking supportRate policing on inputRate shaping on outputPacket buffering, Layer 2 parsingLarge MTUs, up to 9192 bytesLocal and remote loopback
Software features	<ul style="list-style-type: none">Supports G-751 framingE3 diagnostics and loopback controlE3 alarm and event counting and detectionDS3 diagnostics and loopback controlBit error rate test (BERT); you can configure one port in BERT mode and configure the remaining channels to transmit and receive normal trafficEncapsulations:<ul style="list-style-type: none">High-level Data Link Control (HDLC)Frame RelayMultiprotocol Label Switching (MPLS) circuit cross-connect (CCC)Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none">Custom 10 ft (3.05 m) posilock to BNC male cable, separate RX and TX

LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
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Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS) • Equipment failure (does not affect service) • Frame error • Line code violation • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm bit (A-bit) disagreements
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Related Documentation	• M320 PIC Description
	• M320 PIC Combination Limitations on page 15
	• M320 PICs Supported on page 3

E3 IQ PIC (M320 Router)



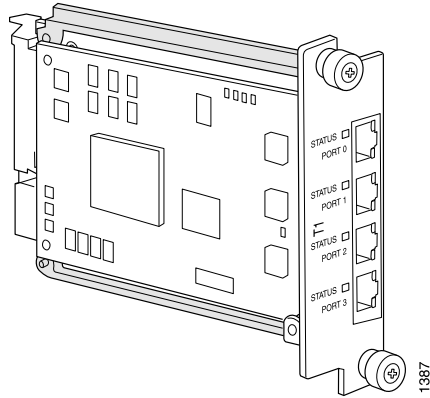
Software release	<ul style="list-style-type: none"> • Junos OS Release 6.2 and later (Type 1) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Four E3 ports • Power requirement: 0.38 A @ 48 V (18 W) • Fine-grained queuing per logical interface • Model number: PB-4E3-QPP

Hardware features	<ul style="list-style-type: none"> • Clear-channel (34.368-Mbps) and subrate E3 • Unframed or ITU G.751 framing • Data service unit (DSU) functionality • Subrate and scrambling: <ul style="list-style-type: none"> • Digital Link/Quick Eagle • Kentrox • HDB3 line encoding • Full bit error rate test (BERT) • Local and remote loopback testing
Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per port: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Simple Network Management Protocol (SNMP): E3 MIB, QoS MIB • Input policing and output shaping • Provider-side rate limiting • Full data link connection identifier (DLCI) range with sparse channel numbering • Per-DLCI queues with weighted deficit round-robin and strict priority • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Point-to-Point Protocol (PPP) • Junos OS Release 7.0 or later is required to configure graceful Routing Engine switchover (GRES).
Cables and connectors	<ul style="list-style-type: none"> • Standard E3 BNC coaxial cable interfaces
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS) • Equipment failure (does not affect service) • Frame error • Line code violation • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm bit (A-bit) disagreements
Instrumentation (counters)	<ul style="list-style-type: none"> • Layer 2 per-queue packet and byte counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)

- [M320 PICs Supported on page 3](#)

T1 PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 6.4 and later <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Four T1 ports • Power requirement: 0.08 A @ 48 V (3.7 W) • Supports clear channel T1 per port (1.544 Mbps per channel) • Supports attenuation up to -12 dBm • Model number: PB-4T1-RJ48
Hardware features	<ul style="list-style-type: none"> • Per-port loop timing • Onboard DSU functionality for T1 connectivity
Software features	<ul style="list-style-type: none"> • ESF and SF framing • B8ZS and AMI coding • ESF CSU counters, WRT impairments, and CRC checking • Local DS1 line loopback, remote line loopback • Configurable clock source—internal or loop • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> • 100-ohm RJ-48 connector
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- Alarm indication signal (AIS)
- Bipolar violations
- Excessive zeros
- Far-end block errors (FEBE, E-bit errors)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Yellow alarm bit (X-bit) disagreements

Related Documentation

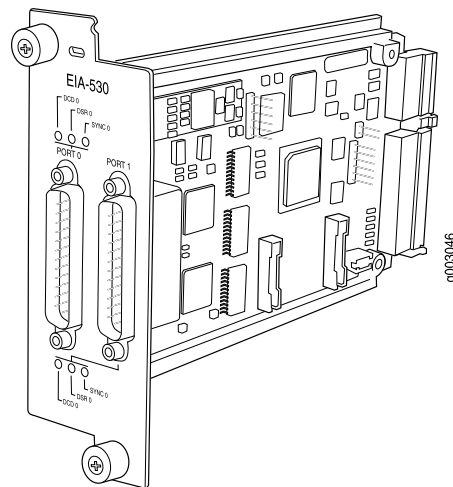
- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 9

EIA-530 PIC Descriptions

- EIA-530 PIC (M320 Router) on page 111

EIA-530 PIC (M320 Router)



Software release	<ul style="list-style-type: none">• Junos OS Release 6.2 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none">• Two EIA-530, X.21, or V.35 serial ports• Power requirement: 0.07 A @ 48 V (3.4 W)• Model number: PB-2EIA530
Hardware features	<ul style="list-style-type: none">• Configured as data terminal equipment (DTE) ports• Resynchronization signal• Receives clock rates up to 16 Mbps• Local, data communications equipment (DCE) local, and DTE remote loopbacks

Software features	<ul style="list-style-type: none"> • Supports four queues per port • Random early detection (RED) • Transmitter Signal Element Timing is looped from the timing received on the Transmitted Signal Element DCE. EIA-530 ports support the ability to invert the Transmit Data Element. The EIA-530 ports support the following rates: <ul style="list-style-type: none"> • 2.048 Mbps • 2.341 Mbps • 2.731 Mbps • 3.277 Mbps • 4.09 Mbps • 5.461 Mbps • 8.192 Mbps • 16.384 Mbps • V.35 ports support up to 2.048 Mbps • X.21 ports support up to 10 Mbps • Encapsulations: <ul style="list-style-type: none"> • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Frame Relay • High-Level Data Link Control (HDLC) • Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> • Two DB-25 male connectors (one per port, included with PIC) • V.35 requires an EIA-530 to V.35 cable and connects to a V.35 DTE 34-pin Winchester type male cable (one per port) • X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable
LEDs	<p>Three bicolor per port:</p> <ul style="list-style-type: none"> • Data set ready (DSR): <ul style="list-style-type: none"> • Green—DSR is detected or ignored • Red—DSR expected but not present • Data carrier detect (DCD): <ul style="list-style-type: none"> • Green—DCD is detected or ignored • Red—DCD expected but not present • Resynchronization: <ul style="list-style-type: none"> • Green—Keepalives are being received • Red—Data terminal ready (DTR) toggled from low to high (resynchronization pulses are being sent)
Instrumentation (counters)	<ul style="list-style-type: none"> • Per-port packet and byte counters • Resynchronization counters: <ul style="list-style-type: none"> • Number of resynchronizations initiated • Time of last resynchronization
Related Documentation	<ul style="list-style-type: none"> • M320 PIC Description • M320 PIC Combination Limitations on page 15

- [M320 PICs Supported on page 3](#)

CHAPTER 10

Fast Ethernet PIC Descriptions

- Fast Ethernet PICs (M320 Router) on page 115

Fast Ethernet PICs (M320 Router)

Figure 9: 4-Port Fast Ethernet PIC

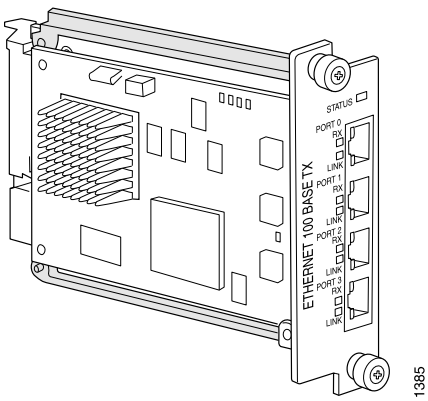


Figure 10: 8-Port Fast Ethernet PIC

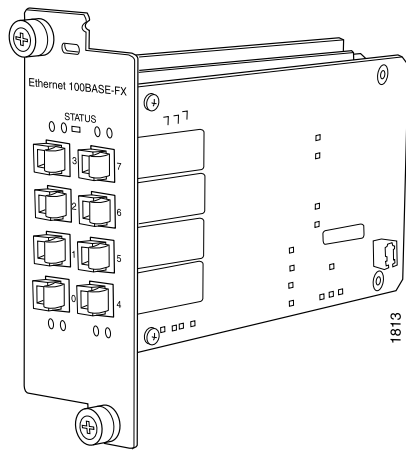


Figure 11: 12-Port Fast Ethernet PIC

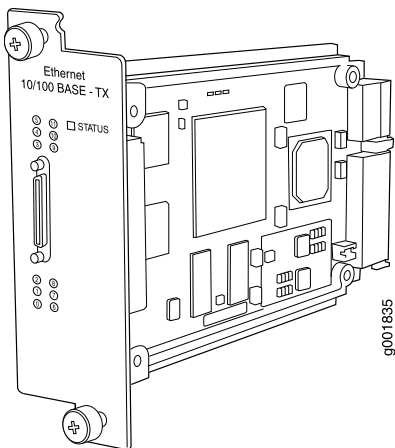


Figure 12: 48-Port Fast Ethernet PIC

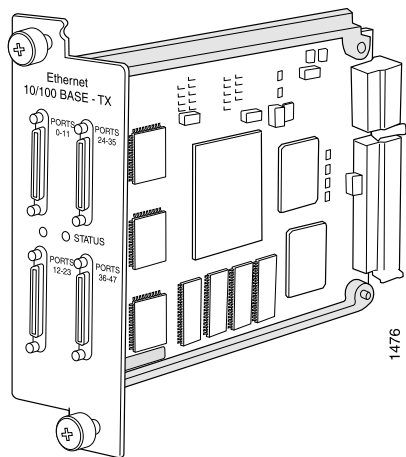
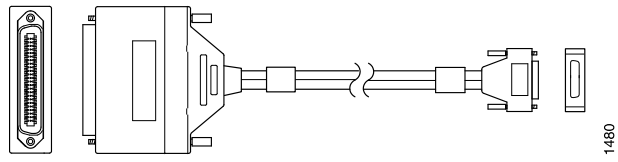


Figure 13: VHDCI to RJ-21 Cable



Software release	<ul style="list-style-type: none"> • 4-port: Junos OS Release 6.2 and later (Type 1) • 8-port: Junos OS Release 6.3 and later (Type 1) • 12-port: Junos OS Release 6.2 and later (Type 1) • 48-port: Junos OS Release 6.4 and later (Type 2) <p>For information on which FPCs support these PICs, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • 4 100Base-TX ports • 8 100Base-FX ports • 12 100Base-TX ports • 48 100Base-TX ports • Power requirement: <ul style="list-style-type: none"> • 4-port: 0.14 A @ 48 V (6.8 W) • 8-port: 0.26 A @ 48 V (12.5 W) • 12-port: 0.23 A @ 48 V (11 W) • 48-port: 0.69 A @ 48 V (33.3 W) • Model number for 4-Port Fast Ethernet PIC: PB-4FE-TX Model number for 8-Port Fast Ethernet PIC: PB-8FE-FX Model number for 12-Port Fast Ethernet PIC: PB12FE-TX-MDI PB-12FE-TX-MDIX Model number for 48-Port Fast Ethernet PIC: PB-48FE-TX
Hardware features	<ul style="list-style-type: none"> • High-performance throughput on each port at speeds up to 100 Mbps • Source and destination Media Access Control (MAC) address filtering • RMON EtherStats packet buffering • 802.3 Ethernet standard compliant • 4-port PICs support MTUs of up to 1,533 bytes; 8-port, 12-port, and 48-port PICs support MTUs of up to 1,532 bytes • 4-port PICs support 1,024 802.1Q VLANs per port; 8-port, 12-port, and 48-port PICs support 16 802.1Q VLANs per port
Software features	<ul style="list-style-type: none"> • Autosensing full-duplex and half-duplex modes • Virtual Router Redundancy Protocol (VRRP) • 802.1q virtual LANs (VLANs) • Circuit cross-connect (CCC) VLAN
Cables and connectors	<p>4-port PIC:</p> <ul style="list-style-type: none"> • Connector: Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector • Pinout: MDI noncrossover <p>8-port PIC:</p> <ul style="list-style-type: none"> • Connector: MT-RJ female <p>FX optical interface—see "Fast Ethernet 100BASE-FX Optical Interface Specifications" on page 24</p> <p>12-port PIC:</p> <ul style="list-style-type: none"> • Connector: One very high density connector interface (VHDCI) to RJ-21 cable that connects to an RJ-45 patch panel

48-port PIC:

- VHDCI to RJ-21 cables that connect to an RJ-45 patch panel
- Four VHDCI connectors that each service 12 10/100 ports

NOTE: Each of the four connectors on a Fast Ethernet 48-port PIC can support a maximum of approximately 800 Mbps. However, this constitutes oversubscription. Use this PIC only in environments that can support this level of oversubscription.

LEDs

Status LED, one bicolor:

- Off—PIC ports not enabled.
- Green—PIC is operating normally.
- Red—PIC has an error or failure.

4-port PIC—One pair of port LEDs:

- Link LED—If green, the port is online; if there is no light, the port is down.
- RX LED—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data.

8-port PIC—one pair of port LEDs per port:

- Port link LED—If green, the port is online; if there is no light, the port is down.

NOTE: The Link LED remains lit on the 8-port PIC when the port is down.

- Port RX LED—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data.

12-port PIC—one port LED per port:

- Green—100-Mbps link established.
- Flashing green—100-Mbps activity.
- Yellow—10-Mbps link established.
- Flashing yellow—10-Mbps activity.
- Off—No link present.

NOTE: The port LEDs remain lit on the 12-port PIC when the ports are down.

NOTE: The 48-port PIC does not have port LEDs. To check port status on a 48-port PIC, use the **show interfaces fe-fpc/pic/port** command. For more information about this command, see the *Junos OS Network Interfaces Library for Routing Devices*.

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 11

Gigabit Ethernet PIC Descriptions

- Gigabit Ethernet PICs with SFP (M320 Router) on page 120
- Gigabit Ethernet IQ PICs with SFP (M320 Router) on page 123
- Gigabit Ethernet IQ2 PICs with SFP (M320 Router) on page 125
- Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router) on page 129

Gigabit Ethernet PICs with SFP (M320 Router)

Figure 14: 1-Port Gigabit Ethernet PIC

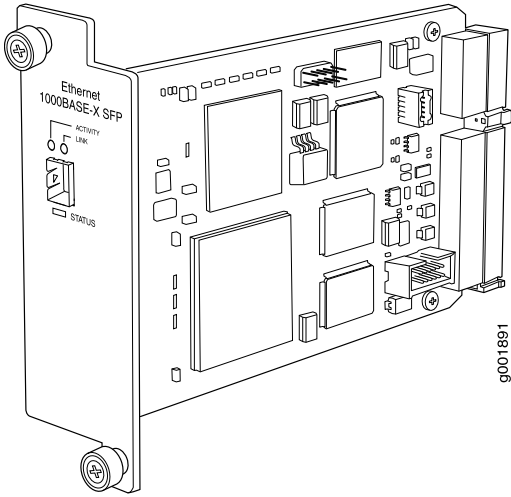


Figure 15: 2-Port Gigabit Ethernet PIC

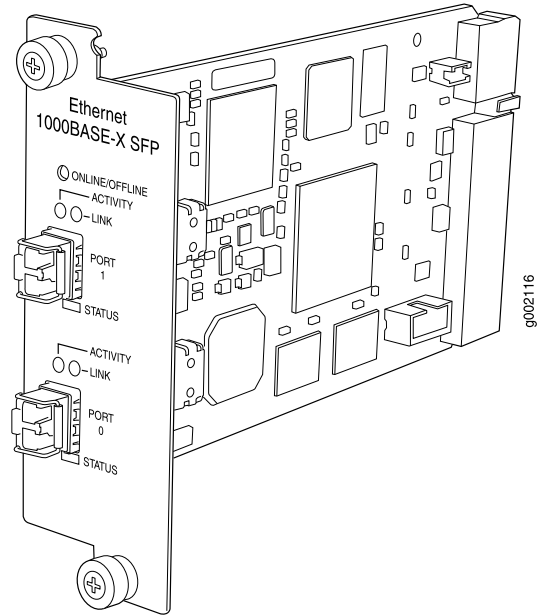


Figure 16: 4-Port Gigabit Ethernet PIC

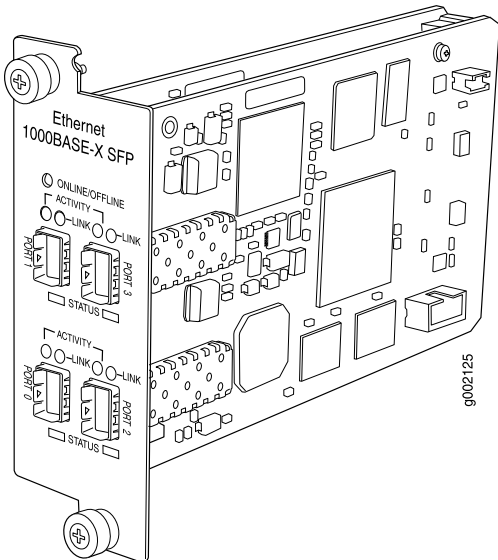
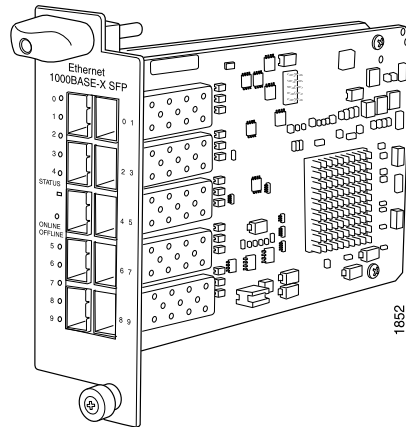


