M120 Multiservice Edge Router Interface Module Reference

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

M120 Multiservice Edge Router Interface Module Reference

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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at https://www.juniper.net/documentation/.

If the information in the latest release notes differs from the information in the documentation, follow the product 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`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	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** *domain-name*

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.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (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** **(*string1* | *string2* | *string3*)**
# (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 [*community-ids*]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  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.	• 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

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page of the Juniper Networks TechLibrary site at https://www.juniper.net/documentation/index.html, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at https://www.juniper.net/documentation/feedback/.

- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
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For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- 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

- M120 Interface Modules Support on page 3
- Network Interface Specifications on page 17
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CHAPTER 1

M120 Interface Modules Support

- M120 PICs Supported on page 3
- M120 End-of-Life PICs Supported on page 8
- M120 PIC/FPC Compatibility on page 11

M120 PICs Supported

Table 3 on page 3 lists the PICs supported in the M120 router. The PICs are listed alphabetically by PIC family.

NOTE: The M120 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 "M120 End-of-Life PICs Supported" on page 8 topic lists PICs that moved to end-of-life before the M120 router itself moved to end-of-life.

Table 3: PICs Supported in the M120 Router

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
ATM2 IQ			
"ATM2 DS3 IQ PIC (M120 Router)" on page 45	4	PB-4DS3-ATM2	8.0R2
"ATM2 E3 IQ PIC (M120 Router)" on page 47	4	PB-4E3-ATM2	8.0R2
"ATM2 OC3/STM1 IQ PIC (M120 Router)" on page 49	2	PB-2OC3-ATM2-MM PB-2OC3-ATM2-SMIR	8.0R2
"ATM2 OC12/STM4 IQ PICs (M120 Router)" on page 51	1	PB-1OC12-ATM2-MM PB-1OC12-ATM2-SMIR	8.0R2
	2	PB-2OC12-ATM2-SMIR	8.0R2
"ATM2 OC12/STM4 IQ PICs (M120 Router)" on page 51	2	PB-2OC12-ATM2-MM	8.0R2

Table 3: PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router)" on page 142	1	PB-1OC48-ATM2-SFP	8.0R2
Channelized Circuit Emulation			
"Channelized OC3/STM1 Circuit Emulation PIC with SFP (M120 Router)" on page 53	4	PB-4CHOC3-CE-SFP	9.4
Channelized IQ			
"Channelized DS3 IQ EOL PIC (M120 Router)" on page 144	4	PB-4CHDS3-QPP	8.0R2
"Channelized E1 IQ EOL PIC (M120 Router)" on page 146	10	PB-10CHE1-RJ48-QPP	8.0R2
"Channelized E1 IQ EOL PIC (M120 Router)" on page 147	10	PB-10CHE1-RJ48-QPP-N	9.1R4 9.2R3 9.3R1
"Channelized T1 IQ EOL PIC (M120 Router)" on page 149	10	PB-10CHT1-RJ48-QPP	8.0R2
"Channelized STM1 IQ EOL PIC (M120 Router)" on page 151	1	PB-1CHSTM1-SMIR-QPP	8.0R2
"Channelized OC3 IQ EOL PIC (M120 Router)" on page 153	1	PB-1CHOC3-SMIR-QPP	8.0R2
"Channelized OC12 IQ EOL PIC (M120 Router)" on page 155	1	PB-1CHOC12-SMIR-QPP	8.0R2
"Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)" on page 157	1	PB-1CHOC48-STM16-IQE-SFP	9.4
Channelized IQE			
"Channelized DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)" on page 58 NOTE: Only DS3 is channelized.	4	PB-4CHDS3-E3-IQE-BNC	9.3
"Channelized E1/T1 Enhanced IQ (IQE) PIC (M120 Router)" on page 61	10	PB-10CHE1-T1-IQE-RJ48	9.5
"Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)" on page 64	2	PB-2CHOC3-STM1-IQE-SFP	9.3
"Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M120 Router)" on page 68	1	PB-1CHOC12-STM4-IQE-SFP	9.3
	4	PB-4CHOC12-STM4-IQE-SFP	9.4

Table 3: PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)" on page 73	1	PB-1CHOC48-STM16-IQE	9.4
DS3, E1, E3, and T1			
"DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)" on page 79	4	PB-4DS3-E3-IQE-BNC	9.3R2
"E3 IQ PIC (M120 Router)" on page 82	4	PB-4E3-QPP	8.0R2
"E1/T1 Circuit Emulation PIC (M120 Router)" on page 84	12	PB-12T1E1-CE-TELCO	9.4
"DS3 EOL PIC (M120 Router)" on page 162	4	PB-4DS3	8.0R2
"E1 EOL PICs (M120 Router)" on page 164	4	PB-4E1-COAX PB-4E1-RJ48	8.0R2
"T1 EOL PIC (M120 Router)" on page 166	4	PB-4T1-RJ48	8.0R2
EIA-530			
"EIA-530 PIC (M120 Router)" on page 89	2	PB-2EIA530	8.0R2
Ethernet			
"Fast Ethernet PICs (M120 Router)" on page 92	4	PB-4FE-TX	8.0R2
"Gigabit Ethernet PICs with SFP (M120 Router)" on page 95	1	PB-1GE-SFP	8.0R2
	4	PB-4GE-SFP	8.0R2
	10	PC-10GE-SFP	8.0R2
"Fast Ethernet PICs (M120 Router)" on page 92	8	PB-8FE-FX	8.0R2
	12	PB-12FE-TX-MDI PB-12FE-TX-MDIX	8.0R2
	48	PB-48FE-TX	8.0R2
"Gigabit Ethernet PICs with SFP (M120 Router)" on page 95	2	PB-2GE-SFP	8.0R2
Ethernet IQ			
"Gigabit Ethernet IQ EOL PICs with SFP (M120 Router)" on page 173	1	PB-1GE-SFP-QPP PB-2GE-SFP-QPP	8.0R2
Ethernet IQ2			

Table 3: PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router)" on page 175	4	PB-4GE-TYPE1-SFP-IQ2	8.0R2
	8	PB-8GE-TYPE2-SFP-IQ2	8.0R2
	8	PB-8GE-TYPE3-SFP-IQ2	8.5
Ethernet Enhanced IQ2 (IQ2E)			
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M120 Router)" on page 99	4	PB-4GE-TYPE1-SFP-IQ2E	9.4
	8	PB-8GE-TYPE2-SFP-IQ2E	9.4
	8	PC-8GE-TYPE3-SFP-IQ2E	9.4
10-Gigabit Ethernet			
"10-Gigabit Ethernet PIC with XENPAK (M120 Router)" on page 103	1	PC-1XGE-XENPAK	8.0R2
"10-Gigabit Ethernet DWDM EOL PIC (M120 Router)" on page 178	1	PC-1XGE-DWDM-CBAND	8.0R2
"10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router)" on page 180	1	PC-1XGE-DWDM-OTN	9.4
"10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router)" on page 181	1	PC-1XGE-TYPE3-XFP-IQ2	8.2
10-Gigabit Ethernet Enhanced IQ2 (IQ2E)			
"10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M120 Router)" on page 105	1	PC-1XGE-TYPE3-XFP-IQ2E	9.4
Services			
"Multiservices PICs (M120 Router)" on page 109	–	PB-MS-100-1	8.2R2
	–	PB-MS-400-2	8.2
	–	PC-MS-500-3	8.3
"Tunnel Services PIC (M120 Router)" on page 112	–	PB-TUNNEL-1	8.0R2
	–	PB-TUNNEL	8.0R2
	–	PC-TUNNEL	8.0R2
"Adaptive Services II EOL PIC (M120 Router)" on page 183	–	PB-AS2	8.0R2

Table 3: PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"Adaptive Services II Layer 2 Services EOL PIC (M120 Router)" on page 185	–	PB-AS2-LAYER2SERVICES	8.0R2
"Adaptive Services II FIPS EOL PIC (M120 Router)" on page 188	–	PB-AS2-FIPS	8.0R2
"Link Services EOL PIC (M120 Router)" on page 190	–	PE-LS-4 PE-LS-32 PE-LS-128	6.1
SONET/SDH			
"SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)" on page 116	4	PB-4OC3-STM1-IQE-SFP	9.3R2
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M120 Router)" on page 119	4	PB-4OC3-1OC12-SON-SFP PB-4OC3-1OC12-SON2-SFP	8.3
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)" on page 122	4	PB-4OC3-4OC12-SON-SFP	8.3
"SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)" on page 125	4	PC-4OC48-STM16-IQE-SFP	11.2
"SONET/SDH OC48c/STM16 PIC with SFP (M120 Router)" on page 129	4	PC-4OC48-SON-SFP	8.0R2
"SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M120 Router)" on page 132	1	PB-1OC48-SON-B-SFP	8.3
"SONET/SDH OC192/STM64 PIC with XFP (M120 Router)" on page 135	1	PC-1OC192-SON-XFP	8.3
"SONET/SDH OC3c/STM1 EOL PICs (M120 Router)" on page 191	4	PB-4OC3-SON-MM PB-4OC3-SON-SMIR	8.0R2
"SONET/SDH OC12c/STM4 EOL PICs (M120 Router)" on page 194	1	PB-1OC12-SON-MM PB-1OC12-SON-SMIR	8.0R2
	4	PB-4OC12-SON-MM PB-4OC12-SON-SMIR	8.0R2
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)" on page 122	1	PB-1OC12-SON-SFP	8.4
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)" on page 197	1	PB-1OC12-STM4-IQE-SFP	9.3

Table 3: PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router)" on page 200	1	PB-1OC48-SON-SFP	8.0R2
"SONET/SDH OC192c/STM64 EOL PIC (M120 Router)" on page 203	1	PC-1OC192-SON-LR PC-1OC192-SON-SR2	5.4

Related Documentation

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8
- M120 PIC/FPC Compatibility on page 11

M120 End-of-Life PICs Supported

Table 4 on page 8 lists the end-of-life PICs supported in the M120 router. The PICs are listed alphabetically by PIC family.

NOTE: The M120 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 "M120 PICs Supported" on page 3 topic lists PICs that had not moved to end-of-life before the M120 router itself moved to end-of-life.

Table 4: End-of-Life PICs Supported in the M120 Router

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
ATM2 IQ			
"ATM2 OC12/STM4 IQ PICs (M120 Router)" on page 51	2	PB-2OC12-ATM2-MM	8.0R2
"ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router)" on page 142	1	PB-1OC48-ATM2-SFP	8.0R2
Channelized IQ			
"Channelized DS3 IQ EOL PIC (M120 Router)" on page 144	4	PB-4CHDS3-QPP	8.0R2
"Channelized E1 IQ EOL PIC (M120 Router)" on page 146	10	PB-10CHE1-RJ48-QPP	8.0R2
"Channelized E1 IQ EOL PIC (M120 Router)" on page 147	10	PB-10CHE1-RJ48-QPP-N	9.1R4 9.2R3 9.3R1

Table 4: End-of-Life PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"Channelized T1 IQ EOL PIC (M120 Router)" on page 149	10	PB-10CHT1-RJ48-QPP	8.0R2
"Channelized STM1 IQ EOL PIC (M120 Router)" on page 151	1	PB-1CHSTM1-SMIR-QPP	8.0R2
"Channelized OC3 IQ EOL PIC (M120 Router)" on page 153	1	PB-1CHOC3-SMIR-QPP	8.0R2
"Channelized OC12 IQ EOL PIC (M120 Router)" on page 155	1	PB-1CHOC12-SMIR-QPP	8.0R2
"Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)" on page 157	1	PB-1CHOC48-STM16-IQE-SFP	9.4
DS3, E1, and T1			
"DS3 EOL PIC (M120 Router)" on page 162	4	PB-4DS3	8.0R2
"E1 EOL PICs (M120 Router)" on page 164	4	PB-4E1-COAX PB-4E1-RJ48	8.0R2
"T1 EOL PIC (M120 Router)" on page 166	4	PB-4T1-RJ48	8.0R2
Ethernet			
"Fast Ethernet PICs (M120 Router)" on page 92	8	PB-8FE-FX	8.0R2
	12	PB-12FE-TX-MDI PB-12FE-TX-MDIX	8.0R2
	48	PB-48FE-TX	8.0R2
"Gigabit Ethernet PICs with SFP (M120 Router)" on page 95	2	PB-2GE-SFP	8.0R2
Ethernet IQ			
"Gigabit Ethernet IQ EOL PICs with SFP (M120 Router)" on page 173	1	PB-1GE-SFP-QPP PB-2GE-SFP-QPP	8.0R2
Ethernet IQ2			
"Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router)" on page 175	4	PB-4GE-TYPE1-SFP-IQ2	8.0R2
	8	PB-8GE-TYPE2-SFP-IQ2	8.0R2
	8	PB-8GE-TYPE3-SFP-IQ2	8.5
10-Gigabit Ethernet			

Table 4: End-of-Life PICs Supported in the M120 Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"10-Gigabit Ethernet DWDM EOL PIC (M120 Router)" on page 178	1	PC-1XGE-DWDM-CBAND	8.0R2
"10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router)" on page 180	1	PC-1XGE-DWDM-OTN	9.4
"10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router)" on page 181	1	PC-1XGE-TYPE3-XFP-IQ2	8.2
Services			
"Adaptive Services II EOL PIC (M120 Router)" on page 183	–	PB-AS2	8.0R2
"Adaptive Services II Layer 2 Services EOL PIC (M120 Router)" on page 185	–	PB-AS2-LAYER2SERVICES	8.0R2
"Adaptive Services II FIPS EOL PIC (M120 Router)" on page 188	–	PB-AS2-FIPS	8.0R2
"Link Services EOL PIC (M120 Router)" on page 190	–	PE-LS-4 PE-LS-32 PE-LS-128	6.1
SONET/SDH			
"SONET/SDH OC3c/STM1 EOL PICs (M120 Router)" on page 191	4	PB-4OC3-SON-MM PB-4OC3-SON-SMIR	8.0R2
"SONET/SDH OC12c/STM4 EOL PICs (M120 Router)" on page 194	1	PB-1OC12-SON-MM PB-1OC12-SON-SMIR	8.0R2
	4	PB-4OC12-SON-MM PB-4OC12-SON-SMIR	8.0R2
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)" on page 122	1	PB-1OC12-SON-SFP	8.4
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)" on page 197	1	PB-1OC12-STM4-IQE-SFP	9.3
"SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router)" on page 200	1	PB-1OC48-SON-SFP	8.0R2
"SONET/SDH OC192c/STM64 EOL PIC (M120 Router)" on page 203	1	PC-1OC192-SON-LR PC-1OC192-SON-SR2	5.4

Related Documentation

- *M120 PICs Description*

- M120 PICs Supported on page 3
- M120 PIC/FPC Compatibility on page 11

M120 PIC/FPC Compatibility

Table 5 on page 11 provides a PIC/FPC compatibility matrix that indicates the first Junos OS Release in which an FPC supports each PIC currently supported for the M120 router. For example, Junos OS Release 8.0R2 is the first release in which the FPC1 supports the ATM2 DS3 IQ PIC.