Figure 17: 10-Port Gigabit Ethernet PIC



Software release	<ul style="list-style-type: none"> • 1-port: Junos OS Release 6.4 and later (Type 1) • 2-port: Junos OS Release 6.4 and later (Type 2) • 4-port: Junos OS Release 7.0 and later (Type 2) • 10-port: Junos OS Release 6.2 and later (Type 3)
For information on which FPCs support these PICs, see " M320 PIC/FPC Compatibility " on page 15.	
Description	<ul style="list-style-type: none"> • One, two, four, or ten Gigabit Ethernet ports • Power requirement: <ul style="list-style-type: none"> • 1-port: 0.15 A @ 48 V (7.3 W) • 2-port: 0.25 A @ 48 V (11.9 W) • 4-port: 0.50 A @ 48 V (23.8 W) • 10-port: 0.62 A @ 48 V (29.9 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network • Model number for 1-Port Gigabit Ethernet PIC: PB-1GE-SFP Model number for 2-Port Gigabit Ethernet PIC: PB-2GE-SFP Model number for 4-Port Gigabit Ethernet PIC: PB-4GE-SFP Model number for 10-Port Gigabit Ethernet PIC: PC-10GE-SFP
Hardware features	<ul style="list-style-type: none"> • High-performance throughput on each port at speeds up to 1 Gbps • Autonegotiation between Gigabit Ethernet circuit partners • Full-duplex mode • Maximum transmission units (MTUs) of up to 9192 bytes
Software features	<ul style="list-style-type: none"> • Virtual Router Redundancy Protocol (VRRP) support • 802.1q virtual LANs (VLANs) support • 960 destination MAC filters per port • Optical diagnostics and related alarms on the 2-port, 4-port, and 10-port PICs (Junos OS Release 8.2 and later) • Flexible Ethernet encapsulation on the 1-port, 2-port, and 4-port PICs • Multiple tag protocol identifiers (TPID) support on the 1-port, 2-port, and 4-port PICs • Source MAC learning on the 1-port, 2-port, and 4-port PICs • MAC accounting and policing—Dynamic local address learning of source MAC addresses on the 1-port, 2-port, and 4-port PICs • Passive monitoring for IPv4 packets on the 10-port PIC (Junos OS Release 11.1 and later) <p>NOTE: The 10-port Gigabit Ethernet PIC with SFP does not support MAC accounting and policing, MAC learning, TPID, or flexible Ethernet encapsulation.</p>

- Cables and connectors
- You can install any transceiver supported by the PIC.
 - Fiber-optic SFP transceivers:
 - Duplex LC/PC connector (Rx and Tx)
 - 1000Base-LH (model number: SFP-1GE-LH)
 - 1000Base-LX (model number: SFP-1GE-LX)
 - 1000Base-SX (model number: SFP-1GE-SX)
 - Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - 1000Base-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - Copper SFP transceivers:
 - Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
 - 1000Base-T (model number: SFP-1GE-T)
 - Copper interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>

NOTE: Do not install Gigabit Ethernet SFPs in the SONET/SDH port. The port will not recognize the SFP.

LEDs

Status LED on the 1-port, 2-port, and 4-port PICs, one bicolor:

- Off—PIC is not enabled.
- Green—PIC is operating normally.
- Red—PIC has an error or failure.

NOTE: The **Status LED** on the 10-port PIC indicates the status of the links and not the status of the PIC.

Status LED on the 10-port PIC, one bicolor:

- Off—PIC is not enabled.
- Green—At least one cable is connected to a port and the link status is green.
- Red—No cables are connected to the ports, or the link status of the connected ports are red.

Port LEDs, one pair per port:

- Link**—If green, the port is online; if there is no light, the port is down.
- Activity**—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data.

Related Documentation

- M320 PIC Description*
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Gigabit Ethernet IQ PICs with SFP (M320 Router)

Figure 18: 1-Port Gigabit Ethernet IQ PIC

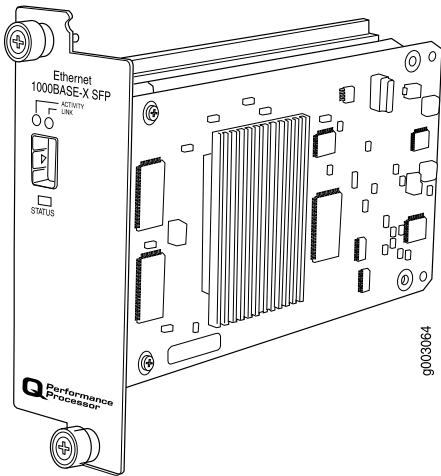
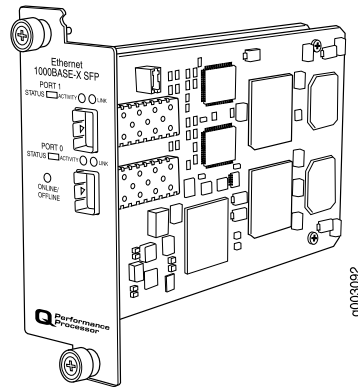


Figure 19: 2-Port Gigabit Ethernet IQ PIC



Software release

- 1-port: Junos OS Release 6.2 and later (Type 1)
- 2-port: Junos OS Release 6.2 and later (Type 2)

For information on which FPCs support these PICs, see ["M320 PIC/FPC Compatibility"](#) on page 15.

Description

- One or two Gigabit Ethernet ports
- Power requirement: 0.46 A @ 48 V (22 W)
- Fine-grained queuing per logical interface
- Model number for 1-Port Gigabit IQ PIC: PB-1GE-SFP-QPP
- Model number for 2-Port Gigabit IQ PIC: PB-2GE-SFP-QPP

Hardware features

- High-performance throughput on each port at speeds up to 1 Gbps
- Full-duplex mode
- Large MTUs of up to 9192 bytes

Software features

- Optical diagnostics and related alarms
- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
- Virtual Router Redundancy Protocol (VRRP) support
- 802.1q virtual LANs (VLANs)
- VLAN stacking and rewriting
- Flexible Ethernet encapsulation
- MAC policing, accounts, and filters
- Junos OS Release 7.0 or later is required to configure graceful Routing Engine switchover (GRES).

- Cables and connectors
- You can install any transceiver supported by the PIC.
 - Fiber-optic SFP transceivers:
 - Duplex LC/PC connector (Rx and Tx)
 - 1000Base-LH (model number: SFP-1GE-LH)
 - 1000Base-LX (model number: SFP-1GE-LX)
 - 1000Base-SX (model number: SFP-1GE-SX)
 - Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - 1000Base-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - Copper transceivers:
 - Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
 - 1000Base-T (model number: SFP-1GE-T)
 - Copper interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>

NOTE: Do not install SONET/SDH OC48c/STM16 SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.

LEDs

Status LED, one tricolor:

- Off—Not enabled.
- Green—Online with no alarms or failures.
- Yellow—Online with alarms for remote failures.
- Red—Active with a local alarm; router has detected a failure.

NOTE: The green status LED is lit on the 2-port Gigabit Ethernet IQ PIC when at least one port is online.

Port LEDs, one per port:

- Off—Port is down.
- Green—Link is established.

Related Documentation

- *M320 PIC Description*
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Gigabit Ethernet IQ2 PICs with SFP (M320 Router)

Figure 20: 4-Port Gigabit Ethernet IQ2 PIC (Type 1)

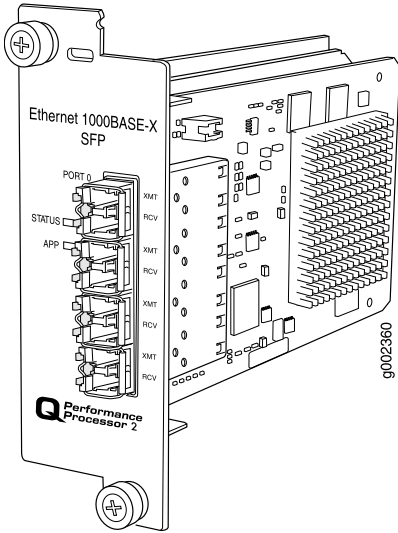


Figure 21: 8-Port Gigabit Ethernet IQ2 PIC (Type 2)

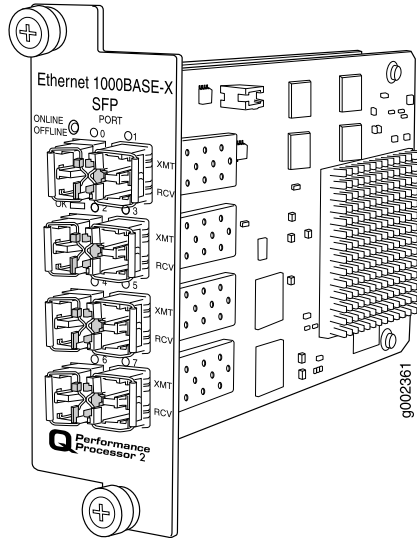
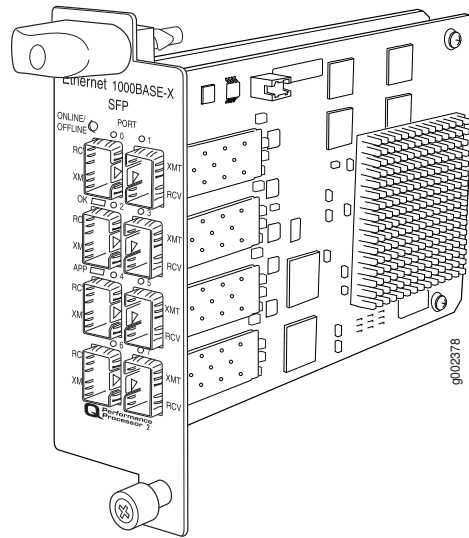


Figure 22: 8-Port Gigabit Ethernet IQ2 PIC (Type 3)



Software release	<ul style="list-style-type: none"> • 4-port: Junos OS Release 7.6R3 and later (Type 1) • 8-port: Junos OS Release 7.6R2 and later (Type 2) <p>NOTE: M320 routers support no more than three 8-port Ethernet IQ2 PICs in an FPC2. Table 46 on page 128 describes which PICs can be installed in the fourth slot of the FPC2.</p> <ul style="list-style-type: none"> • 8-port: Junos OS Release 8.2 and later (Type 3) <p>For information on which FPCs support these PICs, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Four or eight Gigabit Ethernet ports • Power requirement: <ul style="list-style-type: none"> • 4-port: 0.65 A @ 48 V (31 W) • 8-port (Type 2): 0.89 A @ 48 V (42.5 W) • 8-port (Type 3): 1.25 A @ 48 V (60 W) • Model number for 4-Port Gigabit Ethernet IQ2 PIC (Type 1): PB-4GE-TYPE1-SFP-IQ2 • Model number for 8-Port Gigabit Ethernet IQ2 PIC (Type 2): PB-8GE-TYPE2-SFP-IQ2 • Model number for 8-Port Gigabit Ethernet IQ2 PIC (Type 3): PB-8GE-TYPE3-SFP-IQ2
Hardware features	<ul style="list-style-type: none"> • High-performance throughput on each port: <ul style="list-style-type: none"> • 4-port with SFP: speeds up to 1 Gbps • 8-port with SFP: speeds up to 4 Gbps • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes

- Software features
- Intelligent handling of oversubscribed traffic for the Type 1 and Type 2 PICs
 - Optical diagnostics and related alarms
 - Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
 - Virtual Router Redundancy Protocol (VRRP) support
 - Hierarchical shaping
 - Fine-grained queuing and shaping per logical interface at both ingress and egress
 - 802.1q virtual LANs (VLANs)
 - VLAN stacking and rewriting
 - Channels defined by two stacked VLAN tags
 - Multiple tag protocol identifiers (TPID) support
 - IP service for nonstandard TPID and stacked VLAN tags
 - 802.1p rewrite per channel
 - Flexible mapping of channels and scheduler resources at both ingress and egress
 - Flexible Ethernet encapsulation
 - MAC learning, policing, accounting, and filtering

- Cables and connectors
- You can install any transceiver supported by the PIC.

NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.
 - Fiber-optic small form-factor pluggable transceivers (SFPs):
 - Duplex LC/PC connector (Rx and Tx)
 - 1000Base-LH (model number: SFP-1GE-LH)
 - 1000Base-LX (model number: SFP-1GE-LX)
 - 1000Base-SX (model number: SFP-1GE-SX)
 - Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - 1000Base-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - Copper transceivers:
 - Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
 - 1000Base-T (model number: SFP-1GE-T)
 - Copper interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>

LEDs

OK or Status LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one bicolor:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.

Port LEDs, one per port:

- Off—Port is not enabled.
- Green—Port is online with no alarms or failures.

Table 46: PICs Supported in Fourth Slot of FPC2 with Three 8-Port Ethernet IQ2 PICs on M320 Routers

PIC Name	PIC Model Number
Gigabit Ethernet, 2-port SFP	PB-2GE-SFP
Gigabit Ethernet, 4-port SFP	PB-4GE-SFP
Gigabit Ethernet IQ, 2-port SFP	PB-2GE-SFP-QPP
SONET/SDH OC12c/STM4, 4-port with multimode transceivers installed	PB-4OC12-SON-MM
SONET/SDH OC12c/STM4, 4-port with single-mode intermediate reach transceivers installed	PB-4OC12-SON-SMIR
SONET/SDH OC48/STM16, 1-port SFP	PB-1OC48-SON-SFP
Tunnel Services	PB-TUNNEL

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)

Figure 23: 4-Port Gigabit Ethernet IQ2E PIC (Type 1)

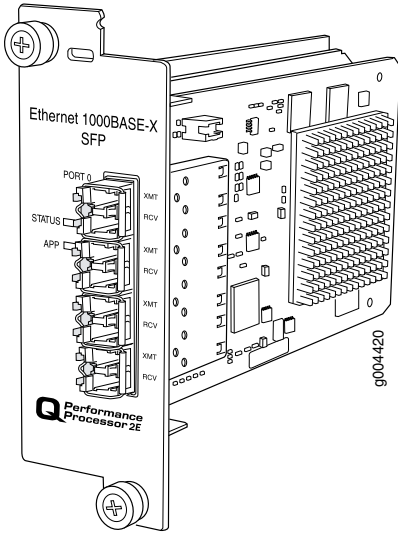


Figure 24: 8-Port Gigabit Ethernet IQ2E PIC (Type 2)

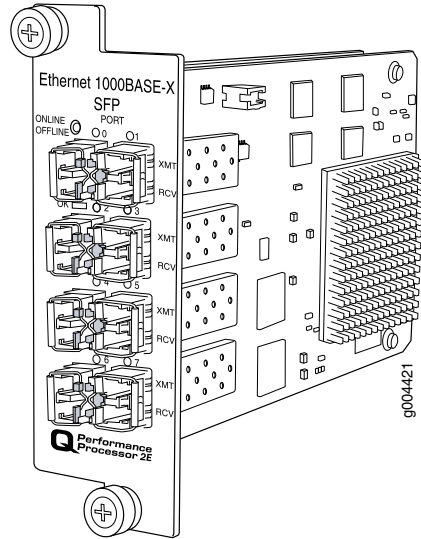
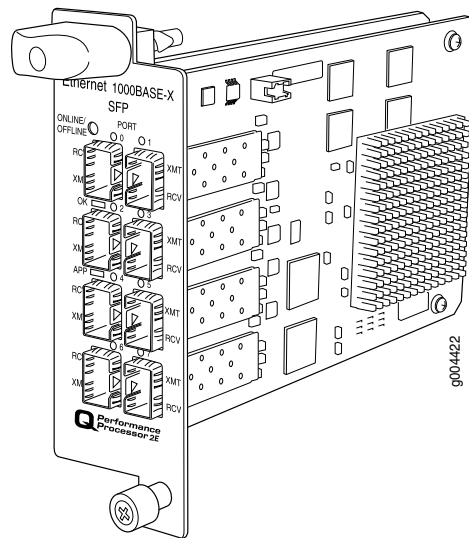


Figure 25: 8-Port Gigabit Ethernet IQ2E PIC (Type 3)



Software release	<ul style="list-style-type: none"> • 4-port: Junos OS Release 9.4 and later (Type 1) • 8-port: Junos OS Release 9.4 and later (Type 2) <p>NOTE: M320 routers support no more than three 8-port Ethernet IQ2E PICs in an FPC2. Table 47 on page 132 describes which PICs you can install in the fourth slot of the FPC2.</p> <ul style="list-style-type: none"> • 8-port: Junos OS Release 9.4 and later (Type 3) <p>For information on which FPCs support these PICs, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> • Four or eight Gigabit Ethernet ports • Power requirement: <ul style="list-style-type: none"> • 4-port: 0.67 A @ 48 V (32 W) • 8-port (Type 2): 0.92 A @ 48 V (44 W) • 8-port (Type 3): 1.25 A @ 48 V (60 W) • Model number for 4-Port Gigabit Ethernet IQ2E PIC (Type 1): PB-4GE-TYPE1-SFP-IQ2E • Model number for 8-Port Gigabit Ethernet IQ2E PIC (Type 2): PB-8GE-TYPE2-SFP-IQ2E • Model number for 8-Port Gigabit Ethernet IQ2E PIC (Type 3): PC-8GE-TYPE3-SFP-IQ2E
Hardware features	<ul style="list-style-type: none"> • High-performance throughput: speeds up to 1 Gbps on each port • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes

- Software features
- Intelligent handling of oversubscribed traffic for the Type 1 and Type 2 PICs
 - Optical diagnostics and related alarms
 - Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
 - Drop statistics reported per queue for each of four priority-based drop profiles
 - Four levels of strict priorities with priority propagation among scheduling levels
 - Hierarchical shaping and hierarchical scheduler
 - Virtual Router Redundancy Protocol (VRRP) support
 - Fine-grained queuing and shaping per logical interface at both ingress and egress
 - 802.1q virtual LANs (VLANs)
 - VLAN stacking and rewriting
 - Channels defined by two stacked VLAN tags
 - Multiple tag protocol identifiers (TPID) support
 - IP service for nonstandard TPID and stacked VLAN tags
 - 802.1p rewrite per channel
 - Flexible mapping of channels and scheduler resources at both ingress and egress
 - 16,000 schedulers (2,000 schedulers with 8 queues each or 4,000 schedulers with 4 queues each)
 - Scheduler resources dynamically allocated across ports
 - Flexible Ethernet encapsulation
 - MAC learning, policing, accounting, and filtering

- Cables and connectors
- You can install any transceiver supported by the PIC.

NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.
 - Small form-factor pluggable transceivers (SFPs):
 - Duplex LC/PC connector (Rx and Tx)
 - Fiber-optic transceivers
 - 1000Base-LH (model number: SFP-IGE-LH)
 - 1000Base-LX (model number: SFP-IGE-LX)
 - 1000Base-SX (model number: SFP-IGE-SX)
 - Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - 1000Base-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>
 - Copper transceivers:
 - Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
 - 1000Base-T (model number: SFP-IGE-T)
 - Copper interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>

LEDs

OK or Status LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one bicolor:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.

Port LEDs, one per port:

- Off—Port is not enabled.
- Green—Port is online with no alarms or failures.

Table 47: PICs Supported in Fourth Slot of FPC2 with Three 8-Port Ethernet IQ2E PICs on M320 Routers

PIC Name	PIC Model Number
Gigabit Ethernet, 2-port SFP	PB-2GE-SFP
Gigabit Ethernet, 4-port SFP	PB-4GE-SFP
Gigabit Ethernet IQ, 2-port SFP	PB-2GE-SFP-QPP
SONET/SDH OC12c/STM4, 4-port with multimode transceivers installed	PB-4OC12-SON-MM
SONET/SDH OC12c/STM4, 4-port with single-mode intermediate reach transceivers installed	PB-4OC12-SON-SMIR
SONET/SDH OC48/STM16, 1-port SFP	PB-1OC48-SON-SFP
Tunnel Services	PB-TUNNEL

**Related
Documentation**

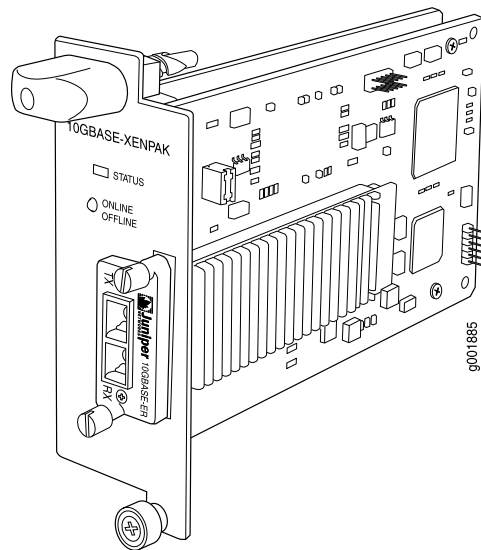
- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

CHAPTER 12

10-Gigabit Ethernet PIC Descriptions

- 10-Gigabit Ethernet PIC with XENPAK (M320 Router) on page 133
- 10-Gigabit Ethernet DWDM PIC (M320 Router) on page 135
- 10-Gigabit Ethernet IQ2 PIC with XFP (M320 Router) on page 136
- 10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router) on page 138

10-Gigabit Ethernet PIC with XENPAK (M320 Router)



Software release

- 10GBASE-LR and 10GBASE-ER transceivers: Junos OS Release 6.2 and later (Type 3)
- 10GBASE-SR and 10GBASE-ZR transceivers: Junos OS Release 7.1 and later (Type 3)

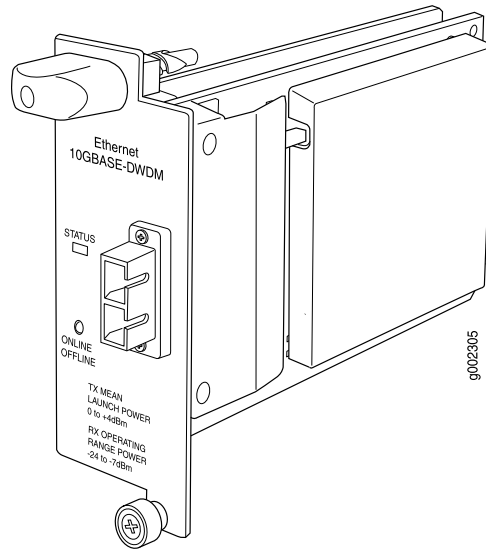
For information on which FPCs support this PIC, see [“M320 PIC/FPC Compatibility”](#) on page 15.

Description

- One 10-Gigabit Ethernet port
 - Power requirement: 0.55 A @ 48 V (26.6 W)
 - Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
 - Model number: PC-1XGE-XENPAK
-

Hardware features	<ul style="list-style-type: none">• High-performance throughput at speeds up to 10 Gbps• Full-duplex mode• Maximum transmission units (MTUs) up to 9192 bytes• 64 source MAC address filters• 960 destination MAC filters
Software features	<ul style="list-style-type: none">• Virtual Router Redundancy Protocol (VRRP) support• 802.1q virtual LANs (VLANs) support• 802.3ad link aggregation support• RMON EtherStats• Optical diagnostics and related alarms :<ul style="list-style-type: none">• Transceiver temperature• Laser bias current• Laser output power• Receive optical power
Cables and connectors	<ul style="list-style-type: none">• Duplex SC/PC connector (RX and TX)• 10-Gigabit Ethernet XENPAK transceivers:<ul style="list-style-type: none">• Short Wavelength Serial (10GBase-SR), LAN Rate (model number: XENPAK-1XGE-SR)• Long Wavelength Serial (10GBase-LR), LAN Rate (model number: XENPAK-1XGE-LR)• Extra-Long Wavelength Serial (10GBase-ER), LAN Rate (model number: XENPAK-1XGE-ER)• Extra-Long Wavelength Serial (10GBase-ZR), LAN Rate (model number: XENPAK-1XGE-ZR) EOL (see notification PSN-2010-02-649) <p>Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/</p>
LEDs	<p>Status LED, one bicolor:</p> <ul style="list-style-type: none">• Off—PIC not enabled.• Green—PIC is operating normally.• Red—PIC has an error or failure. <p>Port LEDs, one pair:</p> <ul style="list-style-type: none">• Link—If green, the port is online; if there is no light, the port is down.• RX—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data.
Related Documentation	<ul style="list-style-type: none">• <i>M320 PIC Description</i>• M320 PIC Combination Limitations on page 15• M320 PICs Supported on page 3

10-Gigabit Ethernet DWDM PIC (M320 Router)



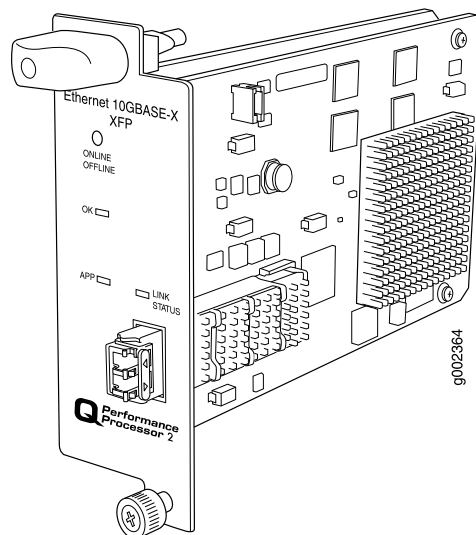
Software release	<ul style="list-style-type: none"> Junos OS Release 7.5 and later (Type 3) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One 10-Gigabit Ethernet port Power requirement: 0.55 A @ 48 V (26.6 W) Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network Model number: PC-1XGE-DWDM-CBAND
Hardware features	<ul style="list-style-type: none"> C-band ITU-Grid with 100 GHz spacing High-performance throughput at speeds up to 10 Gbps Full-duplex mode Maximum transmission units (MTUs) up to 9192 bytes 64 source MAC address filters 960 destination MAC filters 45 individual wavelengths: 1528.77 nm, 1529.55 nm, 1530.33 nm, 1531.12 nm, 1531.90 nm, 1532.68 nm, 1533.47 nm, 1534.25 nm, 1535.04 nm, 1535.82 nm, 1536.61 nm, 1537.40 nm, 1538.19 nm, 1538.98 nm, 1539.77 nm, 1540.56 nm, 1541.35 nm, 1542.14 nm, 1542.94 nm, 1543.73 nm, 1544.53 nm, 1545.32 nm, 1546.12 nm, 1546.92 nm, 1547.72 nm, 1548.52 nm, 1549.32 nm, 1550.12 nm, 1550.92 nm, 1551.72 nm, 1552.52 nm, 1553.33 nm, 1554.13 nm, 1554.94 nm, 1555.75 nm, 1556.56 nm, 1557.36 nm, 1558.17 nm, 1558.98 nm, 1559.79 nm, 1560.61 nm, 1561.42 nm, 1562.23 nm, 1563.05 nm, 1563.86 nm
Software features	<ul style="list-style-type: none"> Enhanced optical monitoring capabilities CLI configurable wavelength support Virtual Router Redundancy Protocol (VRRP) support 802.1q virtual LANs (VLANs) support 802.3ad link aggregation support RMON EtherStats

Cables and connectors	<ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) Fiber-optic 10-Gigabit DWDM transceivers: <ul style="list-style-type: none"> Extra-Long Wavelength Serial DWDM, LAN Rate <p>Optical interface specifications—see “10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND) Optical Interface Specifications” on page 24</p>
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LEDs	<p>Status LED, one bicolor:</p> <ul style="list-style-type: none"> Off—PIC is not enabled. Green—PIC is operating normally. Red—PIC has an error or failure. <p>Port LEDs, one pair:</p> <ul style="list-style-type: none"> Link—If green, the port is online; if there is no light, the port is down. RX—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data.
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Related Documentation	<ul style="list-style-type: none"> M320 PIC Description M320 PIC Combination Limitations on page 15 M320 PICs Supported on page 3
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10-Gigabit Ethernet IQ2 PIC with XFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 8.0R3 and later (Type 3) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> One 10-Gigabit Ethernet port Power requirements: 1.2 A @48 V (56 W) Model number: PC-1XGE-TYPE3-XF-IQ2

Hardware features	<ul style="list-style-type: none"> • High-performance throughput • WAN-PHY mode at 9.953 Gbps • LAN-PHY mode at 10.3125 Gbps • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes
Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Configurable WAN-PHY mode options: <ul style="list-style-type: none"> • loopback • mpls • path-trace • trigger • Virtual Router Redundancy Protocol (VRRP) support • Hierarchical shaping • Fine-grained queueing and shaping per logical interface at both ingress and egress • 802.1q virtual LANs (VLANs) • VLAN stacking and rewriting • Channels defined by two stacked VLAN tags • Multiple tag protocol identifiers (TPID) support • IP service for nonstandard TPID and stacked VLAN tags • 802.1p rewrite per channel • Flexible mapping of channels and scheduler resources at both ingress and egress • Flexible Ethernet encapsulation • MAC learning, policing, accounting, and filtering
Cables and connectors	<ul style="list-style-type: none"> • You can install any transceiver supported by the PIC. • Fiber-optic 10-gigabit small form-factor pluggable (XFP) transceivers: <ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx) • 10-Gigabit Ethernet XFP transceivers: <ul style="list-style-type: none"> • 10GBase-S (model number: XFP-10G-S) • 10GBase-L (model number: XFP-10G-L-OC192-SR1) • 10GBase-E (model number: XFP-10G-E-OC192-IR2) • 10GBase-Z (model number: XFP-10G-Z-OC192-LR2) <p>Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/</p>

LEDs

OK LED, one tricolor:

- Off—PIC is offline and safe to remove from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one:

- Off—Monitoring application is not running.
- Green—Monitoring application is running. under acceptable load
- Yellow—Monitoring application is overloaded.

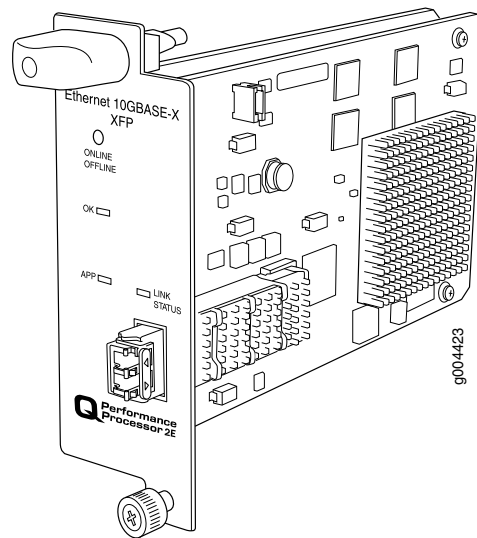
Link Status LED, one:

- Off—Port is down.
- Green—Port is online. Link is established.

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router)



Software release

- Junos OS Release 9.4 and later (Type 3)
For information on which FPCs support this PIC, see "[M320 PIC/FPC Compatibility](#)" on page 15.

Description

- One 10-Gigabit Ethernet port
- Power requirements: 1.2 A @48 V (56 W)
- Model number: PC-1XGE-TYPE3-XFP-IQ2E

Hardware features	<ul style="list-style-type: none"> • High-performance throughput • WAN-PHY mode at 9.953 Gbps • LAN-PHY mode at 10.3125 Gbps • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes
Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Drop statistics reported per queue for each of four priority-based drop profiles • Four levels of strict priorities with priority propagation among scheduling levels • Hierarchical shaping and hierarchical scheduler • Configurable WAN-PHY mode options: <ul style="list-style-type: none"> • loopback • mpls • path-trace • trigger • Virtual Router Redundancy Protocol (VRRP) support • Fine-grained queueing and shaping per logical interface at both ingress and egress • 802.1q virtual LANs (VLANs) • VLAN stacking and rewriting • Channels defined by two stacked VLAN tags • Multiple tag protocol identifiers (TPID) support • IP service for nonstandard TPID and stacked VLAN tags • 802.1p rewrite per channel • Flexible mapping of channels and scheduler resources at both ingress and egress • 16,000 schedulers (2,000 schedulers with 8 queues each or 4,000 schedulers with 4 queues each) • Scheduler resources dynamically allocated across ports • Flexible Ethernet encapsulation • MAC learning, policing, accounting, and filtering
Cables and connectors	<ul style="list-style-type: none"> • You can install any transceiver supported by the PIC. • Fiber-optic 10-gigabit small form-factor pluggable (XFP) transceivers: <ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx) • 10-Gigabit Ethernet XFP transceivers: <ul style="list-style-type: none"> • 10GBase-S (model number: XFP-10G-S) • 10GBase-L (model number: XFP-10G-L-OC192-SR1) • 10GBase-E (model number: XFP-10G-E-OC192-IR2) • 10GBase-Z (model number: XFP-10G-Z-OC192-LR2) <p>Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/</p>

LEDs

OK LED, one tricolor:

- Off—PIC is offline and safe to remove from the router.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure.

APP LED, one:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.
- Yellow—Monitoring application is overloaded.

Link Status LED, one:

- Off—Port is down.
- Green—Port is online. Link is established.

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Services PIC Descriptions

- Multiservices PICs (M320 Router) on page 141
- Tunnel Services PIC (M320 Router) on page 145

Multiservices PICs (M320 Router)

Figure 26: Multiservices 100 PIC

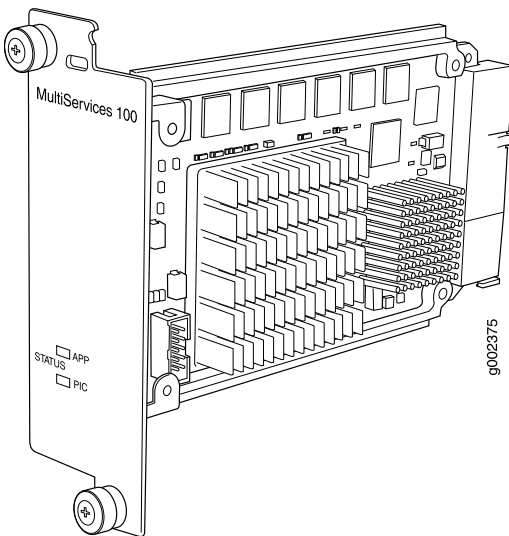


Figure 27: Multiservices 400 PIC

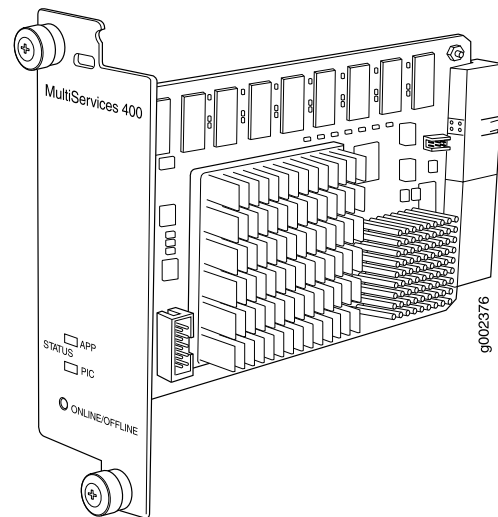
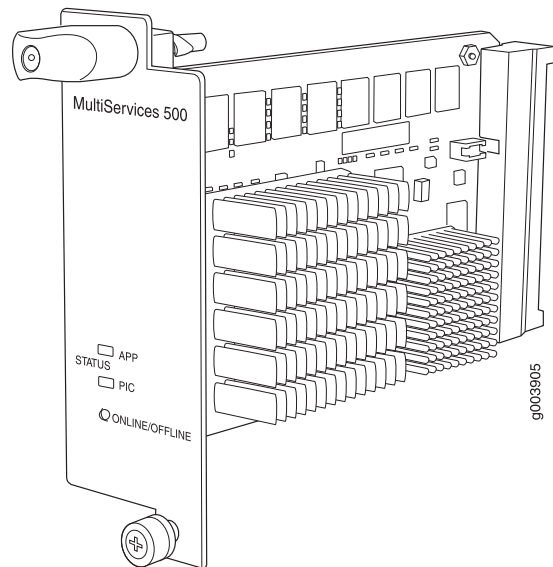


Figure 28: Multiservices 500 PIC



Software release

- Multiservices 100: Junos OS Release 8.1 and later (Type 1)
- Multiservices 400: Junos OS Release 8.1R2 and later (Type 2)
- Multiservices 500: Junos OS Release 8.3 and later (Type 3)

For information on which FPCs support these PICs, see [“M320 PIC/FPC Compatibility” on page 15](#).