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

Table 5: M120 PIC/FPC Compatibility

PIC Type	Number of Ports	PIC Model Number	FPC1	FPC2	FPC3
ATM2 IQ PICs					
ATM2 DS3 IQ	4	PB-4DS3-ATM2	8.0R2	–	–
ATM2 E3 IQ	4	PB-4E3-ATM2	8.0R2	–	–
ATM2 OC3/STM1 IQ	2	PB-2OC3-ATM2-MM PB-2OC3-ATM2-SMIR	8.0R2	–	–
ATM2 OC12/STM4 IQ	1	PB-1OC12-ATM2-MM PB-1OC12-ATM2-SMIR	8.0R2	–	–
ATM2 OC12/STM4 IQ	2	PB-2OC12-ATM2-MM PB-2OC12-ATM2-SMIR	–	8.0R2	–
ATM2 OC48/STM16 IQ, SFP	1	PB-1OC48-ATM2-SFP	–	8.0R2	–
Channelized Circuit Emulation PICs					
ChOC3/STM1 Circuit Emulation	4	PB-4CHOC3-CE-SFP	9.4	–	–
Channelized IQ PICs					
ChDS3 IQ	4	PB-4CHDS3-QPP	8.0R2	–	–
ChE1 IQ EOL	10	PB-10CHE1-RJ48-QPP	8.0R2		
ChE1 IQ	10	PB-10CHE1-RJ48-QPP-N	9.1R4 9.2R3 9.3R1	–	–

Table 5: M120 PIC/FPC Compatibility (continued)

PIC Type	Number of Ports	PIC Model Number	FPC1	FPC2	FPC3
ChOC3 IQ	1	PB-1CHOC3-SMIR-QPP	8.0R2	–	–
ChOC12 IQ EOL		PB-1CHOC12-SMIR-QPP	8.0R2		
ChSTM1 IQ	1	PB-1CHSTM1-SMIR-QPP	8.0R2	–	–
ChT1 IQ	10	PB-10CHT1-RJ48-QPP	8.0R2	–	–
Channelized Enhanced IQ (IQE) PICs					
ChDS3/E3 IQE with SFP	4	PB-4CHDS3-E3-IQE-BNC	9.3	–	–
ChE1/T1 IQE	10	PB-10CHE1-T1-IQE-RJ48	9.5	–	–
ChOC3/STM1 IQE with SFP	2	PB-2CHOC3-STM1-IQE-SFP	9.3	–	–
ChOC12/STM4 IQE with SFP	1	PB-1CHOC12-STM4-IQE-SFP	9.3	–	–
ChOC12/STM4 IQE with SFP	4	PB-4CHOC12-STM4-IQE-SFP	–	9.4	–
ChOC48/STM16 IQE with SFP	1	PB-1CHOC48-STM16-IQE-SFP	–	9.4	–
T1, DS3, E1, E3 PICs					
DS3 EOL	4	PB-2DS3	8.0R2		
DS3 EOL	4	PB-4DS3	8.1R1		
DS3/E3 IQE	4	PB-4DS3-E3-IQE-BNC	9.3R2	–	–
E1	4	PB-4E1-COAX PB-4E1-RJ48	8.0R2	–	–
E1/T1 Circuit Emulation	12	PB-12T1E1-CE-TELCO	9.4	–	–
T1	4	PB-4T1-RJ48	8.0R2	–	–
E3 IQ PIC					
E3 IQ	4	PB-4E3-QPP	8.0R2	–	–
EIA-530 PIC					
EIA-530	2	PB-2EIA530	8.0R2	–	–
Fast Ethernet PICs					
Fast Ethernet	4	PB-4FE-TX	8.0R2	–	–

Table 5: M120 PIC/FPC Compatibility (continued)

PIC Type	Number of Ports	PIC Model Number	FPC1	FPC2	FPC3
Fast Ethernet	8	PB-8FE-FX	8.0R2	–	–
Fast Ethernet	12	PB-12FE-TX	8.0R2	–	–
Fast Ethernet	48	PB-48FE-TX	–	8.0R2	–
Gigabit Ethernet PICs					
Gigabit Ethernet, SFP	1	PB-1GE-SFP	8.0R2	–	–
Gigabit Ethernet, SFP	2	PB-2GE-SFP	–	8.0R2	–
Gigabit Ethernet, SFP	4	PB-4GE-SFP	–	8.0R2	–
Gigabit Ethernet, SFP	10	PC-10GE-SFP	–	–	8.0R2
Gigabit Ethernet IQ PICs					
Gigabit Ethernet IQ, SFP	1	PB-1GE-SFP-QPP	8.0R2	–	–
Gigabit Ethernet IQ, SFP	2	PB-2GE-SFP-QPP	–	8.0R2	–
Gigabit Ethernet IQ2 PICs					
Gigabit Ethernet IQ2, SFP	4	PB-4GE-TYPE1-SFP-IQ2	8.0R2	–	–
Gigabit Ethernet IQ2, SFP	8	PB-8GE-TYPE2-SFP-IQ2	–	8.0R2	–
Gigabit Ethernet IQ2, SFP	8	PC-8GE-TYPE3-SFP-IQ2	–	–	8.5
Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs					
Gigabit Ethernet IQ2E, SFP	4	PB-4GE-TYPE1-SFP-IQ2E	9.4	–	–
Gigabit Ethernet IQ2E, SFP	8	PB-8GE-TYPE2-SFP-IQ2E	–	9.4	–
Gigabit Ethernet IQ2E, SFP	8	PC-8GE-TYPE3-SFP-IQ2E	–	–	9.4
10-Gigabit Ethernet PICs					
10-Gigabit Ethernet, XENPAK	1	PC-1XGE-XENPAK	–	–	8.0R2
10-Gigabit Ethernet, DWDM	1	PC-1XGE-DWDM-CBAND	–	–	8.0R2
10-Gigabit Ethernet, DWDM OTN	1	PC-1XGE-DWDM-OTN	–	–	9.4
10-Gigabit Ethernet IQ2 PICs					
10-Gigabit Ethernet IQ2 PIC, XFP	1	PC-1XGE-TYPE3–XFP-IQ2	–	–	8.2

Table 5: M120 PIC/FPC Compatibility (continued)

PIC Type	Number of Ports	PIC Model Number	FPC1	FPC2	FPC3
10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs					
10-Gigabit Ethernet IQ2E PIC, XFP	1	PC-1XGE-TYPE3–XFP-IQ2E	–	–	9.4
Services PICs					
Adaptive Services II (AS) EOL	0	PB-AS2	8.0R2		
Adaptive Services II (AS) Layer 2 Services	0	PB-AS2-LAYER2SERVICES	8.0R2	–	–
Adaptive Services II (AS) FIPS EOL	0	PB-AS2-FIPS	8.0R2		
Link Services EOL	0	PE-LS-4 PE-LS-32 PE-LS-128	6.1		
Multiservices 100 NOTE: This PIC requires a FPC1 with the 710-017980 version or later of the mezzanine board..	0	PB-MS-100-1	8.2R2	–	–
Multiservices 400	0	PB-MS-400-2	–	8.2	–
Multiservices 500	0	PC-MS-500-3	–	–	8.3
Tunnel Services (Type 1)	0	PB-TUNNEL-1	8.0R2	–	–
Tunnel Services (Type 2)	0	PB-TUNNEL	–	8.0R2	–
Tunnel Services (Type 3)	0	PC-TUNNEL	–	–	8.0R2
SONET/SDH PICs					
OC3/STM1 EOL	4	PB-4OC3-SON-MM PB-4OC3-SON-SMIR	8.0R2		
OC3/STM1 IQE, SFP	4	PB-4OC3-STM1-IQE-SFP	9.3R2	–	–
OC3/STM1 (Multi-Rate), SFP (Type 1)	4	PB-4OC3-1OC12-SON-SFP	8.4	–	–
OC3/STM1 (Multi-Rate), SFP (Type 2)	4	PB-4OC3-1OC12-SON2-SFP	–	8.3	–
OC12c/STM4 EOL	1 4	PB-1OC12-SON-MM PB-1OC12-SON-SMIR	8.0R2		

Table 5: M120 PIC/FPC Compatibility (continued)

PIC Type	Number of Ports	PIC Model Number	FPC1	FPC2	FPC3
OC12/STM4 IQE, SFP	1	PB-1OC12-STM4-IQE-SFP	9.3	–	–
OC12/STM4 (Multi-Rate), SFP	1	PB-1OC12-SON-SFP	8.4	–	–
OC12/STM4 (Multi-Rate), SFP	4	PB-4OC3-4OC12-SON-SFP	–	8.3	–
OC48c/STM16, SFP	4	PC-4OC48-SON-SFP	–	–	8.0R2
OC48c/STM16 SFP EOL	4	PB-1OC48-SON-SFP	8.0R2		
OC48/STM16, SFP	4	PC-4OC48-STM16-IQE-SFP	–	–	11.2
OC48/STM16 (Multi-Rate), SFP	1	PB-1OC48-SON-B-SFP	–	8.3	–
OC192/STM64, XFP	1	PC-1OC192-SON-XFP	–	–	8.3
OC192c/STM64 EOL	1	PC-1OC192-SON-LR PC-1OC192-SON-SR2	5.4		

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 2

Network Interface Specifications

- Determining Transceiver Support and Specifications for M Series and T Series Routers on page 17
- Fast Ethernet 100BASE-FX Optical Interface Specifications on page 18
- 10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND) Optical Interface Specifications on page 18
- 10-Gigabit Ethernet DWDM OTN PIC (PC-1XGE-DWDM-OTN) Optical Interface Specifications on page 19
- SONET/SDH OC3/STM1 Optical Interface Specifications on page 24
- 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 6 on page 18 shows the optical interface specifications for the 100BASE-FX standard.

Table 6: 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 7 on page 18 shows the optical interface specifications for the 10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND).

Table 7: 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 7: 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

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

- 10-Gigabit Ethernet DWDM OTN Optical Interface Specifications on page 19
- 10-Gigabit Ethernet DWDM OTN Supported Wavelengths on page 22
- PC-1XGE-DWDM-OTN Optical Signal-to-Noise Ratio (OSNR) Performance on page 24

10-Gigabit Ethernet DWDM OTN Optical Interface Specifications

Table 8 on page 19 shows the optical interface specifications for the 10-Gigabit Ethernet DWDM OTN PIC transceiver.

Table 8: 10-Gigabit Ethernet DWDM OTN Optical Interface Specifications

Model number	• PIC model number: PC-1XGE-DWDM-OTN

Features	• 10–Gigabit digital wrapper with over-clocked G.709 framing
	• Generic Reed-Solomon forward error correction (GFEC) and enhanced forward error correction (EFEC) to transport 10GBASE-R (10-Gigabit Ethernet LAN PHY)
	• Reduced cost of deploying and maintaining the network due to:
	  ◦ Fewer optical-electrical-optical (OEO) conversions
	  ◦ Fewer optical amplifiers and regenerators
	• 89 tunable wavelengths (channels) supported per DWDM-OTN module
	• Link fault switchover

Transceiver type	• Dense wavelength division multiplexing (DWDM) module

Table 8: 10-Gigabit Ethernet DWDM OTN Optical Interface Specifications (continued)

Standards	• ITU-T G.709—Interfaces for the Optical Transport Network (OTN). The PC-1XGE-DWDM-OTN PIC supports two OTN extended mappings:
	  ◦ Supplement 43, section 7.1, optical channel payload unit 2e (OPU2e). This mapping inserts the original 10GE LAN PHY signal into a "digital wrapper" with overclocked G.709 framing that results in a line rate of 11.1 Gbps instead of the standard 10.7 Gbps.
	  ◦ Supplement 43, section 7.2, optical channel payload unit 1e (OPU1e). This mapping inserts the original 10GE LAN PHY signal into a "digital wrapper" with overclocked G.709 framing, but without the use of fixed stuff bytes, that results in a line rate of 11.05 Gbps instead of the standard 10.7 Gbps.
	See *ITU-T Series G Supplement 43, ver 02/2008* for more information about OPU2e and OPU1e extended mappings.
	• ITU-T G.975—GFEC
	• ITU-T G.975.1—Enhanced FEC
	• ITU-T G.694.1—Spectral grids for WDM applications: DWDM frequency grid Series G: Transmission Systems and Media, Digital Systems and Networks Transmission media characteristics-Characteristics of optical components and subsystems
	• IEEE 802.3ae—2005
	• RFC 3591—Definitions of Managed Objects for the Optical Interface Type

Optical interface	• Single-mode optical fiber

Line interface	• Line rate:
	  ◦ 10GE LAN PHY: 10.3125 Gbps (pass-through)
	  ◦ G.709 LAN PHY without fixed stuff bytes: 11.049 Gbps
	  ◦ G.709 LAN PHY with fixed stuff bytes: 11.0957 Gbps
	• Transmit line rate deviation: G.709 LAN PHY modes: +/-20 ppm
	• Dispersion window: +/-1200 ps/nm or +/-1600 ps/nm (maximum)
	• FEC type (software selectable): Generic Reed-Solomon RS (255, 239) code computed as specified in Annex A/G. 709 (GFEC) or enhanced (EFEC)

Table 8: 10-Gigabit Ethernet DWDM OTN Optical Interface Specifications (continued)

Optical transmitter	• Transmitter type: $LiNbO_3$ MZI (Lithium Niobate Mach-Zehnder Inferometer)
	• Modulation format: Nonretum-to-zero (NRZ)
	• Channel-plan wavelength range: 1528.77 through 1563.86 nm
	• Channel-plan frequency range: 191.7 through 196.1 THz
	• Channel spacing: 50 GHz
	• Channel tunability: 89 channels—see Table 9 on page 23
	• Output power (on): +3 to +7 dBm
	• Output power (off): ≤ –40 dBm
	• Output power stability: –1.5 to +1.0 dB
	• Wavelength accuracy: +/-25 pm, +/-3.125 GHz
	• Tuning time: Warm tune – 10 seconds; cold start – 40 seconds
	• Extinction ratio: ≥ 11 dB
	• Crossing ratio: 45 to 55 percent
	• Side-mode suppression ratio: ≥ 30 dB
	• Optical spectral width: ≤ 25 GHz (informational, not a specification)
	• Average relative intensity noise (RIN):
	  • 10 MHz to 1 GHz: –110 dB/Hz
	  • 1 GHz to 10 GHz: –145 dB/Hz
	• Output OSNR:
	  • Minimum: 50 dB (0.1 nm resolution bandwidth)
	  • Typical: 55 dB (0.1 nm resolution bandwidth)
	• Polarization extinction ratio: 20 dB
	• Eye mask compliance: 802.3—2005
	• Jitter generation compliance: GR-253/G.8251

Optical receiver	• Receiver type: Avalanche photodiode (APD)
	• Average receive power (input power range): see Input Power Range in Table 10 on page 24
	• Jitter tolerance compliance: GR-253/G.8251/802.3ae (LAN PHY)
	• Rx DTV setting:
	  • No FEC (pass-through): Static (factory optimized value)
	  • GFEC: Managed by electronic dispersion compensation (EDC)
	  • EFEC: Managed by EDC
	• Rx wavelength range: 1527 to 1567 nm
	• Overload (receiver saturation): –5 dBm (high OSNR), –8 dBm (low OSNR)
	• Damage input power: +5 dBm
	• Optical return loss: ≥ 27 dB

Table 8: 10-Gigabit Ethernet DWDM OTN Optical Interface Specifications (continued)

Optical performance	Optical Applications—Power-Limited Receiver (High OSNR):
	• Sensitivity:
	  • No FEC: −5 to −24 dBm (>33 dB/0.1 nm OSNR, 0 ps/nm CD) at 10^{-12} BER (10.3 Gbps)
	  • GFEC: −5 to −28 dBm at 8 x 10^{-5} pre-FEC BER (>33 dB/0.1 nm OSNR, 0 ps/nm CD) (10^{-15} post-FEC BER) (11.05 and 11.1 Gbps)
	  • EFEC: −5 to −28 dBm at 1 x 10^{-3} pre-FEC BER (>33 dB/0.1 nm OSNR, 0 ps/nm CD) (10^{-15} post-FEC BER) (11.05 and 11.1 Gbps)
	• Chromatic dispersion (CD) power penalty:
	  • No FEC: 3 dB (typical penalty at +/-1200 ps/nm without EDC)
	  • GFEC or EFEC: 3 dB (typical penalty at +/-1600 ps/nm with EDC)
	Optical Applications—Noise-Limited Receiver (Low OSNR):
	• Required OSNR:
	  • No FEC (10.3 Gbps):
	  • 26 dB/0.1 nm (−8 to −22 dBm Rx input power range, 0 ps/nm CD, at 10^{-12} BER)
	  • 26 dB/0.1 nm (−8 to −20 dBm Rx input power range, +/-1000 ps/nm without EDC, at 10^{-12} BER)
	  • 30 dB/0.1 nm (−8 to −20 dBm Rx input power range, +/-1200 ps/nm without EDC, at 10^{-12} BER)
	  • GFEC (11.05 and 11.1 Gbps):
	  • 15.5 dB/0.1 nm (−8 to −20 dBm Rx input power range, 0 ps/nm, at ≤ 10^{-5} pre-FEC BER, ≤ 10^{-15} post-FEC BER)
	  • 17 dB/0.1 nm (−8 to −20 dBm Rx input power range, +/-1200 ps/nm with EDC, at ≤ 10^{-5} pre-FEC BER, ≤ 10^{-15} post-FEC BER)
	  • EFEC (11.05 and 11.1 Gbps):
	  • 12 dB/0.1 nm (−8 to −20 dBm Rx input power range, 0 ps/nm, at ≤ 10^{-4} pre-FEC BER, ≤ 10^{-15} post-FEC BER)
	  • 14 dB/0.1 nm (−8 to −20 dBm Rx input power range, +/-1200 ps/nm with EDC, at ≤ 10^{-4} pre-FEC BER, ≤ 10^{-15} post-FEC BER)
	  • 16 dB/0.1 nm (−8 to −20 dBm Rx input power range, 0 ps/nm CD, 10^{-15} post-FEC BER)
	• CD OSNR penalty:
	  • GFEC: 1.5 dB (typical penalty at +/-1200 ps/nm with Rx input power range from −8 to −20 dBm).
	  • EFEC: 2 dB (typical penalty at +/-1200 ps/nm with Rx input power range from −8 to −20 dBm).
	For more detailed information, see Table 10 on page 24.

10-Gigabit Ethernet DWDM OTN Supported Wavelengths

Table 9 on page 23 provides the supported wavelengths for the 100-GHz grid and the 50-GHz offset in both THz and nm.

Table 9: 10-Gigabit Ethernet DWDM OTN Supported Wavelengths

100–GHz Grid		50–GHz Offset		100–GHz Grid		50–GHz Offset	
THz	nm	THz	nm	THz	nm	THz	nm
191.70	1563.86	191.75	1563.45	194.00	1545.32	194.05	1544.92
191.80	1563.04	191.85	1562.63	194.10	1544.52	194.15	1544.12
191.90	1562.23	191.95	1561.82	194.20	1543.73	194.25	1543.33
192.00	1561.41	192.05	1561.01	194.30	1542.93	194.35	1542.53
192.10	1560.60	192.15	1560.20	194.40	1542.14	194.45	1541.74
192.20	1559.79	192.25	1559.38	194.50	1541.34	194.55	1540.95
192.30	1558.98	192.35	1558.57	194.60	1540.55	194.65	1540.16
192.40	1558.17	192.45	1557.76	194.70	1539.76	194.75	1539.37
192.50	1557.36	192.55	1556.95	194.80	1538.97	194.85	1538.58
192.60	1556.55	192.65	1556.15	194.90	1538.18	194.95	1537.79
192.70	1555.74	192.75	1555.34	195.00	1537.39	195.05	1537.00
192.80	1554.94	192.85	1554.53	195.10	1536.60	195.15	1536.21
192.90	1554.13	192.95	1553.73	195.20	1535.82	195.25	1535.42
193.00	1553.32	193.05	1552.92	195.30	1535.03	195.35	1534.64
193.10	1552.52	193.15	1552.12	195.40	1534.25	195.45	1533.85
193.20	1551.72	193.25	1551.31	195.50	1533.46	195.55	1533.07
193.30	1550.91	193.35	1550.51	195.60	1532.68	195.65	1532.28
193.40	1550.11	193.45	1549.71	195.70	1531.89	195.75	1531.50
193.50	1549.31	193.55	1548.91	195.80	1531.11	195.85	1530.72
193.60	1548.51	193.65	1548.11	195.90	1530.33	195.95	1529.94
193.70	1547.71	193.75	1547.31	196.00	1529.55	196.05	1529.16
193.80	1546.91	193.85	1546.51	196.10	1528.77		
193.90	1546.11	193.95	1545.72				

PC-1XGE-DWDM-OTN Optical Signal-to-Noise Ratio (OSNR) Performance

The OSNR performance listed in Table 10 on page 24 is for an appropriate level of optical filtering of the amplified spontaneous emission (ASE) reaching the receiver and is derived using a 0.22-nm 3-dB full-width Gaussian filter. When no FEC is used, there is no OTN framing.

Table 10: PC-1XGE-DWDM-OTN Optical Signal-to-Noise Ratio (OSNR) Performance

OSNR (dB/0.1 nm)	OSNR (dB/0.5 nm)	FEC Type	Pre-FEC BER	Post-FEC BER	Input-Power Range (ROP) (dBm)	CD Tolerance (ps/nm)
33	26	None	10^{-12}	NA	–5 to –24	0
33	26	None	10^{-12}	NA	–5 to –21	+/-1200 (no EDC)
26	19	None	10^{-12}	NA	–8 to –22	0
26	19	None	10^{-12}	NA	–8 to –20	+/-1000 (no EDC)
30	23	None	10^{-12}	NA	–8 to –20	+/-1200 (no EDC)
33	26	GFEC	8×10^{-5}	10^{-15}	–5 to –28	0
33	26	GFEC	8×10^{-5}	10^{-15}	–5 to –25	+/-1600 (with EDC)
15.5	8.5	GFEC	10^{-5}	10^{-15}	–8 to –20	0
17	10	GFEC	10^{-5}	10^{-15}	–8 to –20	+/-1200 (with EDC)
33	26	EFEC	10^{-3}	10^{-15}	–5 to –28	0
33	26	EFEC	10^{-3}	10^{-15}	–5 to –25	+/-1600 (with EDC)
12	5	EFEC	7×10^{-4}	10^{-15}	–8 to –20	0
14	7	EFEC	7×10^{-4}	10^{-15}	–8 to –20	+/-1200 (with EDC)

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 25

SONET/SDH OC3/STM1 Specifications

Table 11 on page 25 shows the multimode SONET/SDH OC3/STM1 optical interface specifications.

Table 11: 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 12 on page 25 shows the SONET/SDH OC3/STM1 intermediate reach (IR-1) optical interface specifications.

Table 12: 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 13 on page 26 shows the SONET/SDH OC3/STM1 long reach (LR-1) optical interface specifications.

Table 13: 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 26
- 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 27

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

Table 14 on page 26 shows the SONET/SDH OC12/STM4 short reach (SR-1) optical interface specifications.

Table 14: 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 15 on page 27 shows the SONET/SDH OC12/STM4 short reach (IR-1) optical interface specifications.

Table 15: 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 16 on page 27 shows the SONET/SDH OC12/STM4 short reach (LR-1) optical interface specifications.

Table 16: 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 17 on page 28 shows the SONET/SDH OC12/STM4 short reach (LR-2) optical interface specifications.

Table 17: 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 28
- 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 29

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

Table 18 on page 28 shows the SONET/SDH OC48/STM16 short reach (SR-1) optical interface specifications.

Table 18: 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 19 on page 29 shows the SONET/SDH OC48/STM16 intermediate reach (IR-1) optical interface specifications.

Table 19: 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 20 on page 29 shows the SONET/SDH OC48/STM16 long reach (LR-1) optical interface specifications.

Table 20: 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 21 on page 30 shows the SONET/SDH OC48/STM16 long reach (LR-2) optical interface specifications.

Table 21: 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 30
- SONET/SDH OC192/STM64 Short Reach (SR-1) on page 31
- SONET/SDH OC192/STM64 Short Reach (SR-2) on page 31
- SONET/SDH OC192/STM64 Intermediate Reach (IR-2) on page 31
- SONET/SDH OC192/STM64 Long reach (LR-1) on page 32
- SONET/SDH OC192/STM64 Long reach (LR-2) on page 32

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

Table 22 on page 30 shows the SONET/SDH OC192/STM64 very short reach (VSR) optical interface specifications.

Table 22: 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 23 on page 31 shows the SONET/SDH OC192/STM64 short reach (SR-1) optical interface specifications.

Table 23: 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 24 on page 31 shows the SONET/SDH OC192/STM64 short reach (SR-2) optical interface specifications.

Table 24: 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 25 on page 32 shows the SONET/SDH OC192/STM64 Intermediate reach (IR-2) optical interface specifications.

Table 25: 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) NOTE: 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 26 on page 32 shows the SONET/SDH OC192/STM64 long reach (LR-1) optical interface specifications.

Table 26: 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 27 on page 33 shows the SONET/SDH OC192/STM64 long reach (LR-2) optical interface specifications.

Table 27: 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

CHAPTER 3

Cable Pinouts

- RJ-48 Cable Pinouts for E1 and T1 PICs on page 35
- M120 X.21 and V.35 Cable Pinouts for EIA-530 PIC on page 38
- M120 Fast Ethernet PIC 48-Port Cable Pinouts on page 40

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 28 on page 35, Table 29 on page 36, Table 30 on page 36, and Table 31 on page 37 describe the RJ-48 connector pinouts.

Table 28: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router

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

Table 29: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router

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/+
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect

Table 30: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router

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
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect

Table 30: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router (continued)

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

Table 31: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router

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
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Related Documentation

- *Maintaining M120 PICs and PIC Cables*
- *Installing an M120 PIC Cable*
- *M120 PICs Description*

M120 X.21 and V.35 Cable Pinouts for EIA-530 PIC

The EIA-530 PIC accepts X.21 and V.35 cable connectors.