Description	<ul style="list-style-type: none"> • Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services. • Power requirement: <ul style="list-style-type: none"> • Type 1: 0.52 A @ 48 V (25 W) • Type 2: 0.69 A @ 48 V (33 W) • Type 3: 0.83 A @ 48 V (40 W) • Model number for Multiservices 100 PIC: PB-MS100-1 • Model number for Multiservices 400 PIC: PB-MS-400-2 • Model number for Multiservices 500 PIC: PB-MS-500-3
Hardware features	<ul style="list-style-type: none"> • Active monitoring on: <ul style="list-style-type: none"> • Type 1: up to 1.6 million flows • Type 2: up to 3.2 million flows • Type 3: up to 3.2 million flows
Software features	<ul style="list-style-type: none"> • Support for up to 2000 service sets • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces <p>Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 48 on page 143. For more information about the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p>
LEDs	<p>Status LED, one tricolor:</p> <ul style="list-style-type: none"> • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. <p>Application LED, one bicolor:</p> <ul style="list-style-type: none"> • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 48: Multiservices PICs Software Features Supported on the M320 Router

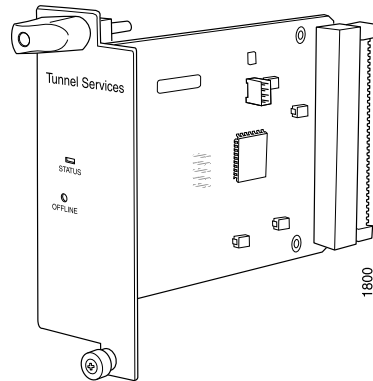
Software Feature	Multiservices 100	Multiservices 400	Multiservices 500
GRE Key	–	–	–
GRE dont-fragment	–	–	–
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	8.1	8.1R2	8.3
Network Address Translation (NAT) for IP addresses	8.1	8.1R2	8.3
Port Address Translation (PAT) for port numbers	8.1	8.1R2	8.3
IP Security (IPSec) encryption	8.1	8.1R2	8.5

Table 48: Multiservices PICs Software Features Supported on the M320 Router (continued)

Software Feature	Multiservices 100	Multiservices 400	Multiservices 500
Flow monitoring exports cflowd version 5 and version 8 records	8.1	8.1R2	8.3
Flow monitoring exports flow monitoring version 9 records, based on RFC 3954	8.3	8.3	8.5
Passive flow monitoring	–	8.4	–
Passive flow collection	–	8.5	–
Flow-tap	8.2	8.2	8.5
Dynamic flow capture	–	8.4	–
RPM	8.2	8.2	8.5
Link Services	8.1	8.1R2	8.5
Tunnel services:	8.1	8.1R2	8.5
<ul style="list-style-type: none"> • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling 			
Virtual tunnel interface for Layer 3 VPNs	8.1	8.1R2	8.5
Layer 2 Tunneling Protocol (L2TP)	–	–	–
Voice services:	8.1	8.1R2	8.5
<ul style="list-style-type: none"> • Compressed Real-Time Transport Protocol (CRTP) 			
Encapsulations:	8.1	8.1R2	8.5
<ul style="list-style-type: none"> • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP) 			

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Tunnel Services PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1 and Type 2) Junos OS Release 6.3 and later (Type 3) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> Power requirement: 0.07 A @ 48 V (3.4 W) Model number for Type 1 Tunnel Services PIC: PB-TUNNEL-1 Model number for Type 2 Tunnel Services PIC: PB-TUNNEL Model number for Type 3 tunnel Services PIC: PC-TUNNEL
Hardware features	<ul style="list-style-type: none"> Loopback function that encapsulates and de-encapsulates packets OC12/STM4 tunneling bandwidth on FPC1; OC48/STM16 tunneling bandwidth on FPC2; OC192/STM64 tunneling bandwidth on FPC3
Software features	<p>For a list of the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p> <ul style="list-style-type: none"> IP-IP unicast tunneling GRE unicast tunneling PIM sparse mode unicast tunneling
LEDs	<p>One tricolor:</p> <ul style="list-style-type: none"> Off—Not enabled Green—Online with no alarms or failures Yellow—Online with alarms for remote failures Red—Active with a local alarm; router has detected a failure

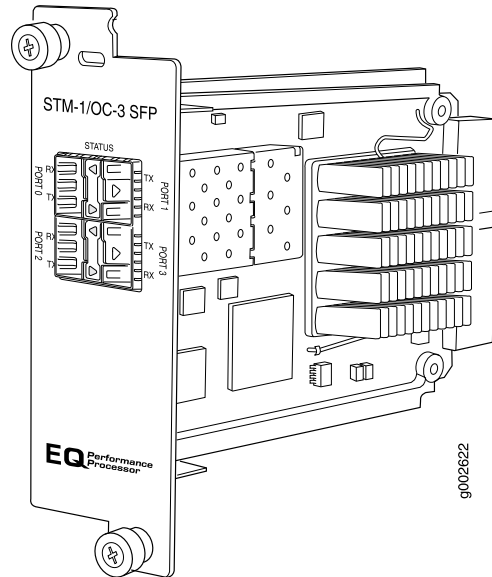
- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

CHAPTER 14

SONET/SDH PIC Descriptions

- SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 148
- SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router) on page 151
- SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 154
- SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router) on page 157
- SONET/SDH OC48c/STM16 PICs with SFP (M320 Router) on page 160
- SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router) on page 163
- SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router) on page 167
- SONET/SDH OC192c/STM64 PIC (M320 Router) on page 170
- SONET/SDH OC192/STM64 PIC with XFP (M320 Router) on page 173

SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.3R2 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Four OC3 or STM1 ports SONET or SDH is configurable on a per-port granularity Power requirement: 0.6 A @ 48 V (28.8 W) Model number: PB-4OC3-STM1-IQE-SFP
Hardware features	<ul style="list-style-type: none"> Top row: Ports are numbered 0 and 1 from left to right Bottom row: Ports are numbered 2 and 3 from left to right

Software features	<ul style="list-style-type: none"> • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Enhanced fine-grained queuing per logical interface. See the <i>Class of Service Feature Guide for Routing Devices and EX9200 Switches</i> for more information about class of service features. • Packet buffering, Layer 2 parsing • Local line and remote payload loopback testing • Simple Network Management Protocol (SNMP): OC3 MIB • Encapsulations: <ul style="list-style-type: none"> • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Extended Frame Relay for CCC and TCC • Flexible Frame Relay • Frame Relay • Frame Relay for CCC • Frame Relay for TCC • Frame Relay port CCC • High-Level Data Link Control (HDLC) • HDLC framing for CCC • HDLC framing for TCC • MPLS CCC • MPLS TCC • Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16) • Point-to-Point Protocol (PPP) • PPP for CCC • PPP for TCC
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Cables and connectors	<ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx) • SONET/SDH OC3/STM1 fiber-optic SFP transceivers: <ul style="list-style-type: none"> • Multimode (model number: SFP-OC3-SR) • Intermediate reach (IR-1) (model number: SFP-OC3-IR) • Long reach (LR-1) (model number: SFP-OC3-LR) <p>Optical interface specifications—see “SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25</p>
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LEDs	<p>One tricolor Status LED per port:</p> <ul style="list-style-type: none"> • Off—Not enabled. • Green—Online with no alarms or failures. • Yellow—Online with alarms for remote failures. • Red—Active with a local alarm; router has detected a failure.
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Alarms, errors, and events	<ul style="list-style-type: none"> • SONET alarms: <ul style="list-style-type: none"> • Alarm indication signal—line (AIS-L) • Alarm indication signal—path (AIS-P) • Bit error rate—signal degrade (BERR-SD) • Bit error rate—signal fail (BERR-SF) • Loss of frame (LOF) • Loss of light (LOL)
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- Loss of pointer (LOP)
- Loss of signal (LOS)
- Payload label mismatch (PLM-P)
- Phase lock loop (PLL)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Remote error indication (REI)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Severely errored frames (SEF)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—alarm indication signal (HP-AIS)
 - Higher order path—far-end receive failure (HP-FERF)
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—far-end receive failure (MS-FERF)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
 - Phase lock loop (PLL)
 - Remote error indication (REI)
 - Severely errored frames (SEF)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router)

Figure 29: SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 1)

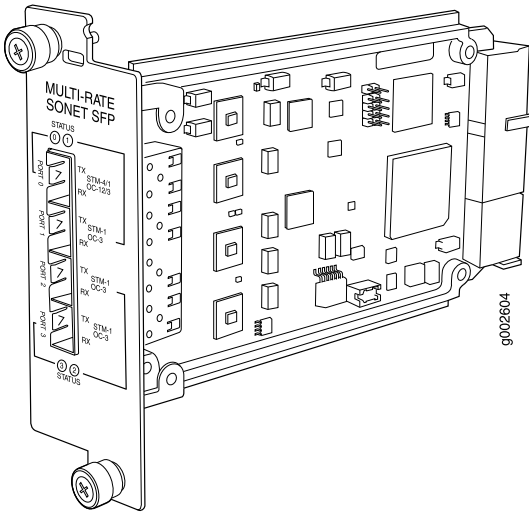
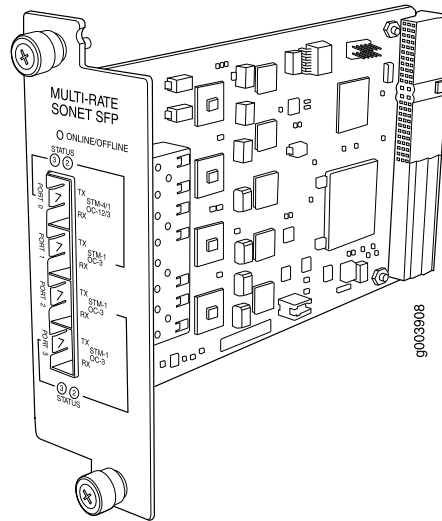


Figure 30: SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 2)



Software release

- 4-port: Junos OS Release 8.4 and later (Type 1)
- 4-port: Junos OS Release 8.3 and later (Type 2)

For information on which FPCs support these PICs, see "M320 PIC/FPC Compatibility" on page 15.

Description

- Rate-selectable using one of the following rates:
 - 1-port OC12
 - 1-port OC12c
 - 4-port OC3c
- Power requirement: 0.40 A @ 48 V (19 W)
- Model number for SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 1): PB-4OC3-1OC12-SON-SFP
Model number for SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 2): PB-4OC3-1OC12-SON2-SFP

Hardware features

- Multiplexing and demultiplexing
- Rate policing on input
- Rate shaping on output
- Packet buffering, Layer 2 parsing

- Software features
- Optical diagnostics and related alarms
 - Per-port SONET/SDH framing
 - Link aggregation
 - Alarm and event counting and detection
 - Dual-router automatic protection switching (APS)
 - Multiprotocol Label Switching (MPLS) fast reroute
 - Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Frame Relay
 - High-Level Data Link Control (HDLC)
 - Point-to-Point Protocol (PPP)

- Cables and connectors
- You can install any transceiver supported by the PIC.
- Duplex LC/PC connector (Rx and Tx)
 - SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:
 - Multimode (model number: SFP-OC3-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC3-IR)
 - Long reach (LR-1) (model number: SFP-OC3-LR)

Optical interface specifications—see [“SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25](#)
 - SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
 - Short reach (model number: SFP-OC12-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC312-IR)
 - Long reach (LR-1) (model number: SFP-OC12-LR)

Optical interface specifications—see [“SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26](#)
- NOTE:** To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the *Junos System Basics and Services Command Reference*.

- LEDs
- One tricolor per port:
- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure

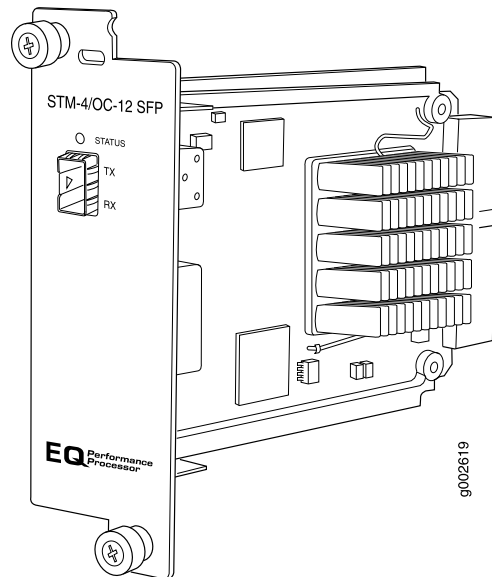
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 9.3 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> One OC12/STM4 port SONET or SDH is configurable on a per-port granularity Power requirement: 0.58 A @ 48 V (27.8 W) Model number: PB-1OC12-STM4-IQE-SFP
Hardware features	<ul style="list-style-type: none"> Port is numbered 0.
Software features	<ul style="list-style-type: none"> Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) Enhanced fine-grained queuing per logical interface. See the <i>Class of Service Feature Guide for Routing Devices and EX9200 Switches</i> for more information about class of service features. Packet buffering, Layer 2 parsing Local line and remote payload loopback testing Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Extended Frame Relay for CCC and TCC Flexible Frame Relay Frame Relay Frame Relay for CCC Frame Relay for TCC Frame Relay port CCC High-Level Data Link Control (HDLC) HDLC framing for CCC

- HDLC framing for TCC
- MPLS CCC
- MPLS TCC
- Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
- Point-to-Point Protocol (PPP)
- PPP for CCC
- PPP for TCC
- Encapsulations available only for DS1:
 - Multilink Frame Relay end-to-end (MLFR FRF.15)
 - Multilink PPP (MLPPP)
 - PPP over Frame Relay

Cables and connectors	<ul style="list-style-type: none"> • Duplex LC/PC connector (Rx and Tx) • SONET/SDH OC12/STM4 fiber-optic SFP transceivers: <ul style="list-style-type: none"> • Short reach (model number: SFP-OC12-SR) • Intermediate reach (IR-1) (model number: SFP-OC12-IR) • Long reach (LR-1) (model number: SFP-OC12-LR) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
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LEDs

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of pointer (LOP)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
 - Remote error indication (REI)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—alarm indication signal (HP-AIS)
 - Higher order path—far-end receive failure (HP-FERF)
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of light (LOL)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—far-end receive failure (MS-FERF)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
 - Phase lock loop (PLL)
 - Remote error indication (REI)
 - Severely errored frame (SEF)

Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router)

Figure 31: 1-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC

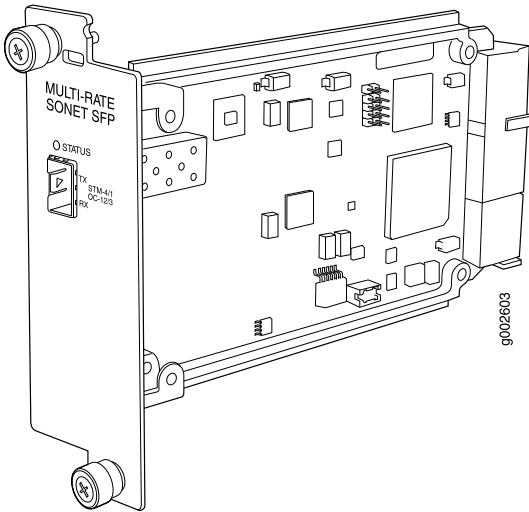
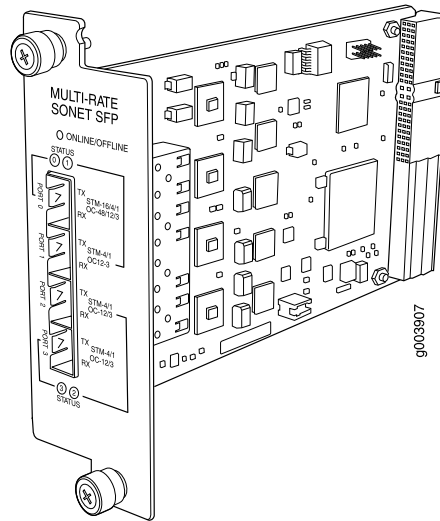


Figure 32: 4-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC



Software release

- 1-port: Junos OS Release 8.4 and later (Type 1)
- 4-port: Junos OS Release 8.3 and later (Type 2)

For information on which FPCs support these PICs, see "M320 PIC/FPC Compatibility" on page 15.