- A V.35 connection requires an DB-25 to V.35 cable and connects to a V.35 data terminal equipment (DTE) 34-pin Winchester type male cable (one per port). Table 32 on page 38 describes the V.35 cable pinouts.
- An X.21 connection requires an DB-25 to X.21 cable and connects to a X.21 DTE DB-15 male cable. Table 33 on page 39 describes the X.21 cable pinouts.

Figure 1: M120 EIA-530 PIC

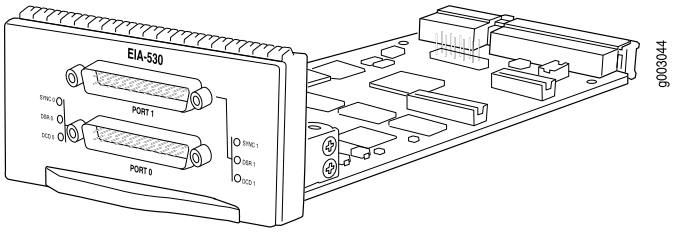


Table 32: M120 DB-25 Connector to V.35 Connector Pinout

DB-25 Pin	Signal	V.35 Pin	Description
2	TD	P	Transmit Data
14	TD	S	Transmit Data
3	RD	R	Receive Data
16	RD	T	Receive Data
4	RTS	C	Ready To Send
5	CTS	D	Clear To Send
6	DSR	E	Data Set Ready
20	DTR	H	Data Terminal Ready
24	XTC	U	DTE Transmit Clock
11	XTC	W	DTE Transmit Clock
15	TC	Y	Transmit Clock

Table 32: M120 DB-25 Connector to V.35 Connector Pinout (continued)

DB-25 Pin	Signal	V.35 Pin	Description
12	TC	AA	Transmit Clock
17	RC	V	Receive Clock
9	RC	X	Receive Clock
1	FGND	A	Protective Ground
7	GND	B	Signal Ground
8	DCD	F	Data Carrier Detect

Table 33: DB-25 Connector to DB-15 (X.21) Connector Pinout

DB-25 Pin	Signal	DB-15 (X.21) Pin	Description
1	FGND	1	Protective Ground
7	GND	8	Signal Ground
2	T	2	Transmit Data
14	T	9	Transmit Data
3	R	4	Receive Data
16	R	11	Receive Data
4	C	3	Request To Send
19	C	10	Request To Send
8	I	5	Data Carrier Detect
10	I	12	Data Carrier Detect
17	S	6	Receive Clock
9	S	13	Receive Clock

Related Documentation

- *Maintaining M120 PICs and PIC Cables*
- *Installing an M120 PIC Cable*
- *M120 PICs Description*

M120 Fast Ethernet PIC 48-Port Cable Pinouts

The Fast Ethernet 48-port PIC has four VHDCI connector ports on its faceplate (see Figure 2 on page 40), each of which accepts one of the four RJ-21 cables supplied with the PIC (see Figure 3 on page 40). Each VHDCI connector port supports 12 Ethernet ports.

Figure 2: Fast Ethernet 48-port PIC

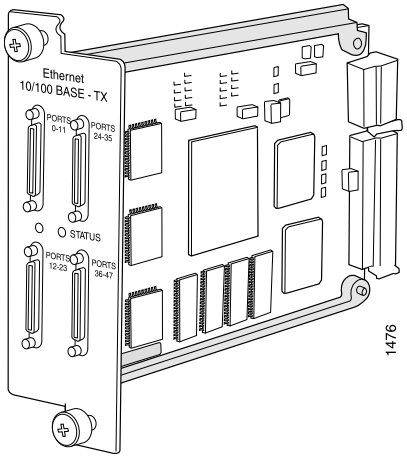


Figure 3: VHDCI to RJ-21 Cable

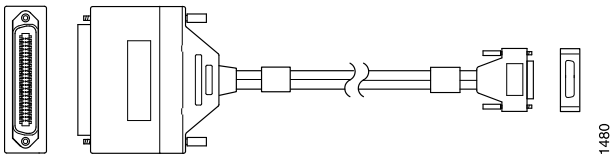


Table 34 on page 40 describes the RJ-21 cable pinouts.

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

Table 34: 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

Table 34: RJ-21 Pin Assignments (continued)

Ethernet Port Numbers	RJ-21 Pin Assignment			
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

- *M120 Router Description*
- *M120 Router Power Requirements*

PART 2

PIC Descriptions

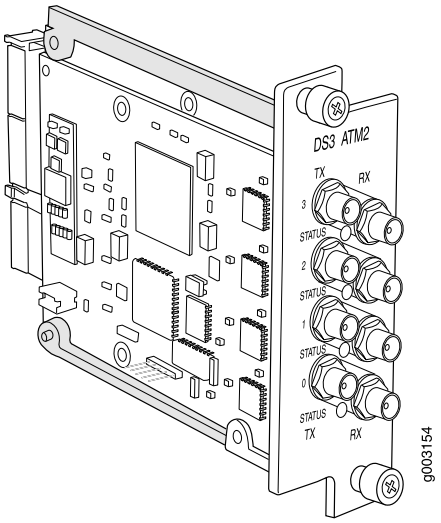
- ATM2 IQ PIC Descriptions on page 45
- Channelized Circuit Emulation PIC Descriptions on page 53
- Channelized Enhanced IQ (IQE) PIC Descriptions on page 57
- DS3, E1, E3, and T1 Pic Descriptions on page 79
- EIA-530 PIC Descriptions on page 89
- Ethernet PIC Descriptions on page 91
- Ethernet Enhanced IQ2 (IQ2E) PIC Descriptions on page 99
- 10-Gigabit Ethernet PIC Descriptions on page 103
- 10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC Descriptions on page 105
- Services PIC Descriptions on page 109
- SONET/SDH PIC Descriptions on page 115
- End-of-Life PIC Descriptions on page 139

CHAPTER 4

ATM2 IQ PIC Descriptions

- ATM2 DS3 IQ PIC (M120 Router) on page 45
- ATM2 E3 IQ PIC (M120 Router) on page 47
- ATM2 OC3/STM1 IQ PIC (M120 Router) on page 49
- ATM2 OC12/STM4 IQ PICs (M120 Router) on page 51

ATM2 DS3 IQ PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four DS3 ports • Power requirement: 0.41 A @ 48 V (20.0 W) • Fine-grained queuing per logical interface. • ATM standards compliant

Hardware features	• 16-MB SDRAM memory for ATM segmentation and reassembly (SAR)
	• ATM switch ID
	• Configurable framing options:
	  ◦ 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

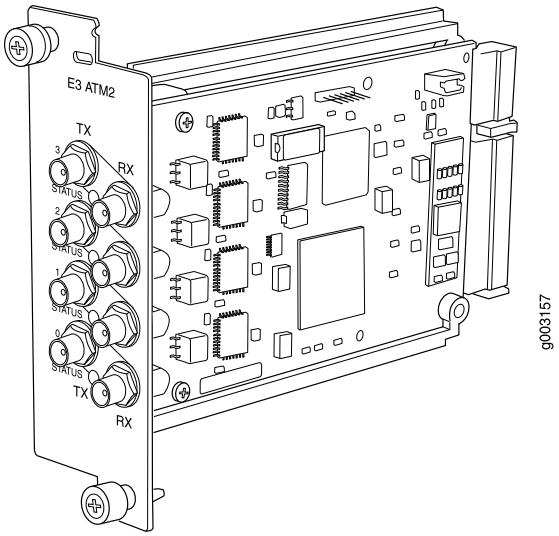
Software features	• Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	• Unspecified bit rate (UBR) traffic shaping
	• Fine-grained variable bit rate (VBR) traffic shaping
	• Circuit cross-connect (CCC)
	• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• AAL5 encapsulations:
	  ◦ ATM-VC-MUX
	  ◦ ATM-NLPID
	  ◦ ATM-Cisco-LLPID
	  ◦ ATM-SNAP
	  ◦ ATM-CCC-VC-MUX

Cables and connectors	• 10 ft (3.05 m) posilock SMB to BNC (provided) • Four pairs of Rx and Tx coaxial cables
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) • 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

ATM2 E3 IQ PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four E3 ports • Power requirement: 0.41 A @ 48 V (20 W) • Fine-grained queuing per logical interface • ATM standards compliant

Hardware features	• 16-MB SDRAM memory for ATM segmentation and reassembly (SAR)
	• ATM switch ID
	• Configurable framing options:
	  ◦ G.751 direct mapping
	  ◦ G.751 with PLCP encapsulation (default)
	  ◦ G.832 ATM direct mapping
	• Internal and loop timing

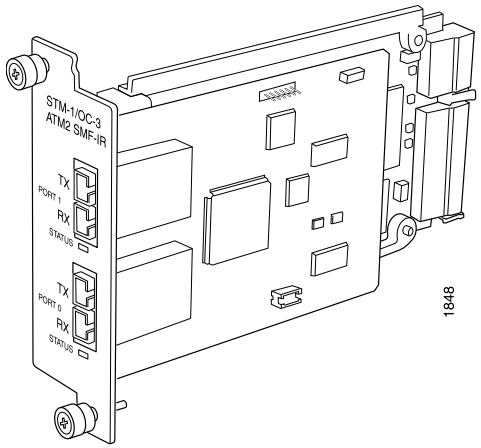
Software features	• Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	• Unspecified bit rate (UBR) traffic shaping
	• Fine-grained variable bit rate (VBR) traffic shaping
	• Circuit cross-connect (CCC)
	• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• AAL5 encapsulations:
	  ◦ ATM-VC-MUX
	  ◦ ATM-NLPID
	  ◦ ATM-Cisco-LLPID
	  ◦ ATM-SNAP
	  ◦ ATM-CCC-VC-MUX

Cables and connectors	• 10 ft (3.05 m) posilock SMB to BNC (provided) • Four pairs of Rx and Tx coaxial cables
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) • Frame error • Line code violation • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

ATM2 OC3/STM1 IQ PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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
Hardware features	• 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	• 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 indicator (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):
	  ◦ 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	• 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 24

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-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

- *M120 PICs Description*
- M120 PICs Supported on page 3

ATM2 OC12/STM4 IQ PICs (M120 Router)

Figure 4: 1-Port ATM2 OC12/STM4 IQ PIC

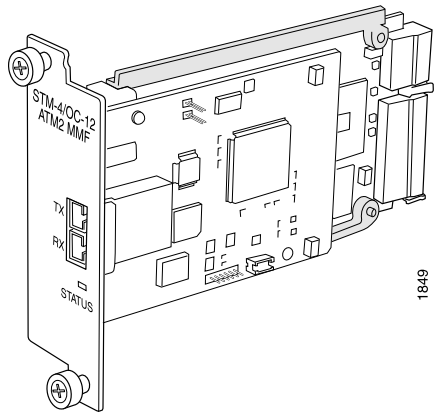
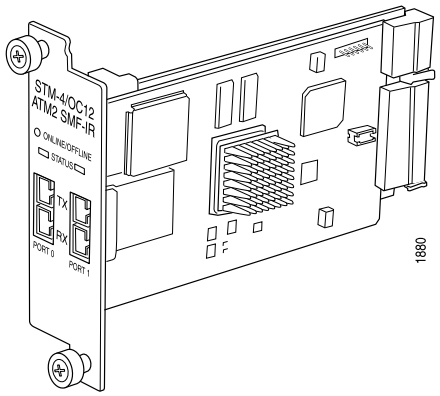


Figure 5: 2-Port ATM2 OC12/STM4 IQ PIC



Software release	• 1-port: Junos OS Release 8.0R2 and later (Type 1) • 2-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-891) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• One or two OC12 ports
	• Power requirement:
	  ◦ 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

Hardware features	• 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	• 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):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• Unspecified bit rate (UBR), realtime variable bit rate (VBRrt), nonrealtime variable bit rate (VBRnrt), 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	• 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

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-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

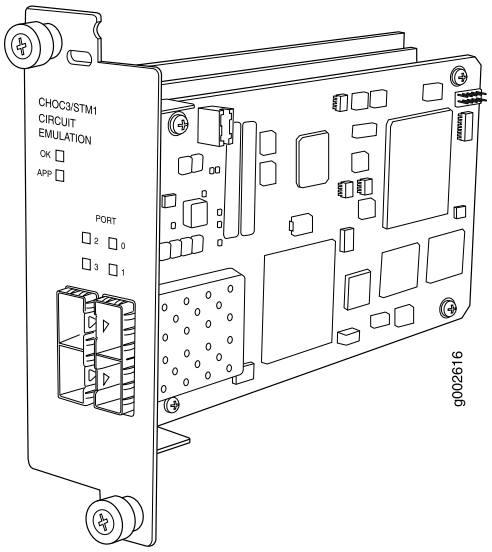
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 5

Channelized Circuit Emulation PIC Descriptions

- Channelized OC3/STM1 Circuit Emulation PIC with SFP (M120 Router) on page 53

Channelized OC3/STM1 Circuit Emulation PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.4 and later For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• 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.