Description

- 1-port: Rate-selectable using one of the following rates:
 - 1-port OC3/STM1
 - 1-port OC12/STM4
 - 1-port OC12c/STM4c
- 4-port: Rate-selectable using one of the following rates:
 - 1-port OC12/STM4
 - 1-port OC48/STM16
 - 1-port OC48c/STM4c
 - 4-port OC3c/STM1c
 - 4-port OC12c/STM4c
- Power requirement:
 - 1-port: 0.20 A @ 48 V (9.5 W)
 - 4-port: 0.40 A @ 48 V (19 W)
- Model number for 1-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC: PB-1OC12-SON-SFP
- Model number for 4-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC: PB-4OC3-4OC12-SON-SFP

Hardware features	<ul style="list-style-type: none">• Multiplexing and demultiplexing• Rate policing on input• Rate shaping on output• Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none">• Optical diagnostics and related alarms• Per-port SONET/SDH framing• Link aggregation• Alarm and event counting and detection• Dual-router automatic protection switching (APS)• Multiprotocol Label Switching (MPLS) fast reroute• Encapsulations:<ul style="list-style-type: none">• Circuit cross-connect (CCC)• Translational cross-connect (TCC)• Frame Relay• High-Level Data Link Control (HDLC)• Point-to-Point Protocol (PPP)
Cables and connectors	<p>You can install any transceiver supported by the PIC.</p> <ul style="list-style-type: none">• Duplex LC/PC connector (Rx and Tx)• SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:<ul style="list-style-type: none">• Multimode (model number: SFP-OC3-SR)• Intermediate reach (IR-1) (model number: SFP-OC3-IR)• Long reach (LR-1) (model number: SFP-OC3-LR)Optical interface specifications—see “SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:<ul style="list-style-type: none">• Short reach (model number: SFP-OC12-SR)• Intermediate reach (IR-1) (model number: SFP-OC312-IR)• Long reach (LR-1) (model number: SFP-OC12-LR)Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26 <p>NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the request chassis pic offline command in the CLI Explorer.</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure

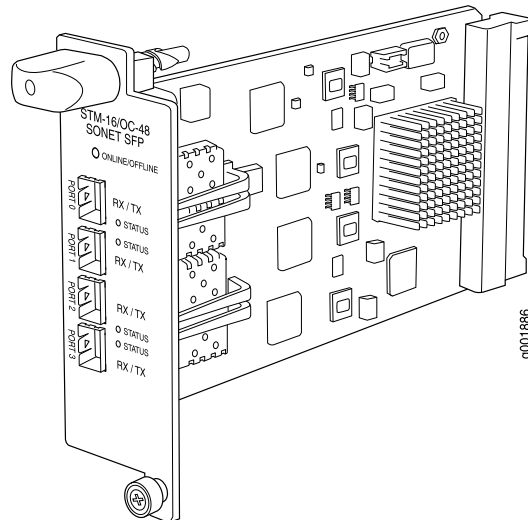
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC48c/STM16 PICs with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 3) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> Four OC48 ports Power requirement: 0.86 A @ 48 V (41.4 W) Model number: PC-4OC48-SON-SFP
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing on the 1-port PIC Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> Optical diagnostics and related alarms Configuration of SONET or SDH framing on a per-port basis (Junos OS Release 8.1 and later) SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Frame Relay High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP)

Cables and connectors	<p>You can install any transceiver supported by the PIC. For information about installing and removing transceivers.</p> <ul style="list-style-type: none">• Duplex LC/PC connector (Rx and Tx)• SONET/SDH OC48/STM16 small form-factor pluggable (SFP) transceivers:<ul style="list-style-type: none">• Short reach (SR-1) (model number: SFP-1OC48-SR)• Intermediate reach (IR-1) (model number: SFP-1OC48-IR)• Long reach (LR-1) (model number: SFP-1OC48-LR) <p>Optical interface specifications—see “SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28</p> <p>NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the request chassis pic offline command in the CLI Explorer.</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure

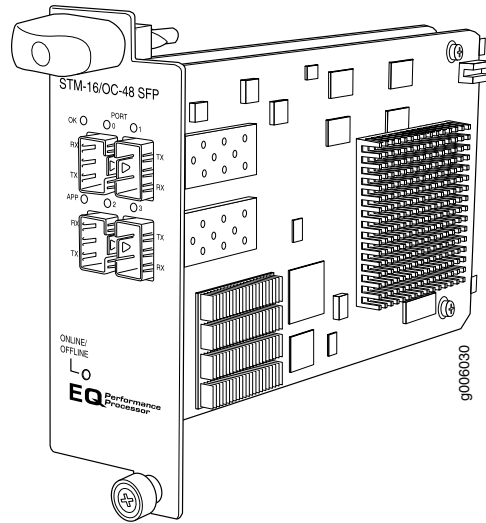
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 10.4R2 and later (Type 3) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> Four OC48/STM16 ports Clear channel functionality SONET and SDH is configured on a per-port granularity Power requirement: 1.06 A @ 48 V (51 W) Weight: 1.6 lb (0.725 kg) Model number: PC-4OC48-STM16-IQE-SFP
Hardware features	<ul style="list-style-type: none"> Ports are numbered: <ul style="list-style-type: none"> Top row: 0 and 1 from left to right Bottom row: 2 and 3 from left to right Maximum transmission units (MTUs) of up to 9192 bytes

Software features

- Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
- Fine-grained egress queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class-of-service features
- Packet buffering
- Local line and remote payload loopback testing
- Optical diagnostics and monitoring
- Clocking options: internal or external/loop mode. Each OC48 transmitter port is configured either in internal or external mode. The default clocking option is internal mode.
- Encapsulations:
 - Extended Frame Relay for circuit cross-connect (CCC) and translational cross-connect (TCC)
 - Flexible Frame Relay
 - Frame Relay
 - Frame Relay for CCC
 - Frame Relay for TCC
 - Frame Relay port CCC
 - High-Level Data Link Control (HDLC)
 - HDLC framing for CCC
 - HDLC framing for TCC
 - MPLS CCC
 - MPLS TCC
 - Point-to-Point Protocol (PPP)
 - PPP for CCC
 - PPP for TCC

Cables and connectors

You can install any transceiver supported by the PIC.

- Duplex LC/PC connector (Rx and Tx)
- SONET/SDH OC48/STM16 small form-factor pluggable (SFP) transceivers:
 - Short reach (SR-1) (model number: SFP-IOC48-SR)
 - Intermediate reach (IR-1) (model number: SFP-IOC48-IR)
 - Long reach (LR-1) (model number: SFP-IOC48-LR)

Optical interface specifications—see “[SONET/SDH OC48/STM16 Optical Interface Specifications](#)” on page 28

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the `request chassis pic offline` command in the *JUNOS System Basics and Services Command Reference*.

LEDs

OK LED, one tricolor:

- Off—PIC is offline and safe to remove from the router
- Green—PIC is operating normally
- Yellow—PIC is initializing
- Red—PIC has an error or failure

APP LED, one green per port:

- Off—Service is not running
- Green—Service is running under acceptable load

Port LEDs, one tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

SONET alarms:

- Loss of light (LOL)
- Phase lock loop (PLL)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Severely errored frame (SEF)
- Alarm indicator signal—line (AIS-L)
- Alarm indicator signal—path (AIS-P)
- Loss of pointer (LOP)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Remote defect indicator—line (RDI-L)
- Remote defect indicator—path (RDI-P)
- Remote error indicator (REI)
- Unequipped (UNEQ)
- Payload label mismatch—path (PLM-P)

SDH alarms:

- Loss of light (LOL)
- Phase lock loop (PLL)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Severely errored frame (SEF)
- Multiplex-section alarm indicator signal (MS-AIS)
- H Path alarm indicator signal (HP-AIS)
- Loss of pointer (LOP)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Multiplex section—far end receive failure (MS-FERF)
- High order path—far end receive failure (HP-FERF)
- Remote error indicator (REI)
- Unequipped (UNEQ)
- High order path—payload label mismatch - Path (HP-PLM)

Optical diagnostics related alarms:

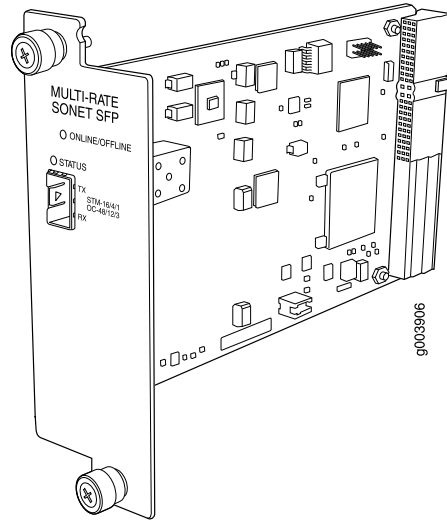
NOTE: Transceivers from some vendors do not support these fields.

- Temperature high/low alarms and warnings
- Supply voltage high/low alarms and warnings
- Tx bias current high/low alarms and warnings
- Tx output power high/low alarms and warnings
- Rx received power high/low alarms and warnings

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 8.3 and later (Type 2) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> Rate-selectable using one of the following rates: <ul style="list-style-type: none"> 1-port OC3c 1-port OC12 1-port OC12c 1-port OC48 1-port OC48c Power requirement: 0.20 A @ 48 V (9.5 W) Model number: PB-1OC48-SON-B-SFP
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing

- Software features
- Optical diagnostics and related alarms
 - Per-port SONET/SDH framing
 - Link aggregation
 - Alarm and event counting and detection
 - Dual-router automatic protection switching (APS)
 - Multiprotocol Label Switching (MPLS) fast reroute
 - Encapsulations:
 - Circuit cross-connect (CCC)
 - Translational cross-connect (TCC)
 - Frame Relay
 - High-Level Data Link Control (HDLC)
 - Point-to-Point Protocol (PPP)

Cables and connectors You can install any transceiver supported by the PIC.

- Duplex LC/PC connector (Rx and Tx)
- SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:
 - Multimode (model number: SFP-OC3-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC3-IR)
 - Long reach (LR-1) (model number: SFP-OC3-LR)

Optical interface specifications—see [“SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25](#)

- SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
 - Short reach (model number: SFP-OC12-SR)
 - Intermediate reach (IR-1) (model number: SFP-OC312-IR)
 - Long reach (LR-1) (model number: SFP-OC12-LR)

Optical interface specifications—see [“SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26](#)

- SONET/SDH OC48/STM16 small form-factor pluggable (SFP) transceivers:
 - Short reach (SR-1) (model number: SFP-IOC48-SR)
 - Intermediate reach (IR-1) (model number: SFP-IOC48-IR)
 - Long reach (LR-1) (model number: SFP-IOC48-LR)

Optical interface specifications—see [“SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28](#)

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the [CLI Explorer](#).

LEDs

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

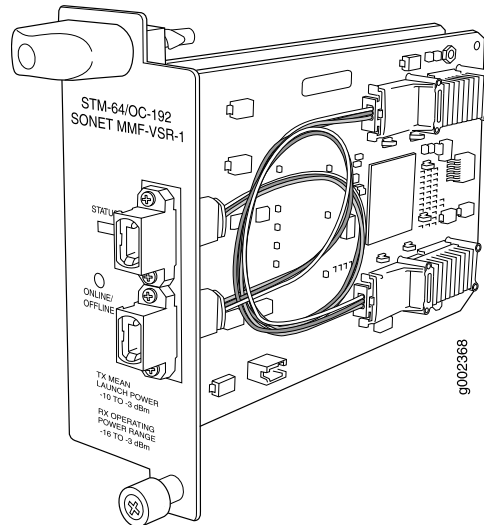
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC192c/STM64 PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 3) <p>For information on which FPCs support this PIC, see "M320 PIC/FPC Compatibility" on page 15.</p>
Description	<ul style="list-style-type: none"> One OC192 port Power requirement: 0.45 A @ 48 V (21.6 W) Model number: PB-1OC192-SON-VSR
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Frame Relay High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP)

-
- Cables and connectors
- 12-ribbon multimode fiber with MTP connector (Rx and Tx)
 - SONET/SDH OC192/STM64 fixed very short reach (VSR 1): transceiver
Optical interface specifications—see “[SONET/SDH OC192/STM64 Optical Interface Specifications](#)” on page 30

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the [CLI Explorer](#).

LEDs

One tricolor per port:

- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure
-

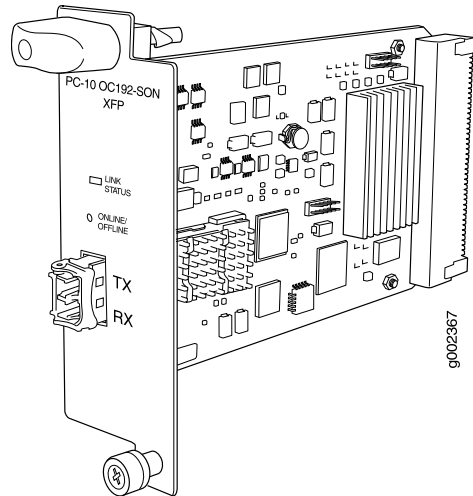
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored frames (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

SONET/SDH OC192/STM64 PIC with XFP (M320 Router)



Software release	<ul style="list-style-type: none"> 1-port: Junos OS Release 8.1 and later (Type 3) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> One OC192 port Power requirement: 0.52A @ 48 V (25 W) Model number: PB-1OC192-SON-XFP
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Frame Relay High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP)
Cables and connectors	<p>TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.</p> <p>NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the <code>request chassis pic offline</code> command in the CLI Explorer.</p>

LEDs

One tricolor LED per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate—signal degrade (BERR-SD)
 - Bit error rate—signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Payload label mismatch (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1, B2, B3
 - Higher order path—payload label mismatch (HP-PLM)
 - Higher order path—loss of pointer (HP-LOP)
 - Higher order path—remote defect indication (HP-RDI)
 - Higher order path—unequipped (HP-UNEQ)
 - Loss of frame (LOF)
 - Loss of signal (LOS)
 - Multiplex section—alarm indication signal (MS-AIS)
 - Multiplex section—remote defect indication (MS-RDI)
 - Multiplex section—remote error indication (MS-REI)
- Error detection:
 - Errored seconds (ES-S, ES-L, ES-P)
 - Far-end errored seconds (ES-LFE, ES-PFE)
 - Far-end severely errored seconds (SES-LFE, SES-PFE)
 - Far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored framing (SEF)
 - Severely errored framing seconds (SEFS-S)
 - Severely errored seconds (SES-S, SES-L, SES-P)
 - Unavailable seconds (UAS-L, UAS-P)

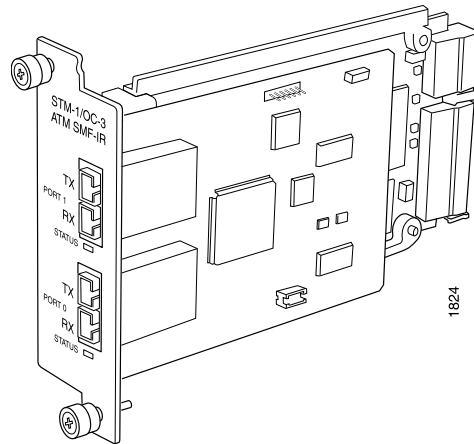
- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

CHAPTER 15

End-of-Life PIC Descriptions

- ATM OC3 EOL PIC (M320 Router) on page 178
- ATM OC12 EOL PIC (M320 Router) on page 179
- Channelized DS3 EOL PIC (M320 Router) on page 181
- Channelized OC12 EOL PIC (M320 Router) on page 182
- Multichannel DS3 EOL PIC (M320 Router) on page 184
- Channelized E1 IQ EOL PIC (M320 Router) on page 186
- Channelized OC12 IQ EOL PIC (M320 Router) on page 187
- DS3 EOL PIC (M320 Router) on page 190
- Gigabit Ethernet EOL PICs (M320 Router) on page 191
- 10-Gigabit Ethernet EOL PIC (M320 Router) on page 193
- Adaptive Services II EOL PIC (M320 Router) on page 195
- Adaptive Services II Layer 2 Services EOL PIC (M320 Router) on page 197
- Adaptive Services II FIPS EOL PIC (M320 Router) on page 200
- ES EOL PIC (M320 Router) on page 202
- Link Services EOL PIC (M320 Router) on page 203
- Monitoring Services II EOL PIC (M320 Router) on page 205
- Monitoring Services III EOL PIC (M320 Router) on page 206
- SONET/SDH OC3c/STM1 EOL PICs (M320 Router) on page 208
- SONET/SDH OC12c/STM4 EOL PICs (M320 Router) on page 211
- SONET/SDH OC48c/STM16 EOL PICs (M320 Router) on page 214
- SONET/SDH OC48c/STM16 EOL PIC with SFP (M320 Router) on page 217
- SONET/SDH OC192c/STM64 EOL PICs (M320 Router) on page 219

ATM OC3 EOL PIC (M320 Router)

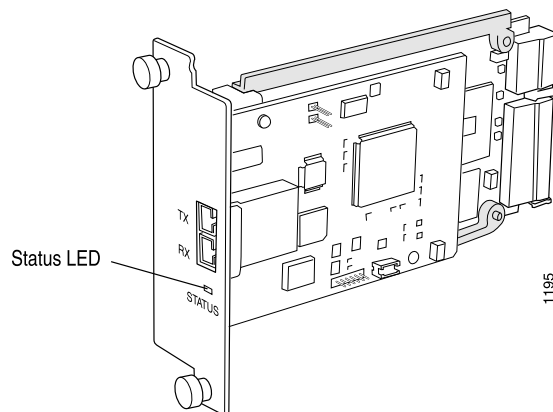


Software release	<ul style="list-style-type: none"> Junos OS Release 6.3 and later
Description	<ul style="list-style-type: none"> Two OC3 ports Power requirement: 0.49 A @ 48 V (23.7 W) Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 ATM and SONET/SDH standards compliant Alarm and event counting and detection Compatible with well-known ATM switches ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches
Hardware features	<ul style="list-style-type: none"> Dual 3010 SAR for segmentation and reassembly into 53-byte ATM cells High-performance parsing of SONET/SDH frames OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells ASIC-based packet segmentation and reassembly (SAR) management and output port queuing 16-MB SDRAM memory for ATM SAR Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks Support for user-configurable virtual circuits (VC) and virtual paths (VP) ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC) Unspecified bit rate (UBR) traffic shaping Fine-grained variable bit rate (VBR) traffic shaping Outbound PIC queues cells on a per-VC basis Encapsulations—AAL5 subnetwork attachment point (SNAP)

Cables and connectors	<ul style="list-style-type: none"> • Duplex SC/PC connector (RX and TX) • SONET/SDH OC3/STM1 fixed transceivers: <ul style="list-style-type: none"> • Multimode • Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC3/STM1 Optical Interface Specifications” on page 25</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE) • Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Remote defect indication (RDI-L, RDI-P) • Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

ATM OC12 EOL PIC (M320 Router)

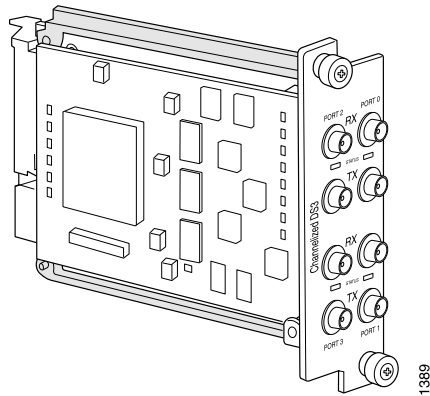


- Software release
- Junos OS Release 6.3 and later

Description	<ul style="list-style-type: none"> • One OC12 port • Power requirement: 0.43 A @ 48 V (20.8 W) • Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 • ATM and SONET/SDH standards compliant • Alarm and event counting and detection • Compatible with well-known ATM switches • ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches
Hardware features	<ul style="list-style-type: none"> • High-performance parsing of SONET/SDH frames • OAM fault management processes Alarm indication signal (AIS) and remote defect indicator (RDI) cells • ASIC-based packet segmentation and reassembly (SAR) management and output port queuing • 16-MB SDRAM memory for ATM SAR • Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> • Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks • Support for user-configurable virtual circuits (VC) and virtual paths (VP) • ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC) • Unspecified bit rate (UBR) traffic shaping • Fine-grained variable bit rate (VBR) traffic shaping • Outbound PIC queues cells on a per-VC basis • Encapsulations—AAL5 subnetwork attachment point (SNAP)
Cables and connectors	<ul style="list-style-type: none"> • Duplex SC/PC connector (RX and TX) • SONET/SDH OC12/STM4 fixed transceivers: <ul style="list-style-type: none"> • Multimode • Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE) • Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Remote defect indication (RDI-L, RDI-P) • Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Channelized DS3 EOL PIC (M320 Router)

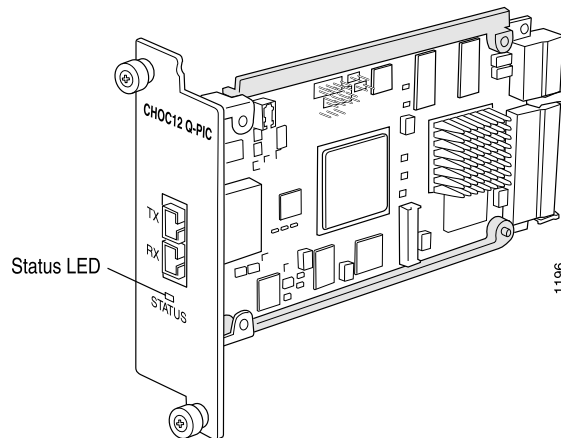


Software release	<ul style="list-style-type: none"> • Junos OS Release 6.3 and later
Description	<ul style="list-style-type: none"> • Four DS3 ports • Power requirement: 0.32 A @ 48 V (15.6 W) • Supports up to 28 T1 channels per port • Data Service Unit (DSU) functionality
Hardware features	<ul style="list-style-type: none"> • Each T1 channel supports a single High-level Data Link Control (HDLC) framer that can be configured for speeds ranging from DS0 (64 Kbps) through full T1 (1.54 Mbps) • Predictable throughput on all ports at 1.54 Mbps, full duplex • Rate limiting on input and output • Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> • DS3 alarm and event counting • DS3 alarm and event detection • DS3 diagnostics and loopback control • B3ZS line encoding • M13 or C-bit parity • DS3 Simple Network Management Protocol (SNMP) support (DS3 MIB) • Per-packet counts and byte counts • Local and remote loopback testing • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> • Custom 10-ft (3.05-m) posilock to BNC male cable, separate RX and TX

LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS) • Bit error rate (BER) • Equipment failure (Does not affect service) • Excessive zeros (EXZ) • Far-end block error (FEBE) • Frame error • Idle code, Idle received • Line code violation (LCV) • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Parity bit (P-bit) disagreements • Path parity error • Yellow alarm bit (X-bit) disagreements

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Channelized OC12 EOL PIC (M320 Router)



- Software release
- Junos OS Release 6.3 and later

Description	<ul style="list-style-type: none"> • One OC12 port • Power requirement: 0.23 A @ 48 V (10.8 W) • 12 DS3 channels • Supports IP version 4 (IPv4) unicast and multicast as well as MPLS, Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), and Border Gateway Protocol (BGP)
Hardware features	<ul style="list-style-type: none"> • ASIC-based, high-performance throughput on all ports • Integrated DSU functionality with subrate and scrambling support for each DS3 channel • Class-of-service support for each DS3 channel • Dual-router SONET automatic protection switching (APS) • Rate policing on input for each DS3 channel • Rate shaping output for each DS3 channel • Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> • M13/C-bit parity encoding • Full instrumentation per DS3 channel • DS3 diagnostics and loopback control • DS3 alarm and event counting and detection • DS3 Far-end Alarm and Control (FEAC) channel support • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> • Duplex SC/PC connector (RX and TX) • SONET/SDH OC12/STM4 fixed transceivers: <ul style="list-style-type: none"> • Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
LEDs	<p>One tricolor per port:</p> <p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

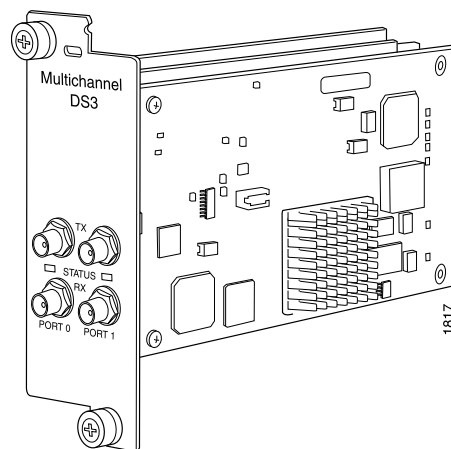
Alarms, errors, and events

- Alarm indication signal (AIS-L, AIS-P)
- BERT functionality (you can configure one DS3 channel in BERT mode and configure the remaining channels to transmit and receive normal traffic)
- Bit error rate signal degrade (BERR-SD), Bit error rate signal fail (BERR-SF)
- Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)
- Equipment failure (Does not affect service)
- Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), far-end block error (FEBE), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Frame error
- Idle code, Idle received
- Loss of frame (LOF), Loss of pointer (LOP-P), Loss of signal (LOS)
- Out of frame (OOF)
- Payload Mismatch (PLM-P), payload unequipped (UNEQ-P)
- Parity bit (P-bit) disagreements
- Path parity error
- Remote defect indication (RDI-L, RDI-P)
- Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)
- Yellow alarm bit (X-bit) disagreements

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

Multichannel DS3 EOL PIC (M320 Router)



Software release

- Junos OS Release 6.2 and later

Description

- Two DS3 ports
- Power requirement: 0.31 A @ 48 V (14.9 W)
- Supports up to 128 logical customer channels per DS3 port

- | | |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hardware features | <ul style="list-style-type: none"> • Support for NxT1 by interoperating with the Link Services and Multilink Services PICs, using MLPPP and MLFR protocols • Onboard DSU functionality |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- | | |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software features | <ul style="list-style-type: none"> • Support for four data-link connection identifiers (DLCIs) per logical customer channel • DS3 alarm and event counting • DS3 alarm and event detection • DS3 diagnostics and loopback control • DS3 framing: M13, C-bit • T1 framing: super frame (SF) and extended super frame (ESF) • Encapsulations: <ul style="list-style-type: none"> • High-Level Data Link Control (HDLC) • Frame Relay • Circuit cross-connect (CCC) • Point-to-Point Protocol (PPP) |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

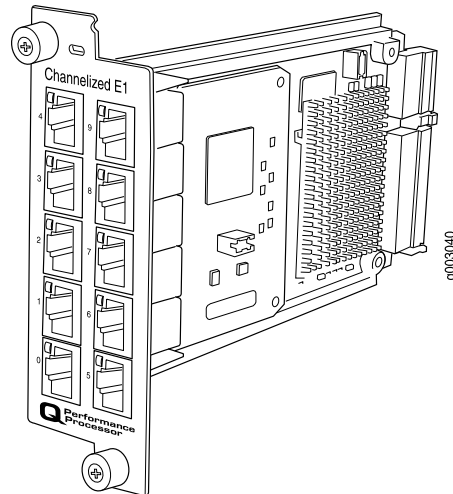
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| Cables and connectors | <ul style="list-style-type: none"> • Custom 10 ft/3.05 m posilock to BNC male cable, separate Rx and Tx |
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|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LEDs | <p>One tricolor per port:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure |
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| Alarms, errors, and events | <ul style="list-style-type: none"> • Far-end block error (FEBE) • Parity bit (P-bit) disagreements • Path priority error • Alarm indication signal (AIS) • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm • AIS received • Simultaneous BERT functionality • Idle received • Local and remote loopback |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Related Documentation | <ul style="list-style-type: none"> • M320 PIC Description • M320 End-of-Life PICs Supported on page 12 |
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Channelized E1 IQ EOL PIC (M320 Router)

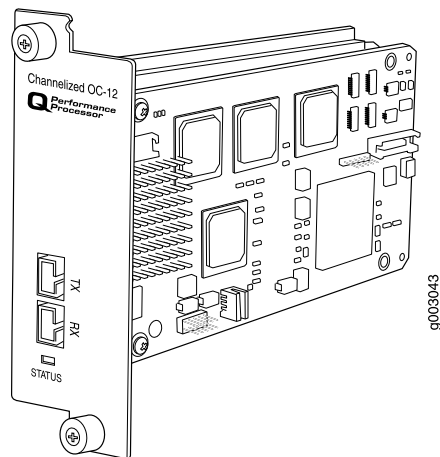


Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later
Description	<ul style="list-style-type: none"> Ten E1 ports Power requirement: 0.15 A @ 48 V (7.2 W) Fine-grained queuing per logical interface Channelization: E1, DS0
Hardware features	<ul style="list-style-type: none"> Data service unit (DSU) functionality Ports configurable as clear channel E1 interfaces with 2.048-Mbps connectivity Supports unframed E1 G.703 and G.704 framing modes Supports HDB3 line coding CRC4 configurable Local and remote loopback testing
Software features	<ul style="list-style-type: none"> Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) Simple Network Management Protocol (SNMP): E1 MIB, DS0 MIB Dynamic, arbitrary channel configuration Full bit error rate test (BERT) Encapsulations: <ul style="list-style-type: none"> Circuit cross-connect (CCC) Translational cross-connect (TCC) Frame Relay High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> 120-ohm RJ-48C

LEDs	<p>One bicolor per E1 port:</p> <ul style="list-style-type: none"> • Off—Port not enabled • Green—Physical E1 link is up; individual subchannels can be down • Red—Physical E1 link is down
Alarms, errors, and events	<ul style="list-style-type: none"> • Alarm indication signal (AIS) • Loss of frame (LOF) • Out of frame (OOF) • Failed signal rate (FSR)
Instrumentation (counters)	<ul style="list-style-type: none"> • Layer 2 per-queue and per-channel packet and byte counters

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Channelized OC12 IQ EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 6.2 and later (Type 1)
Description	<ul style="list-style-type: none"> • One OC12 port • Power requirement: 0.23 A @ 48 V (10.8 W) • Fine-grained queuing per logical interface • Channelization: OC3, DS3, DS1, DS0

Hardware features	<ul style="list-style-type: none">• Subrate and scrambling:<ul style="list-style-type: none">• Digital Link/Quick Eagle• Kentrox• Larscom• ADTRAN• Verilink• Packet buffering, Layer 2 parsing• M13/C-bit parity encoding• DS3 far-end alarm and control (FEAC) channel support• Local and remote loopback testing
Software features	<ul style="list-style-type: none">• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB• Dynamic, arbitrary channel configuration• Full bit error rate test (BERT)• Encapsulations:<ul style="list-style-type: none">• Circuit cross-connect (CCC)• Translational cross-connect (TCC)• Frame Relay• High-Level Data Link Control (HDLC)• Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none">• Duplex SC/PC connector (Rx and Tx); single-mode fiber• SONET/SDH OC12/STM4 fixed transceivers:<ul style="list-style-type: none">• Intermediate reach (IR-1) <p>Optical interface specifications—see “SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26</p>
LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

Alarms:

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Frame error
- Idle code, Idle received
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)
- Out of frame (OOF)
- Payload mismatch (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Parity bit (P-bit) disagreements
- Path parity error
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)
- Yellow alarm bit (X-bit) disagreements

Error detection:

- Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)
- Errored seconds (ES-S, ES-L, ES-P)
- Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
- Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
- Far-end errored seconds (ES-LFE, ES-PFE)
- Far-end severely errored seconds (SES-LFE, SES-PFE)
- Far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored frames (SEF)
- Severely errored framing seconds (SEFS-S)
- Severely errored seconds (SES-S, SES-L, SES-P)
- Unavailable seconds (UAS-L, UAS-P)

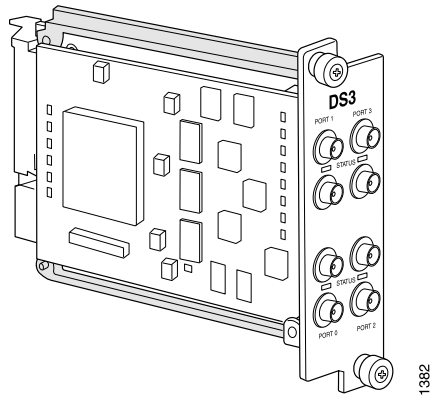
Instrumentation (counters)

- Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

DS3 EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1)
Description	<ul style="list-style-type: none"> Four DS3 ports Power requirement: 0.47 A @ 48 V (22.5 W) Integrated DSU interoperability with leading DSU vendors
Hardware features	<ul style="list-style-type: none"> High-performance throughput on each port at speeds up to 44.736 Mbps, full duplex C-bit framing B3ZS line encoding Subrate and scrambling: <ul style="list-style-type: none"> Digital Link Kentrox Larscom Per-port rate policing on input Per-port rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> DS3 functionality: <ul style="list-style-type: none"> C-bit framing B3ZS line encoding DS3 diagnostics and loopback control DS3 alarm and event counting and detection Per-packet counts and byte counts Local and remote loopback testing, as well as BERT testing per DS3 DS3 far-end alarm and control (FEAC) channel support Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> Custom 10-ft (3.05-m) posilock SMB to BNC male cable, separate Rx and Tx (provided)

LEDs

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- Alarm indication signal (AIS)
- Bit error rate test (BERT) functionality on PIC (you can configure one DS3 channel in BERT mode and configure the remaining channels to transmit and receive normal traffic)
- Equipment failure (does not affect service)
- Far-end block error (FEBE)
- Frame error
- Idle code, Idle received
- Local and remote loopback
- Loss of signal (LOS)
- Out of frame (OOF)
- Parity bit (P-bit) disagreements
- Path parity error
- Yellow alarm bit (X-bit) disagreements

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

Gigabit Ethernet EOL PICs (M320 Router)

Figure 33: 1-Port Gigabit Ethernet PIC

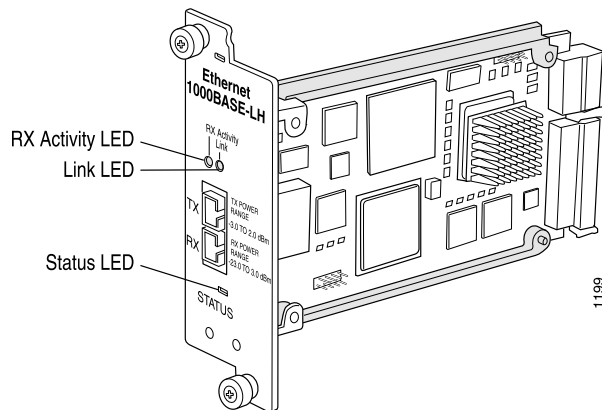


Figure 34: 2-Port Gigabit Ethernet PIC

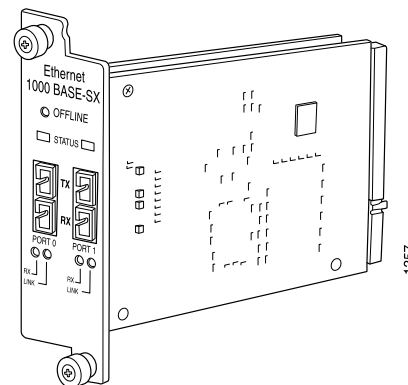
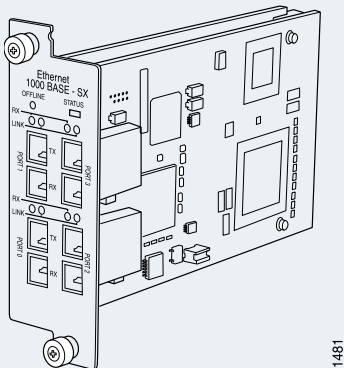