Hardware features	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	  ◦ Larscom
	  ◦ ADTRAN
	  ◦ Verilink
	• M13/C-bit parity encoding
	• Local and remote loopback testing

Software features	• 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):
	  ◦ OC3 MIB
	  ◦ T1 MIB
	  ◦ ATM MIB for the 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 mulitplexing (IMA) for ATM (Junos OS Release 10.0 and later)
	• ATM QoS for the Junos OS Release 10.2 and later
	  ◦ 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 non-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	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 SFPs:
	  ◦ 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 24

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

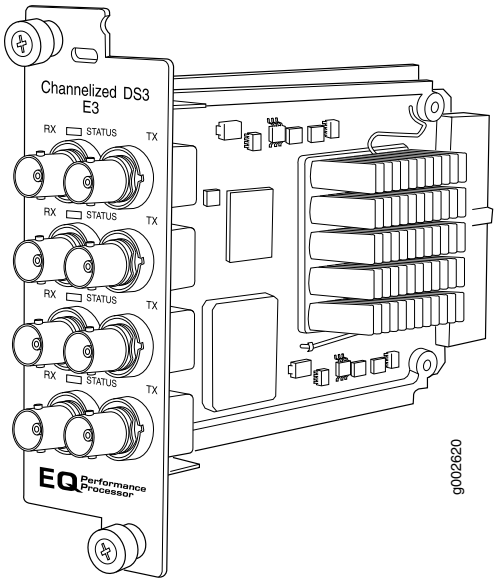
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 6

Channelized Enhanced IQ (IQE) PIC Descriptions

- Channelized DS3/E3 Enhanced IQ (IQE) PIC (M120 Router) on page 58
- Channelized E1/T1 Enhanced IQ (IQE) PIC (M120 Router) on page 61
- Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 64
- Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 68
- Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 73

Channelized DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)



Software release	• Junos OS Release 9.3 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• Four E3 or Channelized DS3 ports
	• E3 or Channelized DS3 is configurable on a per-port granularity
	• DS3 channelization:
	  ◦ 4 DS3 channels
	  ◦ 112 DS1 channels
	  ◦ 1011 DS0 channels
	• Power requirement: 0.53 A @ 48 V (25.4 W)

Hardware features	• Ports are numbered 0 through 3 top to bottom

Software features	• Maximum transmission units (MTUs) of up to 9000 bytes
	• Dynamic, arbitrary channel configuration
	• Subrate and scrambling:
	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) 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 DS1channels
- 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	• Standard DS3 BNC coaxial cable interfaces
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

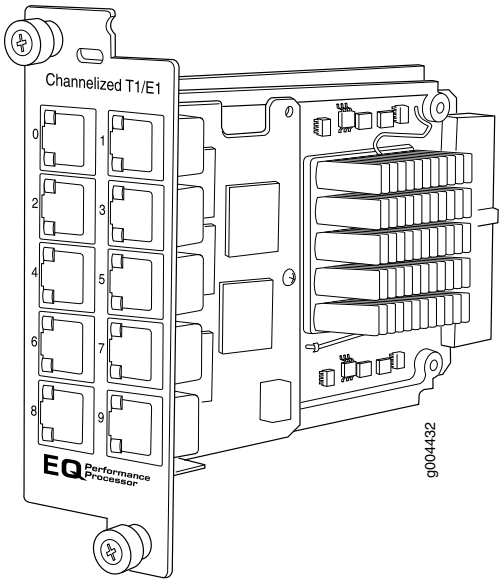
Alarms, errors, and events	• Alarm reporting for error statistics and failure counts
	• DS1 alarms:
	  • Alarm indication signal (AIS)
	  • Loss of frame (LOF)
	  • Remote alarm indication signal (RAIS)
	• DS1 error detection:
	  • Bursty errored seconds (BES)
	  • CRC errors
	  • Errored seconds (ES)
	  • 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)
	• 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized E1/T1 Enhanced IQ (IQE) PIC (M120 Router)



Software release	• Junos OS Release 9.5 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• Ten E1 or T1 ports
	• DS1 and E1 interfaces are selectable on a per-port granularity
	• E1 channelization per PIC:
	  ◦ 10 E1 channels
	  ◦ 310 DS0 channels
	• T1 channelization per PIC:
	  ◦ 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	Ports are numbered: • 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	• 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.
	• Support sending and receiving in-band loopback codes in both framed and unframed mode:
	  ◦ 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: • 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: • T1—CLI configurable as AMI or B8ZS • E1—HDB3 • 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 • 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	• 120-ohm RJ-48C connector (female)

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

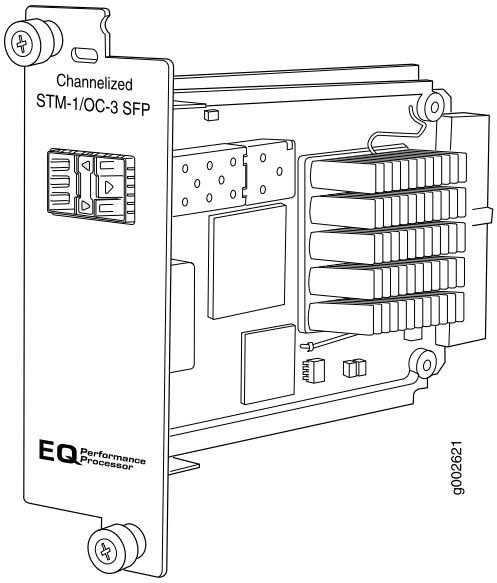
Alarms, errors, and events	• DS1 alarms:
	  ◦ Alarm indication signal (AIS)
	  ◦ Loss of frame (LOF)
	  ◦ Remote alarm indication signal (RAIS)
	  ◦ 24-hour alarm reporting history maintained for error statistics and failure counts, 15-minute intervals on all errors
	• DS1 error detection:
	  ◦ Bursty 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)	• 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.3 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• Two OC3 or STM1 ports
	• SONET or SDH is configurable on a per-port granularity
	• Channelization: OC3, DS3, DS1, DS0, E3, E1
	• SONET channelization:
	  ◦ 2 OC3 channels
	  ◦ 6 DS3 channels
	  ◦ 168 DS1 channels
	  ◦ 1011 DS0 channels
	• SDH channelization:
	  ◦ 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)

Hardware features	• 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 *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): 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 DS1:
	  ◦ 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 SFPs:
	  ◦ 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 24

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 (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 receiver error (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 error (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)
  - 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)
- 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M120 Router)

Figure 6: 1-Port IQE PIC

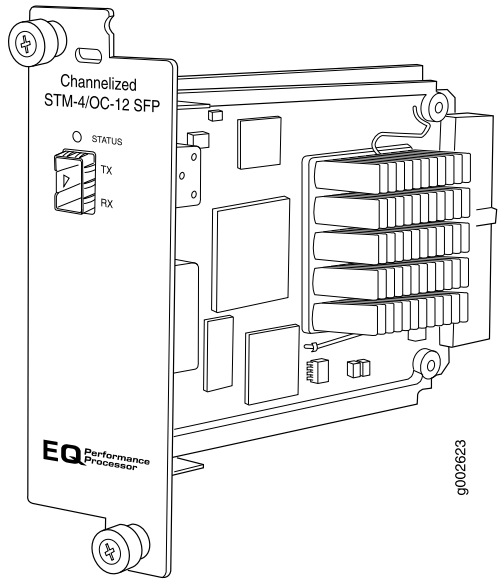
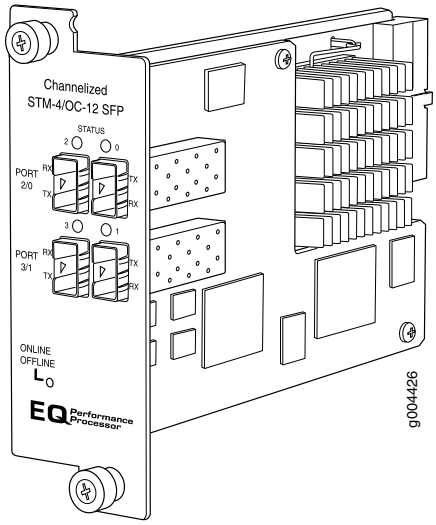


Figure 7: 4-Port IQE PIC



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"M120 PIC/FPC Compatibility" on page 11.

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	• 1-port: Port is numbered 0. • 4-port: Ports are numbered: • Top row: 2 and 0 from left to right • Bottom row: 3 and 1 from left to right
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): 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/PC connector (Rx and Tx); single-mode fiber
	• SONET/SDH OC12/STM4 fiber-optic SFP transceivers:
	  • 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)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 26

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 (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-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

NOTE: Do not install Type 2 IQE PICs in both PIC slot number 2 and PIC slot number 3 of the M120-FPC2. You can install one 4-port Channelized OC12/STM4 IQE PIC or one 1-port Channelized OC48/STM4 IQE PIC into either PIC slot number 2 or PIC slot number 3. In the other slot, you can install any Type 2 PIC except the 8-port Gigabit Ethernet IQ2 PIC or 8-port Gigabit Ethernet IQ2E PIC.

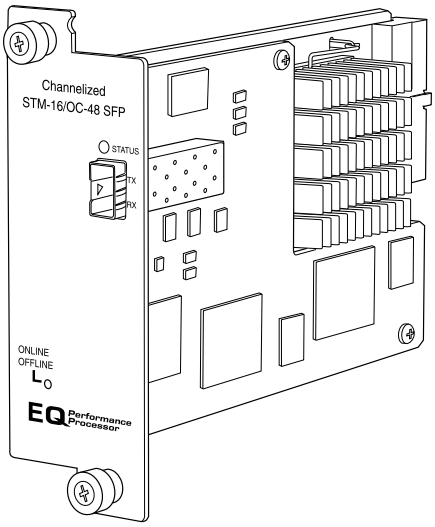
Table 35: PICs Supported in Fourth Slot of M120-FPC2 with Type 2 IQE PICs on M120 Routers

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.4 and later (Type 2) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• One OC48/STM16 port
	• SONET or SDH is configurable on a per-port granularity
	• Channelization: OC12, OC3, DS3, DS1, DS0, E3, E1
	• SONET channelization:
	  ◦ 4 OC12 channel
	  ◦ 16 OC3 channels
	  ◦ 48 DS3 channels
	  ◦ 672 DS1 channels
	  ◦ 975 DS0 channels
	• SDH channelization:
	  ◦ 4 STM4 channel
	  ◦ 16 STM1 channels
	  ◦ 48 E3 channels
	  ◦ 504 E1 channels
	  ◦ 975 DS0 channels
	• Power requirement: 1.10 A @ 48V (53 W)
	• Model number: PB-1CHOC48-STM16-IQE

Hardware features	• 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/PC connector (Rx and Tx); single-mode fiber
	• SONET/SDH OC48/STM16 SFPs:
	  • 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 (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

NOTE: Do not install Type 2 IQE PICs in both PIC slot number 2 and PIC slot number 3 of the M120-FPC2. You can install one 4-port Channelized OC12/STM4 IQE PIC or one 1-port Channelized OC48/STM4 IQE PIC into either PIC slot number 2 or PIC slot number 3. In the other slot, you can install any Type 2 PIC except the 8-port Gigabit Ethernet IQ2 PIC or 8-port Gigabit Ethernet IQ2E PIC.

Table 36: PICs Supported in Fourth Slot of M120-FPC2 with Type 2 IQE PICs on M120 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

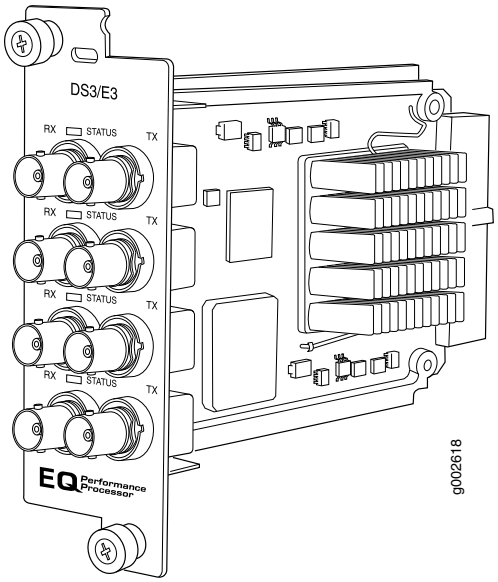
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 7

DS3, E1, E3, and T1 Pic Descriptions

- DS3/E3 Enhanced IQ (IQE) PIC (M120 Router) on page 79
- E3 IQ PIC (M120 Router) on page 82
- E1/T1 Circuit Emulation PIC (M120 Router) on page 84

DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)



Software release	• Junos OS Release 9.3R2 and later For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• 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	• Ports are numbered 0 through 3 top to bottom
Software features	• Maximum transmission units (MTUs) of up to 9192 bytes • Subrate and scrambling:

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	• Standard DS3 BNC coaxial cable interfaces

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

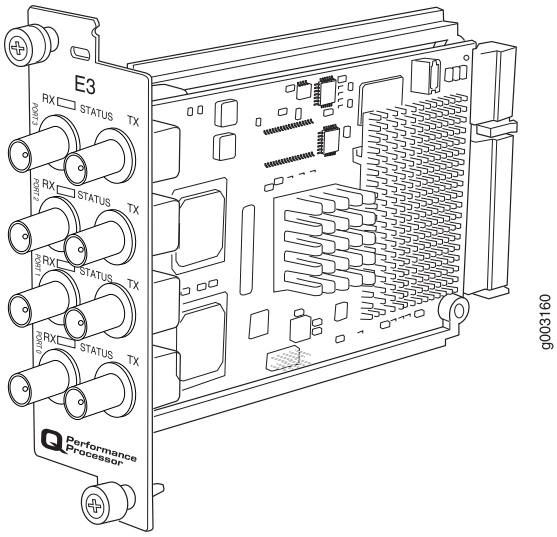
Alarms, errors, and events	• DS3 alarms:
	  ◦ Alarm indication signal (AIS)
	  ◦ Loss of frame (LOF)
	  ◦ Loss of signal (LOS)
	  ◦ Phase lock loop (PLL)
	  ◦ Yellow alarm
	• DS3 error detection:
	  ◦ C-bit code violations (CCV)
	  ◦ C-bit errored seconds (CES)
	  ◦ C-bit severely errored framing seconds (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

- *M120 PICs Description*
- M120 PICs Supported on page 3

E3 IQ PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four E3 ports • Power requirement: 0.38 A @ 48 V (18 W) • Fine-grained queuing per logical interface

Hardware features	• Clear-channel (34.368-Mbps) and subrate E3
	• Unframed or ITU G.751 framing
	• Data service unit (DSU) functionality
	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	• HDB3 line encoding
	• Full bit error rate test (BERT)
	• Local and remote loopback testing