Figure 35: 4-Port Gigabit Ethernet PIC

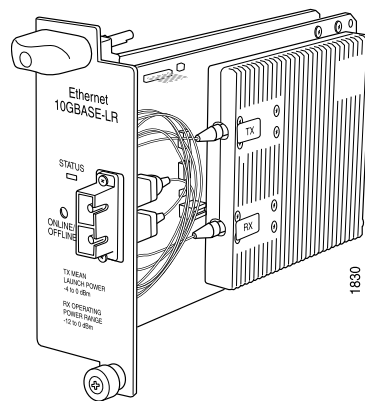


Software release	<ul style="list-style-type: none"> • Junos OS Release 6.2 and later • Junos OS Release 8.4 and later supports the 2-port PIC and 4-port PIC on the Enhanced III FPC2.
Description	<ul style="list-style-type: none"> • One, two, or four Gigabit Ethernet ports • Power requirement: <ul style="list-style-type: none"> • 1-port: 0.27 A @ 48 V (13.2 W) • 2-port: 0.35 A @ 48 V (17 W) • 4-port: 0.40 A @ 48 V (19.2 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
Hardware features	<ul style="list-style-type: none"> • High-performance throughput on all ports at speeds up to 1 Gbps • Autonegotiation between Gigabit Ethernet circuit partners • Full-duplex mode • Maximum transmission units (MTUs) of up to 9192 bytes
Software features	<ul style="list-style-type: none"> • Virtual Router Redundancy Protocol (VRRP) support • 802.1Q virtual LANs (VLANs) support • 64 source MAC address filters per port • 960 destination MAC filters per port
Cables and connectors	<ul style="list-style-type: none"> • Duplex SC connector (TX and RX) • Fiber-optic fixed transceivers: <ul style="list-style-type: none"> • 1000Base-LH • 1000Base-LX • 1000Base-SX • 1000Base-T <p>Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/</p>

LEDs	<p>Status LEDs, one bicolor:</p> <ul style="list-style-type: none"> • Off—PIC not enabled • Green—PIC is operating normally • Red—PIC has an error or failure <p>Port LEDs, one pair per port:</p> <ul style="list-style-type: none"> • Link—If green, the port is online; if there is no light, the port is down • Activity—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data
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- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

10-Gigabit Ethernet EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 6.2 and later • Junos OS Release 8.4 and later supports this PIC on the Enhanced III FPC
Description	<ul style="list-style-type: none"> • One 10-Gigabit Ethernet port • Power requirement: 0.74 A @ 48 V (35.5 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
Hardware features	<ul style="list-style-type: none"> • High-performance throughput at speeds up to 10 Gbps • Full-duplex mode • Maximum transmission units (MTUs) up to 9192 bytes • 64 source MAC address filters • 960 destination MAC filters
Software features	<ul style="list-style-type: none"> • Virtual Router Redundancy Protocol (VRRP) support • 802.1Q virtual LANs (VLANs) support • 802.3ae link aggregation support • RMON EtherStats

- Cables and connectors
- Duplex SC connector (RX and TX)
 - Long Wavelength Serial transceivers:
 - Duplex LC/PC connector (Rx and Tx)
 - 10-Gigabit Ethernet XFP transceivers:
 - 10GBASE-LR
- Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct/>

LEDs

Status LEDs, one bicolor:

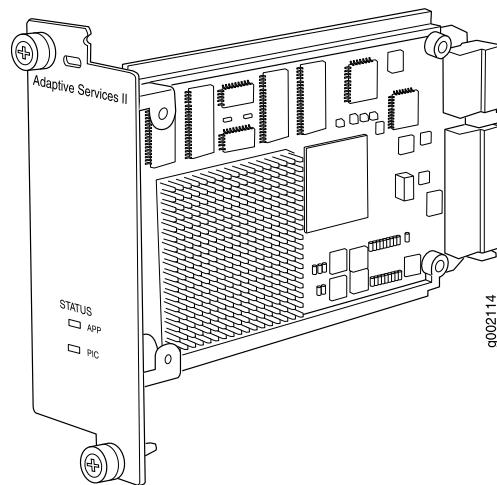
- Off—PIC not enabled
- Green—PIC is operating normally
- Red—PIC has an error or failure

Port LEDs, one pair:

- Link—If green, the port is online; if there is no light, the port is down
 - RX—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data
-

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Adaptive Services II EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 6.4 and later
Description	<ul style="list-style-type: none"> • Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	<ul style="list-style-type: none"> • Support for up to 2000 service sets • Active monitoring on up to 1 million flows • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces
Software features	<p>Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 49 on page 196. For more information about the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p>
LEDs	<p>Status LED, one tricolor:</p> <ul style="list-style-type: none"> • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. <p>Application LED, one bicolor:</p> <ul style="list-style-type: none"> • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 49: Adaptive Services PICs Software Features

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE Key	–	–
GRE dont-fragment	–	–
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	6.4	–
Network Address Translation (NAT) for IP addresses	6.4	–
Port Address Translation (PAT) for port numbers	6.4	–
IP Security (IPSec) encryption	6.4	–
Flow monitoring exports cflowd version 5 and version 8 records	7.0	–
Flow monitoring exports flow monitoring version 9 records, based on RFC 3954 (IP v4 templates only)	8.3	–
Passive flow monitoring	–	–
Passive flow collection	–	–
Flow-tap	8.1	–
Dynamic flow capture	–	–
Real-time performance monitoring	8.3	–
Link Services	7.3	7.5
Tunnel services: <ul style="list-style-type: none"> • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling 	6.4	7.5
Virtual tunnel interface for Layer 3 VPNs	6.4	–
Layer 2 Tunneling Protocol (L2TP)	–	–

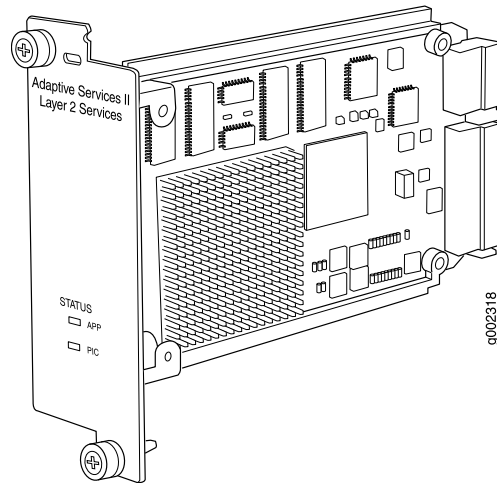
Table 49: Adaptive Services PICs Software Features (continued)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Voice services:	7.3	7.5
<ul style="list-style-type: none"> Compressed Real-Time Transport Protocol (CRTP) 		
Encapsulations:	7.1	—
<ul style="list-style-type: none"> Multilink Frame Relay (MLFR) Multilink Point-to-Point Protocol (MLPP) 		

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

Adaptive Services II Layer 2 Services EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> • Junos OS Release 7.5 and later (Type 1)
Description	<ul style="list-style-type: none"> • Supports Layer 2 Service package only. Tunnel services are included with the PIC. Other services require an individual license. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	<ul style="list-style-type: none"> • Support for up to 2000 service sets • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces
Software features	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 50 on page 198 . For more information about the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i> .

LEDs	<p>Status LED, one tricolor:</p> <ul style="list-style-type: none"> • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. <p>Application LED, one bicolor:</p> <ul style="list-style-type: none"> • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.
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Table 50: Adaptive Services PICs Software Features

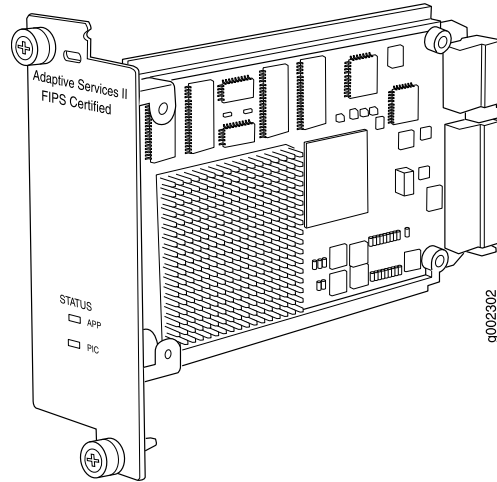
Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE Key	–	–
GRE dont-fragment	–	–
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	6.4	–
Network Address Translation (NAT) for IP addresses	6.4	–
Port Address Translation (PAT) for port numbers	6.4	–
IP Security (IPSec) encryption	6.4	–
Flow monitoring exports cflowd version 5 and version 8 records	7.0	–
Flow monitoring exports flow monitoring version 9 records, based on RFC 3954 (IP v4 templates only)	8.3	–
Passive flow monitoring	–	–
Passive flow collection	–	–
Flow-tap	8.1	–
Dynamic flow capture	–	–
Real-time performance monitoring	8.3	–
Link Services	7.3	7.5

Table 50: Adaptive Services PICs Software Features (continued)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Tunnel services: <ul style="list-style-type: none"> • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling 	6.4	7.5
Virtual tunnel interface for Layer 3 VPNs	6.4	–
Layer 2 Tunneling Protocol (L2TP)	–	–
Voice services: <ul style="list-style-type: none"> • Compressed Real-Time Transport Protocol (CRTP) 	7.3	7.5
Encapsulations: <ul style="list-style-type: none"> • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP) 	7.1	–

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Adaptive Services II FIPS EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 7.2 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p>
Description	<ul style="list-style-type: none"> Junos-FIPS requires an Adaptive Services II FIPS PIC for external IPSec connections. See the <i>Secure Configuration Guide for Common Criteria and Junos-FIPS</i> for more information. Supports tunnel services. This feature is included with the PIC and does not require an individual license. Individual licenses must be purchased for additional services such as Network Address Translation (NAT), stateful firewall, intrusion detection services (IDS), IPSec, J-Flow accounting, and voice services. For information about which services are supported by PIC and platform type, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>. Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	<ul style="list-style-type: none"> Support for up to 2000 service sets Active monitoring on up to 1 million flows Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces

Software features For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.

Depending on your Junos OS Release and individual licenses, software features for this PIC can include:

- Stateful firewall with packet inspection:
 - Detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks
- NAT for IP addresses
- Port Address Translation (PAT) for port numbers
- J-Flow accounting exports cflowd version 5 and version 8 records
- Tunnel services:
 - IP-IP unicast tunneling
 - GRE unicast tunneling—Supports GRE fragmentation
 - PIM sparse mode unicast tunneling
 - Virtual tunnel interface for Layer 3 VPNs
- IPSec encryption
- Voice services:
 - Compressed Real-Time Protocol (CRTP)
- Encapsulations:
 - Multilink Frame Relay (MLFR)
 - Multilink Point-to-Point Protocol (MLPP)

LEDs

Status LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the chassis.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure and no further harm can be done by removing it from the chassis.

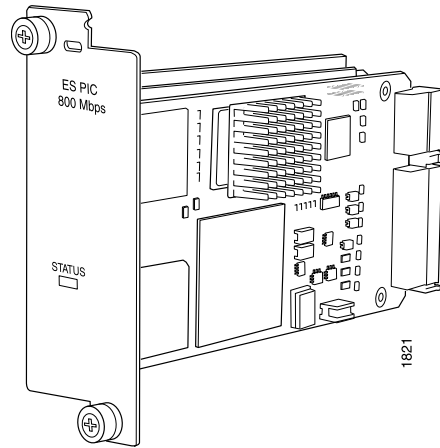
Application LED, one tricolor:

- Off—Service is not running.
- Green—Service is running under acceptable load.
- Yellow—Service is overloaded.

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

ES EOL PIC (M320 Router)

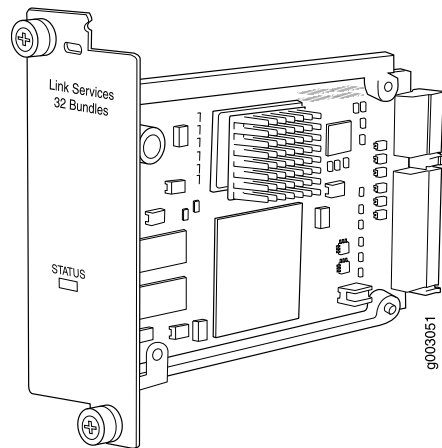


Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1) <p>For information on which FPCs support this PIC, see “M320 PIC/FPC Compatibility” on page 15.</p> <ul style="list-style-type: none"> EOL notification: PSN-2010-04-734
Description	<ul style="list-style-type: none"> High-bandwidth encryption (in accordance with IPSec standards) Power requirement: 0.21 A @ 48 V (10 W) Support for IPSec encryption, decryption, and key calculation acceleration <p>NOTE: The ES PIC does not support reassembly and decryption of encrypted packets that were fragmented in an IPSec tunnel.</p>
Hardware features	<ul style="list-style-type: none"> Extends the existing security functionality to Internet traffic at high-performance rates Throughput at 800 Mbps, half duplex 1000 IPSec tunnels or 2000 IPSec security association (SA) pairs Supports MTUs of up to 3900 bytes
Software features	<p>For a list of the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p> <ul style="list-style-type: none"> Support for IPv4 Authentication hash algorithms: MD-5 and SHA-1 Encryption algorithms: DES, 3-DES, and Null Automated key management using Diffie-Hellman key establishment Support for preshared key management Authentication Header and Encapsulating Security Payload (ESP) independently or in bundle mode Tunnel mode IPSec encryption and decryption for data traffic Transport mode IPSec encryption and decryption for control traffic Static and dynamic security associations (SA) supported SA lifetime configurable in seconds and kilobytes Junos OS Release 7.0 or later is required to configure graceful Routing Engine switchover (GRES).

LEDs	<p>One tricolor:</p> <ul style="list-style-type: none"> • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Instrumentation (counters)	<ul style="list-style-type: none"> • Input and output bytes per tunnel • Total authentication failures • Total antireply failures • Total encryption ASIC errors per PIC

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

Link Services EOL PIC (M320 Router)

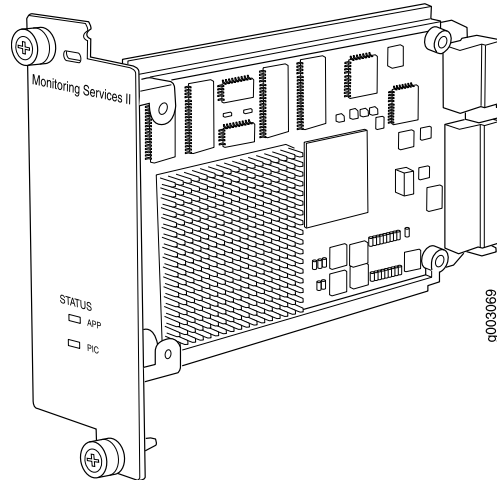


Software release	<ul style="list-style-type: none"> • Junos OS Release 6.2 and later (Type 1)
Description	<ul style="list-style-type: none"> • Power requirement: 0.17 A @ 48 V (8 W) • Three versions: <ul style="list-style-type: none"> • 4 multilink bundles, 256 LFI links • 32 multilink bundles, 256 LFI links • 128 multilink bundles, 256 LFI links • Multilink bonding, link fragmentation and interleaving (LFI), and tunneling

Hardware features	<ul style="list-style-type: none">• Rate limiting/policing per multilink bundle• Byte-wise load balancing across multilink bundles• Bonding T1 links enable service ranging from 1.5 Mbps through 12 Mbps• Bonding E1 links enable service ranging from 2 Mbps through 16 Mbps• Loopback function that encapsulates and de-encapsulates packets
Software features	<p>For a list of the software features available for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p> <ul style="list-style-type: none">• Protocol support:<ul style="list-style-type: none">• Multilink PPP (MLPPP)• Multilink Frame Relay (MLFR)—FRF.15 and FRF.16• Link fragmentation and interleaving (LFI)—FRF.12• LFI over MLPPP• IP-IP unicast tunneling• GRE unicast tunneling• PIM sparse mode unicast tunneling
LEDs	<p>One bicolor:</p> <ul style="list-style-type: none">• Off—PIC is offline• Green—PIC is online and at least one configured bundle is operating• Yellow—PIC is online, but no configured bundles are operating

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

Monitoring Services II EOL PIC (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.0 and later (Type 1)
Description	<ul style="list-style-type: none"> Passive traffic monitoring or flow collection services Power requirement: 0.4 A @ 48 V (19 W) Monitors IPv4 packets Support for collecting and exporting cflowd records
Hardware features	<ul style="list-style-type: none"> Monitors up to 400,000 packets per second Support for MTUs up to 4474 bytes for SONET interfaces
Software features	<p>For more information about the software features for services PICs, see the <i>Junos OS Services Interfaces Library for Routing Devices</i>.</p> <ul style="list-style-type: none"> Load distribution across multiple PICs Active monitoring cflowd version 5 support Provides start and end times of each export Encapsulations: <ul style="list-style-type: none"> Multilink Frame Relay (MLFR) Multilink Point-to-Point Protocol (MLPP) Supports firewall filtering and filter-based forwarding (FBF) <p>NOTE: Flow collection services are supported.</p> <p>NOTE: This PIC does not support graceful Routing Engine switchover.</p>
Cables and connectors	<ul style="list-style-type: none"> None

LEDs

Status LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the chassis.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure and no further harm can be done by removing it from the chassis.