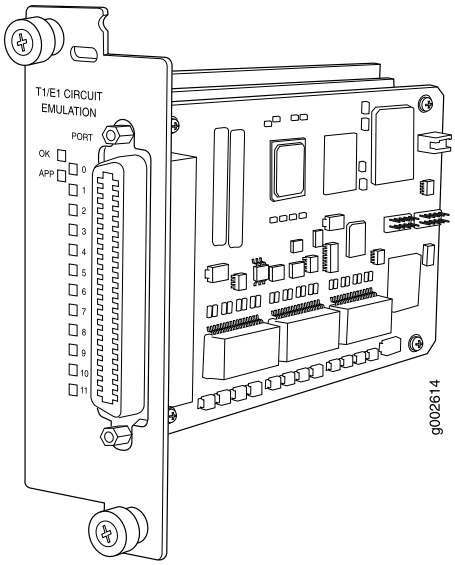
Software features	• Quality of service (QoS) per port: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): E3 MIB, QoS MIB
	• Input policing and output shaping
	• Provider-side rate limiting
	• Full data link connection identifier (DLCI) range with sparse channel numbering
	• Per-DLCI queues with weighted deficit round-robin and strict priority
	• Encapsulations:
	  ◦ 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	• Standard E3 BNC coaxial cable interfaces
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) • 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)	• Layer 2 per-queue packet and byte counters

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

E1/T1 Circuit Emulation PIC (M120 Router)



Software release	• Junos OS Release 9.4 and later For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• Configurable as either twelve E1 ports or twelve T1 ports NOTE: Mixing E1 and T1 ports on the same PIC is not supported. • Power requirement: 0.52 A @ 48 V (25 W) • Onboard DSU functionality for E1 connectivity

Hardware features	• Maximum transmission units (MTUs) of up to 1024 bytes
	• Per-interface diagnostics and loopback control
	• Per-interface alarm and event counting and detection
	• Framing
	  ◦ 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	• PIC can be configured as twelve T1 ports or twelve E1 ports
	• Local and remote loopback diagnostics
	• E1 ports
	  • 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
	  NOTE: The G.704 implementation supports speeds slower than 2.048 Mbps; multiple channels within a single E1 interface are not supported.
	  • G.704 framed without CRC4
	  • Unframed
	  • Framed clear channel mode
	  • Unframed clear channel mode
	  • Framed fractional mode
	• T1 ports
	  • 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 mulitplexing (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:
	  • 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 non-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	• 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) • Cylical 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

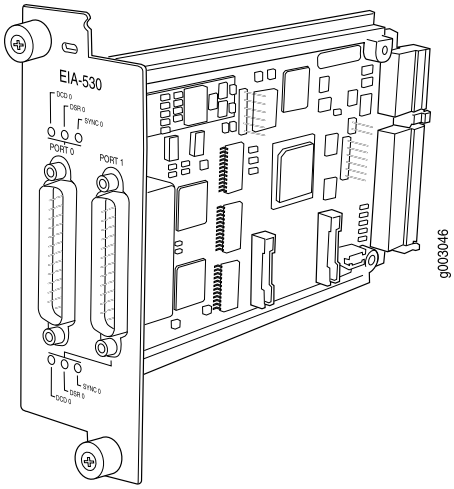
- Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 73
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 8

EIA-530 PIC Descriptions

- EIA-530 PIC (M120 Router) on page 89

EIA-530 PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Two EIA-530, X.21 or V.35 serial ports • Power requirement: 0.07 A @ 48 V (3.4 W)
Hardware features	• 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	• 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:
	  ◦ 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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 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	Three bicolor per port:
	• Data set ready (DSR):
	  ◦ Green—DSR is detected or ignored
	  ◦ Red—DSR expected but not present
	• Data carrier detect (DCD):
	  ◦ Green—DCD is detected or ignored
	  ◦ Red—DCD expected but not present
	• Resynchronization:
	  ◦ Green—Keepalives are being received
	  ◦ Red—Data terminal ready (DTR) toggled from low to high (resynchronization pulses are being sent)

Instrumentation (counters)	• Per-port packet and byte counters
	• Resynchronization counters:
	  ◦ Number of resynchronizations initiated
	  ◦ Time of last resynchronization

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 9

Ethernet PIC Descriptions

- Fast Ethernet PICs (M120 Router) on page 92
- Gigabit Ethernet PICs with SFP (M120 Router) on page 95

Fast Ethernet PICs (M120 Router)

Figure 8: 4-Port Fast Ethernet PIC

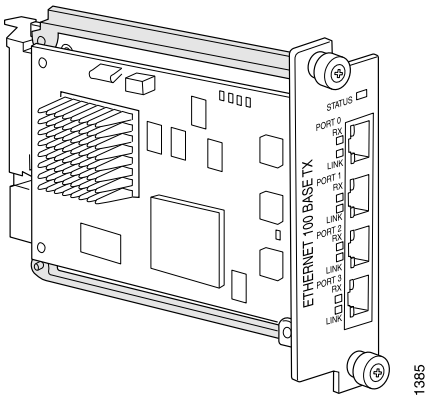


Figure 9: 8-Port Fast Ethernet PIC

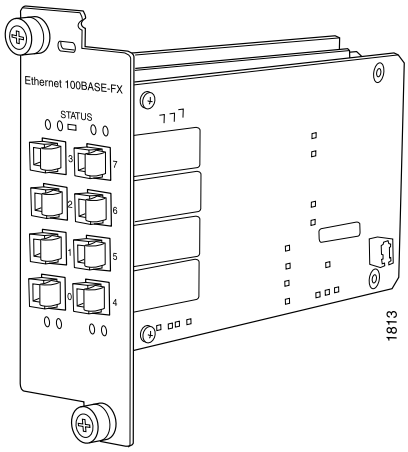


Figure 10: 12-Port Fast Ethernet PIC

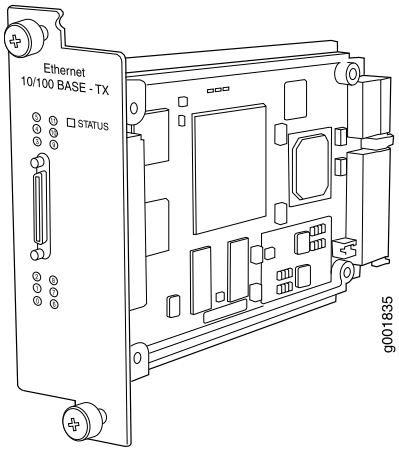


Figure 11: 48-Port Fast Ethernet PIC

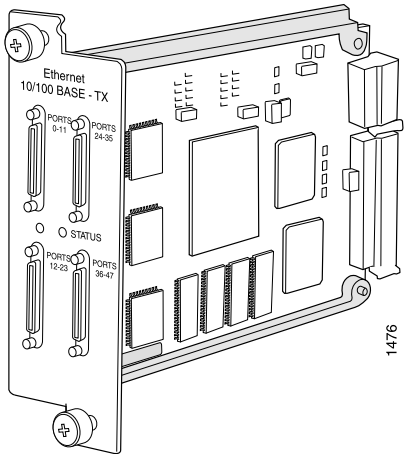
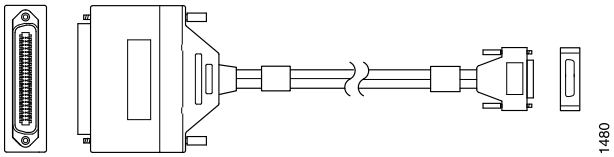


Figure 12: VHDCI to RJ-21 Cable



Software release	• 4-port: Junos OS Release 8.0R2 and later (Type 1) • 8-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) • 12-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) • 48-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2009-04-327) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.
Description	• 4 100Base-TX ports • 8 100Base-FX ports • 12 100Base-TX ports • 48 100Base-TX ports • Power requirement: ◦ 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)
Hardware features	• 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 9,192 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	• 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	4-port PIC: • Connector: Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector • Pinout: MDI noncrossover 8-port PIC: • Connector: MT-RJ female FX optical interface—see "Fast Ethernet 100BASE-FX Optical Interface Specifications" on page 18 12-port PIC: • 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.
	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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Gigabit Ethernet PICs with SFP (M120 Router)

Figure 13: 1-Port Gigabit Ethernet PIC

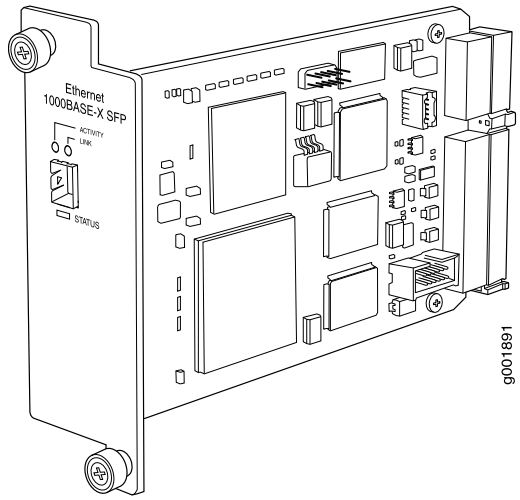


Figure 14: 2-Port Gigabit Ethernet PIC

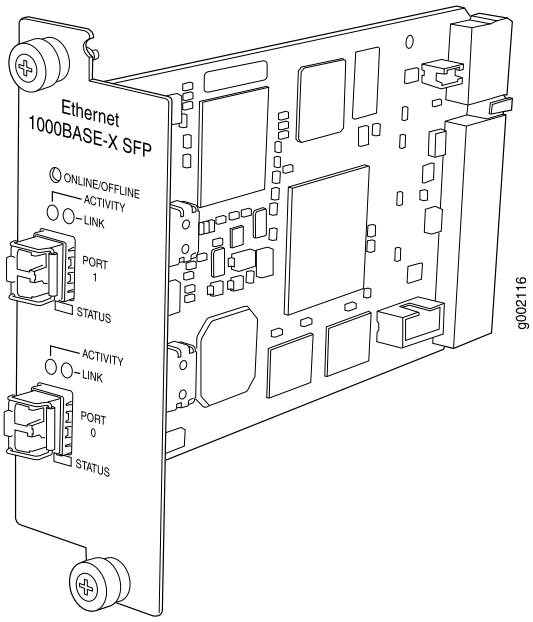


Figure 15: 4-Port Gigabit Ethernet PIC

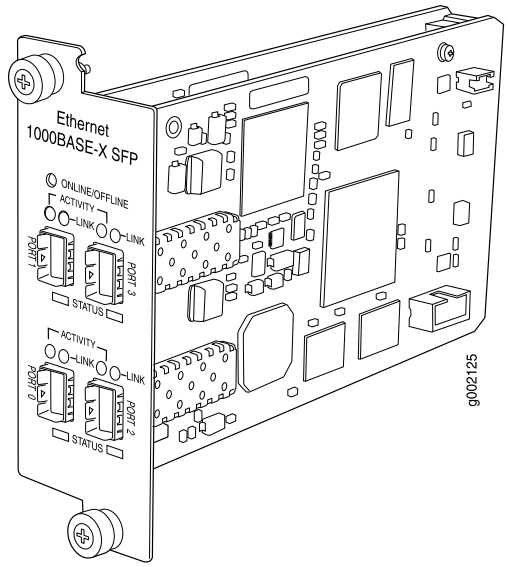
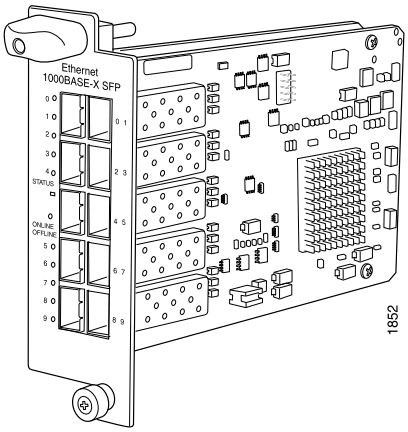


Figure 16: 10-Port Gigabit Ethernet PIC



Software release	• 1-port: Junos OS Release 8.0R2 and later (Type 1) • 2-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-891) • 4-port: Junos OS Release 8.0R2 and later (Type 2) • 10-port: Junos OS Release 8.0R2 and later (Type 3) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• One, two, four, or ten Gigabit Ethernet ports
	• Power requirement:
	  • 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

Hardware features	• 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	• 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 NOTE: The 10-port Gigabit Ethernet PIC with SFP does not support MAC accounting and policing, MAC learning, TPID, or flexible Ethernet encapsulation.

Cables and connectors	• You can install any transceiver supported by the PIC.
	• Fiber-optic SFP transceivers:
	  • Duplex LC/PC connector (Rx and Tx)
	  • Small form-factor pluggable (SFP) transceivers:
	  • 1000Base-LH (model number: SFP-1GE-LH)
	  • 1000Base-LX (model number: SFP-1GE-LX)
	  • 1000Base-SX (model number: SFP-1GE-SX)
	  • 1000Base-T (model number: SFP-1GE-T)
	  Optical interface specifications—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)
	  Optical 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, one bicolor: • Off—PIC is not enabled. • Green—PIC is operating normally. • Red—PIC has an error or failure. 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 10

Ethernet Enhanced IQ2 (IQ2E) PIC Descriptions

- Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M120 Router) on page 99

Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M120 Router)

Figure 17: 4-Port Gigabit Ethernet IQ2E PIC (Type 1)

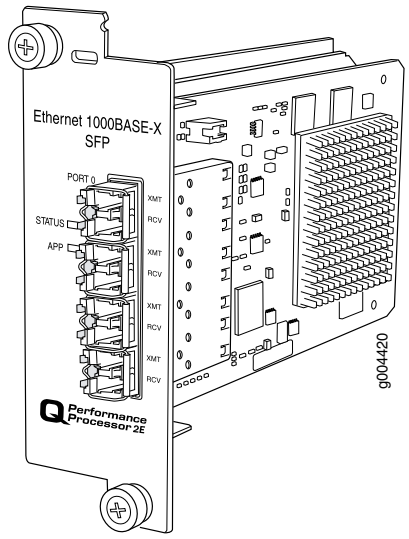


Figure 18: 8-Port Gigabit Ethernet IQ2E PIC (Type 2)

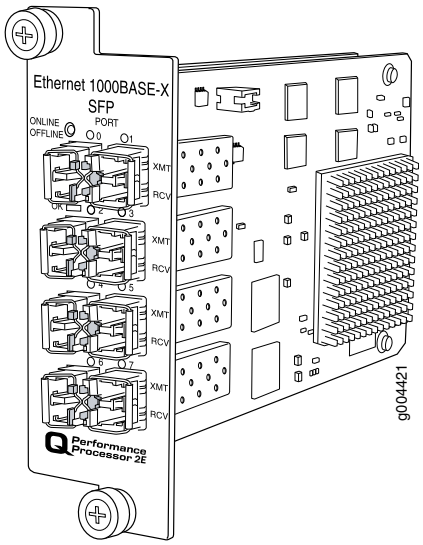
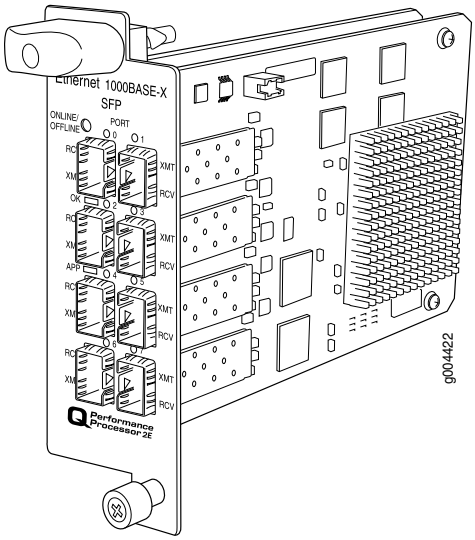


Figure 19: 8-Port Gigabit Ethernet IQ2E PIC (Type 3)



Software release	• 4-port: Junos OS Release 9.4 and later (Type 1) • 8-port: Junos OS Release 9.4 and later (Type 2) • 8-port: Junos OS Release 9.4 and later (Type 3) For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• Four or eight Gigabit Ethernet ports
	• Power requirement:
	  • 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)

Hardware features	• 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 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 • Point-to-Point Protocol over Ethernet (PPPoE) over VLAN • 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. • Fiber-optic SFP transceivers: ◦ Duplex LC/PC connector (Rx and Tx) ◦ Small form-factor pluggable (SFP) transceivers: ▪ 1000Base-LH (model number: SFP-1GE-LH) ▪ 1000Base-LX (model number: SFP-1GE-LX) ▪ 1000Base-SX (model number: SFP-1GE-SX) ▪ 1000Base-T (model number: SFP-1GE-T) Optical interface specifications—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) Optical interface specifications—see *OBSOLETE: Gigabit Ethernet 1000BASE Optical Interface Specifications*

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.

Related Documentation

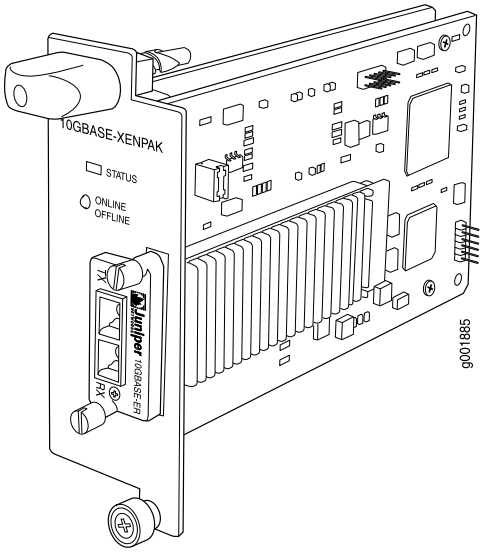
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 11

10-Gigabit Ethernet PIC Descriptions

- 10-Gigabit Ethernet PIC with XENPAK (M120 Router) on page 103

10-Gigabit Ethernet PIC with XENPAK (M120 Router)



Software release	• 10-Gigabit Ethernet PIC with XENPAK: Junos OS Release 8.0R2 and later (Type 3) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
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
Hardware features	• 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	• Virtual Router Redundancy Protocol (VRRP) support
	• 802.1q virtual LANs (VLANs) support
	• 802.3ad link aggregation support
	• RMON EtherStats
	• Optical diagnostics and related alarms :
	  ◦ Transceiver temperature
	  ◦ Laser bias current
	  ◦ Laser output power
	  ◦ Receive optical power

Cables and connectors	Fiber-optic 10-Gigabit XENPAK transceivers: • 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) Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
LEDs	Status LED, 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

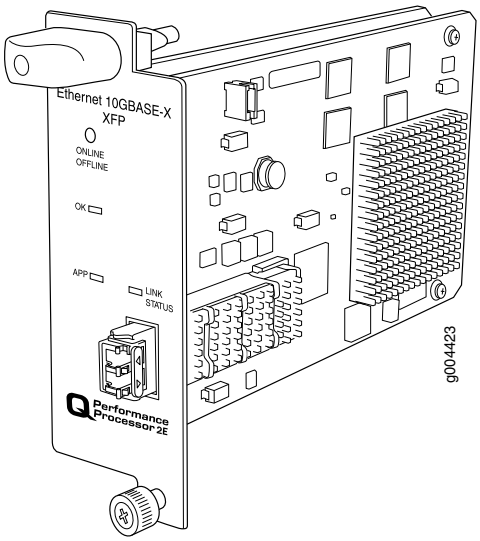
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 12

10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC Descriptions

- 10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M120 Router) on page 105

10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M120 Router)



Software release	• Junos OS Release 9.4 and later (Type 3) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11.
Description	• One 10–Gigabit Ethernet port • Power requirements: 1.2 A @48 V (56 W)
Hardware features	• 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	• 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:
	  ◦ 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)
	• Point-to-Point Protocol over Ethernet (PPPoE) over VLAN (Junos OS Release 8.5 and later.)
	• 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.
	• Fiber-optic 10–Gigabit small form-factor pluggable (XFP) transceivers:
	  ◦ Duplex LC/PC connector (Rx and Tx)
	  ◦ 10-Gigabit Ethernet XFP transceivers:
	  ▪ 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)
	Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 13

Services PIC Descriptions

- Multiservices PICs (M120 Router) on page 109
- Tunnel Services PIC (M120 Router) on page 112

Multiservices PICs (M120 Router)

Figure 20: Multiservices 100 PIC

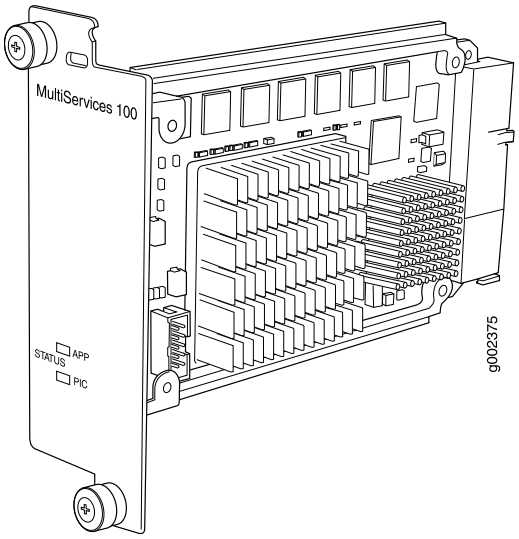


Figure 21: Multiservices 400 PIC

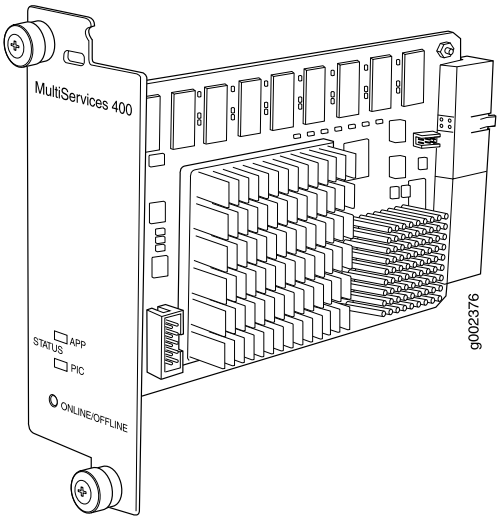
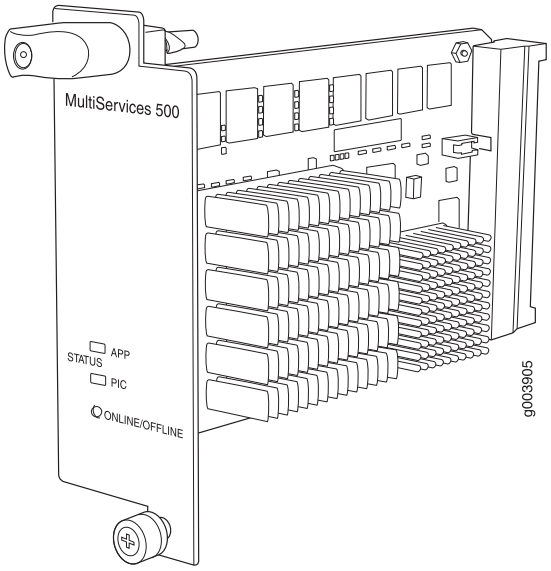


Figure 22: Multiservices 500 PIC



Software release	• Multiservices 100: Junos OS Release 8.2R2 and later (Type 1) NOTE: This PIC requires the 710-017980 version of the FPC1. • Multiservices 400: Junos OS Release 8.2 and later (Type 2) • Multiservices 500: Junos OS Release 8.3 and later (Type 3) For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• 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:
	  ◦ 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)

Hardware features	• Active monitoring on:
	  ◦ 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	• Support for up to 2000 service sets • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 37 on page 111. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.

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

Table 37: Multiservices PICs Software Features Supported on the M120 Router

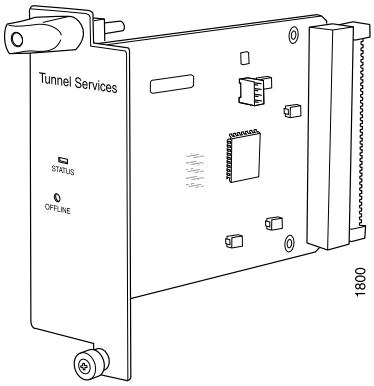
Software Feature	Multiservices 100	Multiservices 400	Multiservices 500
GRE Key	–	–	–
GRE dont-fragment	–	–	–
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	8.2R2	8.2	8.3
Network Address Translation (NAT) for IP addresses	8.2R2	8.2	8.3
Port Address Translation (PAT) for port numbers	8.2R2	8.2	8.3
IP Security (IPSec) encryption	8.2R2	8.2	8.5
Active flow monitoring exports cflowd version 5 and version 8 records	8.2R2	8.2	8.3
Active 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	8.2R2	8.2	8.5
Dynamic flow capture	–	8.4	–
Real-time Performance Monitoring	8.2R2	8.2	8.5
Link services	8.2R2	8.2	8.5

Table 37: Multiservices PICs Software Features Supported on the M120 Router (continued)

Software Feature	Multiservices 100	Multiservices 400	Multiservices 500
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.2R2	8.2	8.3
Virtual tunnel interface for Layer 3 VPNs	8.2R2	8.2	8.3
Layer 2 Tunneling Protocol (L2TP)	8.2R2	8.2	8.3
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	8.2R2	8.2	8.5
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	8.2R2	8.2	8.3

Related Documentation
- *M120 PICs Description*
- M120 PICs Supported on page 3

Tunnel Services PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1, Type 2, and Type 3) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Power requirement: 0.07 A @ 48 V (3.4 W)

Hardware features	• 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	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*. • IP-IP unicast tunneling • GRE unicast tunneling • PIM sparse mode unicast tunneling
LEDs	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

Related Documentation

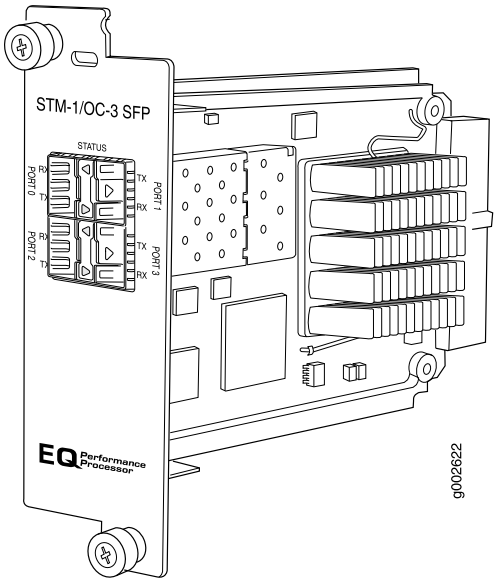
- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 14

SONET/SDH PIC Descriptions

- SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 116
- SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M120 Router) on page 119
- SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router) on page 122
- SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router) on page 125
- SONET/SDH OC48c/STM16 PIC with SFP (M120 Router) on page 129
- SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M120 Router) on page 132
- SONET/SDH OC192/STM64 PIC with XFP (M120 Router) on page 135

SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.3R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• 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	• 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	• 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.
	• Packet buffering, Layer 2 parsing
	• Local line and remote payload loopback testing
	• Simple Network Management Protocol (SNMP): OC3 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	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 fiber-optic 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 24

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)
- 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M120 Router)

Figure 23: SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 1)

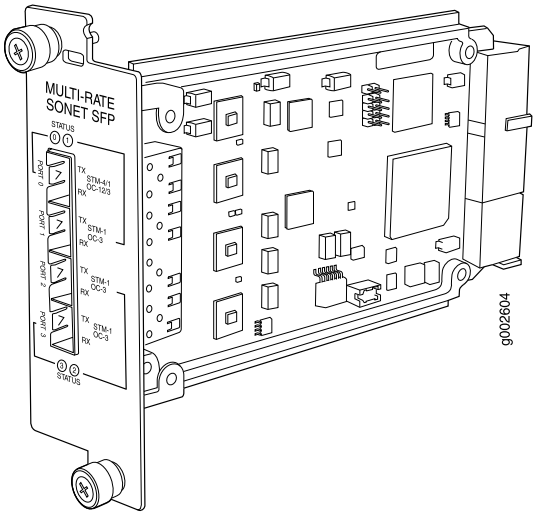
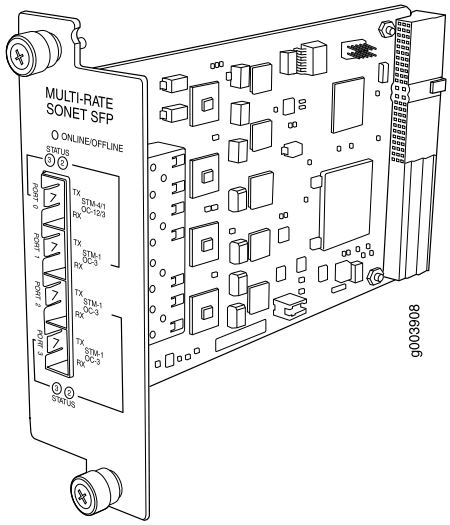


Figure 24: SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type 2)



Software release	• PB-4OC3-1OC12-SON-SFP: Junos OS Release 8.4 and later (Type 1) • PB-4OC3-1OC12-SON2-SFP: Junos OS Release 8.3 and later (Type 2) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11.