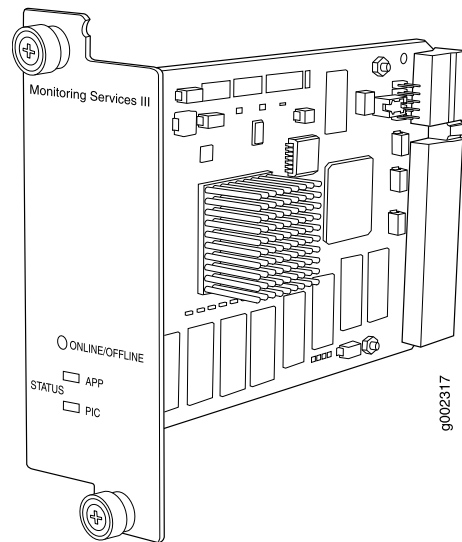
Application LED, one bicolor:

- Off—Flow collector is not running.
- Green—Flow collector is running under acceptable load.
- Yellow—Flow collector is overloaded.

**Related
Documentation**

- [M320 PIC Description](#)
- [M320 PIC Combination Limitations on page 15](#)
- [M320 PICs Supported on page 3](#)

Monitoring Services III EOL PIC (M320 Router)



Software release

- Junos OS Release 7.4 and later (Type 2)
For information on which FPCs support this PIC, see "[M320 PIC/FPC Compatibility](#)" on page 15.

Description

- Power requirement: 0.4 A @ 48 V (19 W)
- Supports dynamic flow capture
- 2 Gbps of sustained packet bandwidth

Hardware features

- Supports MTUs up to 4474 bytes for SONET interfaces

Software features For more information about the software features for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.

- Dynamic flow capture

Cables and connectors • None

LEDs Two Status LEDs: PIC and APP

PIC LED, one tricolor:

- Off—PIC is offline and it is safe to remove it from the chassis.
- Green—PIC is operating normally.
- Yellow—PIC is initializing.
- Red—PIC has an error or failure and no further harm can be done by removing it from the chassis.

Application LED, one tricolor:

- Off—Monitoring application is not running.
- Green—Monitoring application is running under acceptable load.
- Yellow—Monitoring application is overloaded.
- Red—Not used.

-
- Related Documentation**
- [M320 PIC Description](#)
 - [M320 PIC Combination Limitations on page 15](#)
 - [M320 PICs Supported on page 3](#)

SONET/SDH OC3c/STM1 EOL PICs (M320 Router)

Figure 36: 4-Port SONET/SDH OC3c/STM1 PIC (MMF)

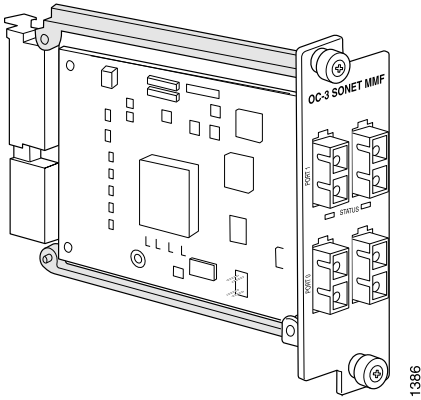
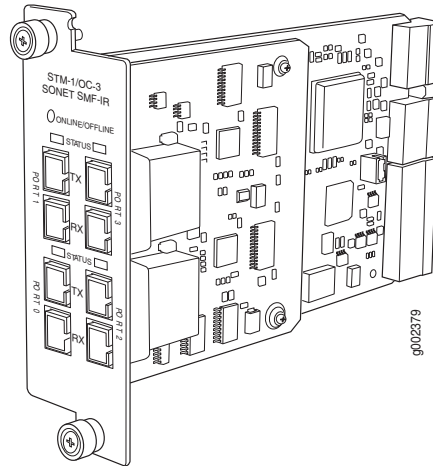


Figure 37: 4-Port SONET/SDH OC3c/STM1 PIC (SMF-IR)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later (Type 1 and Type 2) multimode and single-mode intermediate reach Junos OS Release 8.4 and later supports the SONET/SDH OC3c/STM1 PIC (PC-4OC3-SON-SMIR) on the Enhanced III FPC1.
Description	<ul style="list-style-type: none"> Four OC3 ports Power requirement: 0.49 A @ 48 V (23.7 W)
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)

- Cables and connectors
- Duplex SC/PC connector (Rx and Tx)
 - SONET/SDH OC3/STM1 fixed transceivers:
 - Multimode
 - Intermediate reach (IR-1)
- Optical interface specifications—see “[SONET/SDH OC3/STM1 Optical Interface Specifications](#)” on page 25

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the [CLI Explorer](#).

LEDs

One tricolor per port:

- Off—Not enabled
- Green—Online with no alarms or failures
- Yellow—Online with alarms for remote failures
- Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Far-end bit error: remote error indication—line (REI-L) (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P) (CV-PFE)
 - Payload mismatch (path label mismatch) (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Multiplex section alarm indication signal (MS-AIS)
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (HP-LOP)
 - Loss of signal (LOS)
 - Multiplex section remote error indication (MS-REI)
 - Higher path label mismatch (HP-PLM)
 - Higher path unequipped (HP-UNEQ)
 - Multiplex section remote defect indication (MS-RDI)
 - Higher path remote defect indication (HP-RDI)
- Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

Related Documentation

- [M320 PIC Description](#)
- [M320 End-of-Life PICs Supported on page 12](#)

SONET/SDH OC12c/STM4 EOL PICs (M320 Router)

Figure 38: 1-Port SONET/SDH OC12c/STM4 PIC

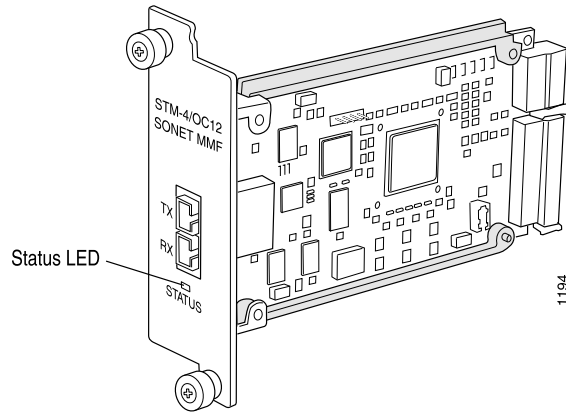
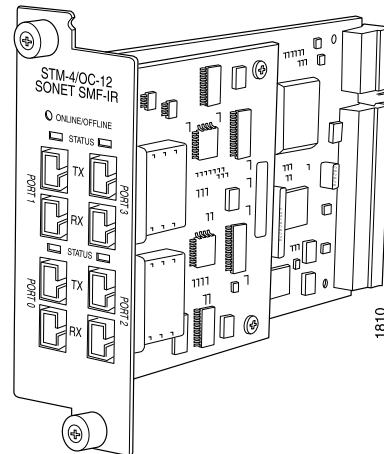


Figure 39: 4-Port SONET/SDH OC12c/STM4 PIC



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later Junos OS Release 8.4 and later supports the SONET/SDH OC12c/STM4 PICs (PB-4OC12-SON-MM) and (PB-4OC12-SON-SMIR) on the Enhanced III FPC2.
Description	<ul style="list-style-type: none"> One or four ports Power requirement: 0.23 A @ 48 V (10.8 W)
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)

- Cables and connectors
- Duplex SC/PC connector (Rx and Tx)
 - SONET/SDH OC12/STM4 fixed transceivers:
 - Multimode
 - Intermediate reach (IR-1)
- Optical interface specifications—see [“SONET/SDH OC12/STM4 Optical Interface Specifications” on page 26](#)

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the [CLI Explorer](#).

- | | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LEDs | One tricolor per port: <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Far-end bit error: remote error indication—line (REI-L) (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P) (CV-PFE)
 - Payload mismatch (path label mismatch) (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Multiplex section alarm indication signal (MS-AIS)
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (HP-LOP)
 - Loss of signal (LOS)
 - Multiplex section remote error indication (MS-REI)
 - Higher path label mismatch (HP-PLM)
 - Higher path unequipped (HP-UNEQ)
 - Multiplex section remote defect indication (MS-RDI)
 - Higher path remote defect indication (HP-RDI)
- Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

Related Documentation

- *M320 PIC Description*
- [M320 End-of-Life PICs Supported on page 12](#)

SONET/SDH OC48c/STM16 EOL PICs (M320 Router)

Figure 40: 1-Port SONET/SDH OC48c/STM16 PIC

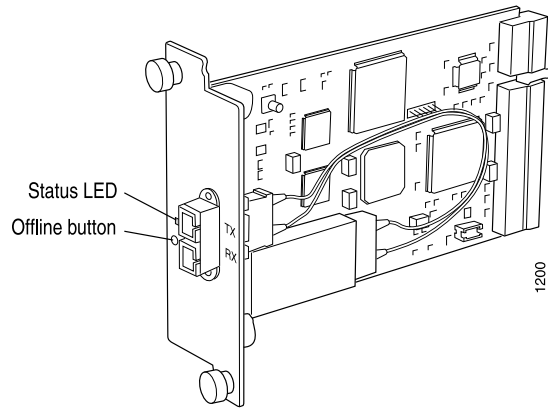
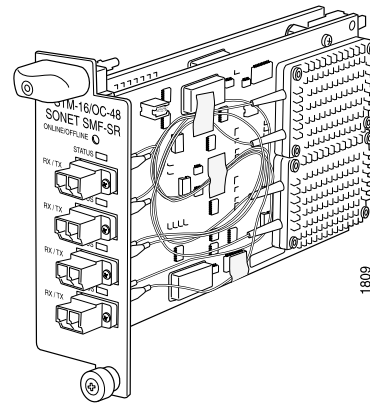


Figure 41: 4-Port SONET/SDH OC48c/STM16 PIC



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later Junos OS Release 9.0 and later supports the 1-port (Type 2) SONET/SDH OC48c/STM16 EOL PICs (PB-1OC48-SON-SMSR) and (PB-1OC48-SON-SMLR) on the Enhanced III FPC2.
Description	<ul style="list-style-type: none"> One or four OC48 ports Power requirement: <ul style="list-style-type: none"> 1-port: 0.38 A @ 48 V (18 W) 4-port: 0.86 A @ 48 V (41.4 W)
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)

- Cables and connectors
- Duplex LC/PC Connector (Rx and Tx)
 - SONET/SDH OC48/STM16 fixed transceivers:
 - Short reach (SR-1)
 - Long reach (LR-1)
- Optical interface specifications—see [“SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28](#)

NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the [CLI Explorer](#).

- | | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LEDs | One tricolor per port: <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

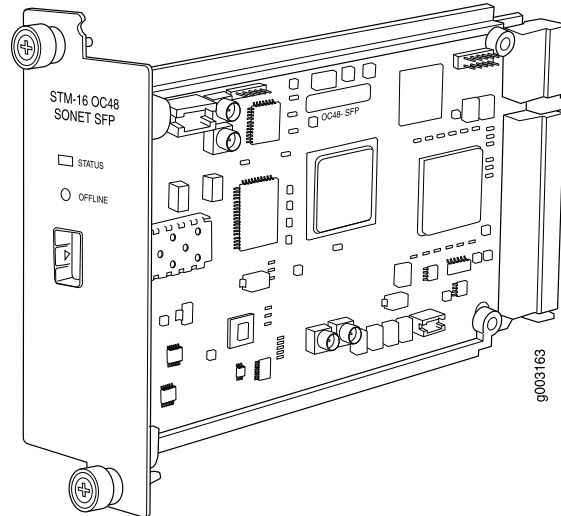
Alarms, errors, and events

- SONET alarms:
 - Alarm indication signal—line (AIS-L)
 - Alarm indication signal—path (AIS-P)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (LOP-P)
 - Loss of signal (LOS)
 - Far-end bit error: remote error indication—line (REI-L) (CV-LFE)
 - Far-end bit error: remote error indication—path (REI-P) (CV-PFE)
 - Payload mismatch (path label mismatch) (PLM-P)
 - Payload unequipped (unequipped STS at path level) (UNEQ-P)
 - Remote defect indication—line (RDI-L)
 - Remote defect indication—path (RDI-P)
- SDH alarms:
 - Multiplex section alarm indication signal (MS-AIS)
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (HP-LOP)
 - Loss of signal (LOS)
 - Multiplex section remote error indication (MS-REI)
 - Higher path label mismatch (HP-PLM)
 - Higher path unequipped (HP-UNEQ)
 - Multiplex section remote defect indication (MS-RDI)
 - Higher path remote defect indication (HP-RDI)
- Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

Related Documentation

- *M320 PIC Description*
- [M320 End-of-Life PICs Supported on page 12](#)

SONET/SDH OC48c/STM16 EOL PIC with SFP (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 6.2 and later Junos OS Release 8.4 and later supports the 1-port (Type 2) SONET/SDH OC48c/STM16 EOL PIC with SFP (PB-1OC48-SON-SFP) on the Enhanced III FPC2.
Description	<ul style="list-style-type: none"> One OC48 port Power requirement: 0.33 A @ 48 V (16 W)
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)

- Cables and connectors
- Duplex LC/PC Connector (Rx and Tx)
 - SONET/SDH OC48/STM16 fiber-optic SFP transceivers:
 - Short reach (SR-1) (model number: SFP-1OC48-SR)
 - Intermediate reach (IR-1) (model number: SFP-1OC48-IR)
 - Long reach (LR-1) (model number: SFP-1OC48-LR)
- Optical interface specifications—see [“SONET/SDH OC48/STM16 Optical Interface Specifications” on page 28](#)

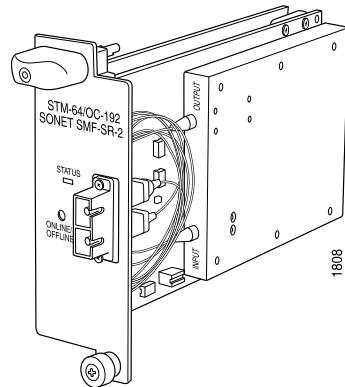
NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the `request chassis pic offline` command in the [CLI Explorer](#).

- LEDs
- One tricolor per port:
- Off—Not enabled
 - Green—Online with no alarms or failures
 - Yellow—Online with alarms for remote failures
 - Red—Active with a local alarm; router has detected a failure

- Alarms, errors, and events
- SDH alarms:
 - Multiplex section alarm indication signal (MS-AIS)
 - Administrative unit alarm indication signal (AU-AIS)
 - Bit error rate signal degrade (BERR-SD)
 - Bit error rate signal fail (BERR-SF)
 - Bit interleaved parity (BIP) error B1
 - Bit interleaved parity (BIP) error B2
 - Bit interleaved parity (BIP) error B3
 - Loss of frame (LOF)
 - Loss of pointer (HP-LOP)
 - Loss of signal (LOS)
 - Multiplex section remote error indication (MS-REI)
 - Higher path label mismatch (HP-PLM)
 - Higher path unequipped (HP-UNEQ)
 - Multiplex section remote defect indication (MS-RDI)
 - Higher path remote defect indication (HP-RDI)
 - Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
 - Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)

SONET/SDH OC192c/STM64 EOL PICs (M320 Router)



Software release	<ul style="list-style-type: none"> Junos OS Release 5.4 and later (Type 3) Junos OS Release 8.4 and later supports the 1-port (Type 3) SONET/SDH OC192c/STM64 EOL PICs (PC-IOC192-SON-SR2) and (PC-IOC192-SON-LR) on the Enhanced III FPC.
Description	<ul style="list-style-type: none"> One OC192 port Power requirement: 0.45 A @ 48 V (21.6 W)
Hardware features	<ul style="list-style-type: none"> Multiplexing and demultiplexing Rate policing on input Rate shaping on output Packet buffering, Layer 2 parsing
Software features	<ul style="list-style-type: none"> SONET/SDH framing Link aggregation Alarm and event counting and detection Dual-router automatic protection switching (APS) Multiprotocol Label Switching (MPLS) fast reroute Encapsulations: <ul style="list-style-type: none"> High-Level Data Link Control (HDLC) Frame Relay Circuit cross-connect (CCC) Translational cross-connect (TCC) Point-to-Point Protocol (PPP)
Cables and connectors	<ul style="list-style-type: none"> Duplex SC/PC connector (Rx and Tx) SONET/SDH OC192/STM64 transceivers: <ul style="list-style-type: none"> Short reach (SR-2) Long reach (LR-1) <p>Optical interface specifications—see “SONET/SDH OC192/STM64 Optical Interface Specifications” on page 30</p> <p>NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the request chassis pic offline command in the CLI Explorer.</p>

LEDs	<p>One tricolor per port:</p> <ul style="list-style-type: none">• Off—Not enabled• Green—Online with no alarms or failures• Yellow—Online with alarms for remote failures• Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	<ul style="list-style-type: none">• SDH alarms:<ul style="list-style-type: none">• Multiplex section alarm indication signal (MS-AIS)• Administrative unit alarm indication signal (AU-AIS)• Bit error rate signal degrade (BERR-SD)• Bit error rate signal fail (BERR-SF)• Bit interleaved parity (BIP) error B1• Bit interleaved parity (BIP) error B2• Bit interleaved parity (BIP) error B3• Loss of frame (LOF)• Loss of pointer (HP-LOP)• Loss of signal (LOS)• Multiplex section remote error indication (MS-REI)• Higher path label mismatch (HP-PLM)• Higher path unequipped (HP-UNEQ)• Multiplex section remote defect indication (MS-RDI)• Higher path remote defect indication (HP-RDI)• Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)• Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

- Related Documentation**
- [M320 PIC Description](#)
 - [M320 End-of-Life PICs Supported on page 12](#)