Description	• Rate-selectable using one of the following rates:
	  • 1-port OC12/STM4
	  • 1-port OC12c/STM4c
	  • 4-port OC3c/STM1c
	• Power requirement: 0.40 A @ 48 V (19 W)

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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ 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 24
	• 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 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)

Figure 25: 1-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC

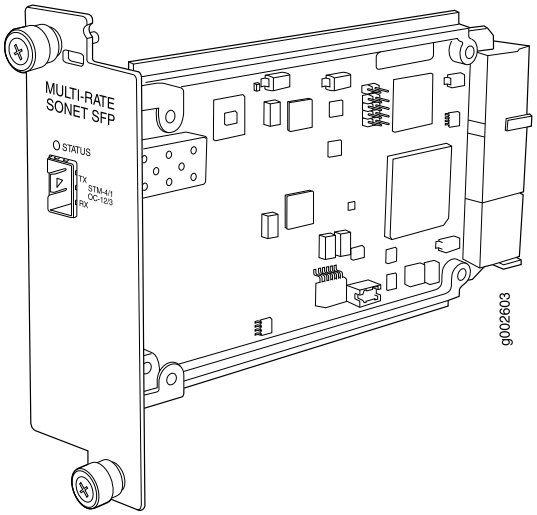
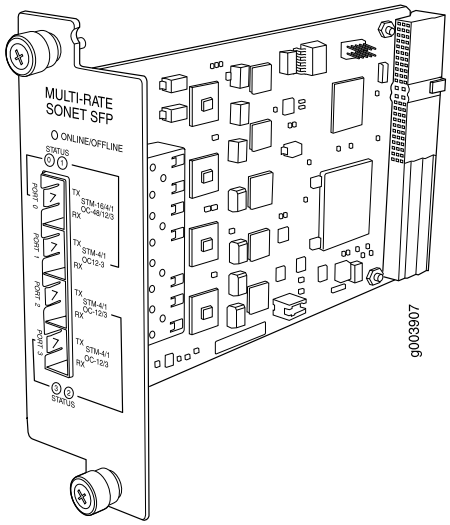


Figure 26: 4-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC



Software release	• 1-port: Junos OS Release 8.4 and later (Type 1) End-of-life (see notification PSN-2013-03-891) • 4-port: Junos OS Release 8.3 and later (Type 2) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11.
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/STM16c ◦ 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)
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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ 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 24
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	  ◦ Short reach (SR-1)
	  ◦ Intermediate reach (IR-1)
	  ◦ Long reach (LR-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.

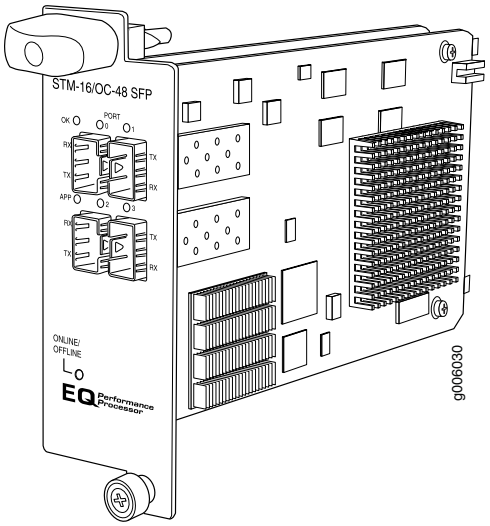
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)



Software release	• Junos OS Release 11.2 and later (Type 3) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• 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	• Ports are numbered:
	  • 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-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 *JUNOS System Basics and Services Command Reference*.

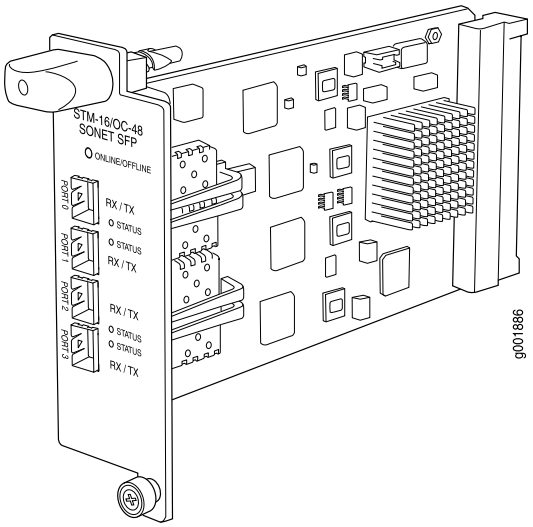
LEDs	OK LED, one tricolor: • Off—PIC is offline and safe to remove from the router • Green—PIC is operating normally • Yellow—PIC is initializing • Red—PIC has an error or failure APP LED, one green per port: • Off—Service is not running • Green—Service is running under acceptable load Port LEDs, one 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC48c/STM16 PIC with SFP (M120 Router)



Software release	• Junos OS Release 8.0R2 and later For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four OC48 ports • Power requirement: 0.86 A @ 48 V (41.4 W)
Hardware features	• Multiplexing and demultiplexing on the 1-port PIC • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ 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 OC48/STM16 small form-factor pluggable (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.

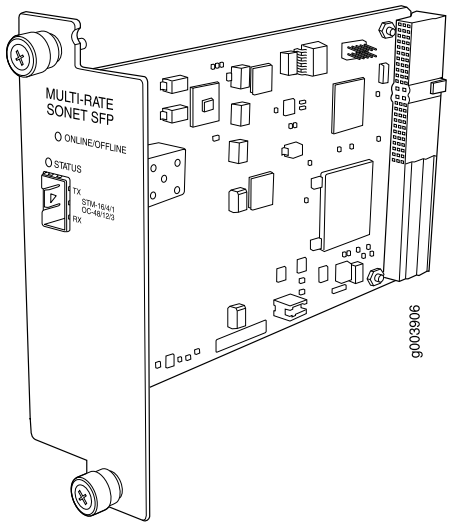
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M120 Router)



Software release	• Junos OS Release 8.3 and later (Type 2) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• Rate-selectable using one of the following rates:
	  • 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)

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:
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • 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 24
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	  • Short reach (SR-1)
	  • Intermediate reach (IR-1)
	  • Long reach (LR-1)
	  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-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.

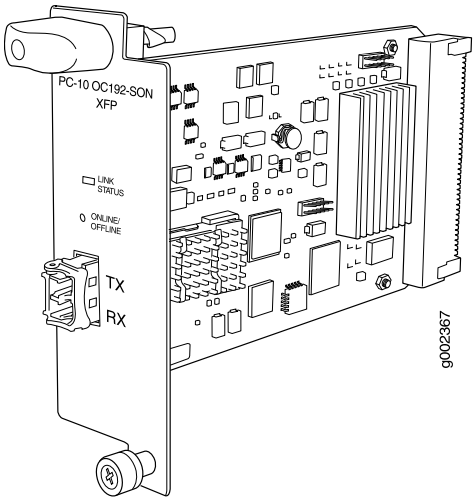
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC192/STM64 PIC with XFP (M120 Router)



Software release	• Junos OS Release 8.3 and later (Type 3) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• One OC192 port • Power requirement: 0.52A @ 48 V (25 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ 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 OC192/STM64 XFP transceivers:
	  • Short reach (SR-1) (model number: XFP-10G-L-OC192-SR1)
	  • Intermediate reach (IR-1) (model number: XFP-10G-E-OC192-IR2)
	  • Long reach (LR-1) (model number: XFP-10G-Z-OC192-LR2)
	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 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
	  • 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

CHAPTER 15

End-of-Life PIC Descriptions

- ATM2 OC12/STM4 IQ PICs (M120 Router) on page 140
- ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router) on page 142
- Channelized DS3 IQ EOL PIC (M120 Router) on page 144
- Channelized E1 IQ EOL PIC (M120 Router) on page 146
- Channelized E1 IQ EOL PIC (M120 Router) on page 147
- Channelized T1 IQ EOL PIC (M120 Router) on page 149
- Channelized STM1 IQ EOL PIC (M120 Router) on page 151
- Channelized OC3 IQ EOL PIC (M120 Router) on page 153
- Channelized OC12 IQ EOL PIC (M120 Router) on page 155
- Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router) on page 157
- DS3 EOL PIC (M120 Router) on page 162
- E1 EOL PICs (M120 Router) on page 164
- T1 EOL PIC (M120 Router) on page 166
- Fast Ethernet PICs (M120 Router) on page 167
- Gigabit Ethernet PICs with SFP (M120 Router) on page 170
- Gigabit Ethernet IQ EOL PICs with SFP (M120 Router) on page 173
- Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router) on page 175
- 10-Gigabit Ethernet DWDM EOL PIC (M120 Router) on page 178
- 10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router) on page 180
- 10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router) on page 181
- Adaptive Services II EOL PIC (M120 Router) on page 183
- Adaptive Services II Layer 2 Services EOL PIC (M120 Router) on page 185
- Adaptive Services II FIPS EOL PIC (M120 Router) on page 188
- Link Services EOL PIC (M120 Router) on page 190
- SONET/SDH OC3c/STM1 EOL PICs (M120 Router) on page 191
- SONET/SDH OC12c/STM4 EOL PICs (M120 Router) on page 194

- SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router) on page 197
- SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router) on page 200
- SONET/SDH OC192c/STM64 EOL PIC (M120 Router) on page 203

ATM2 OC12/STM4 IQ PICs (M120 Router)

Figure 27: 1-Port ATM2 OC12/STM4 IQ PIC

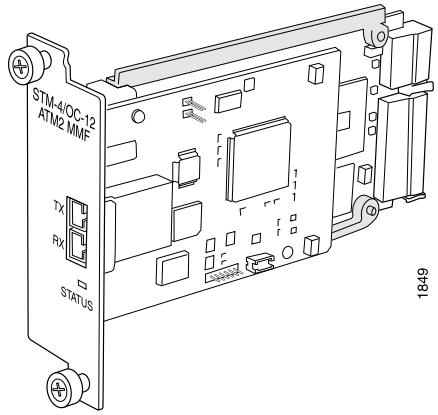
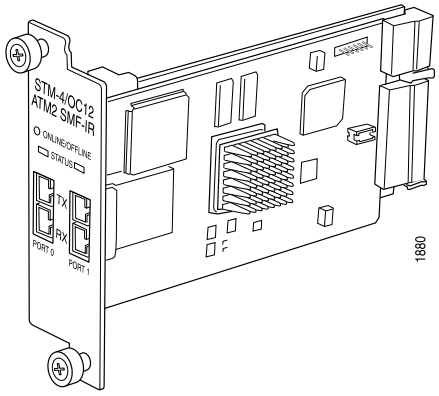


Figure 28: 2-Port ATM2 OC12/STM4 IQ PIC



Software release	• 1-port: Junos OS Release 8.0R2 and later (Type 1) • 2-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-891) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11.

Description	• One or two OC12 ports
	• Power requirement:
	  ◦ 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

Hardware features	• 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	• 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):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• Unspecified bit rate (UBR), realtime variable bit rate (VBRrt), nonrealtime variable bit rate (VBRnrt), 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

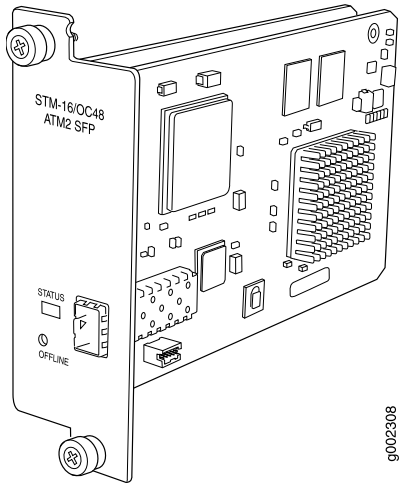
Cables and connectors	• Duplex SC/PC connector (Rx and Tx)
	• SONET/SDH OC12/STM4 fixed transceivers:
	  ◦ Multimode
	  ◦ Intermediate reach (IR-1)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 26

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-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

- *M120 PICs Description*
- M120 PICs Supported on page 3

ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-891) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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	• 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

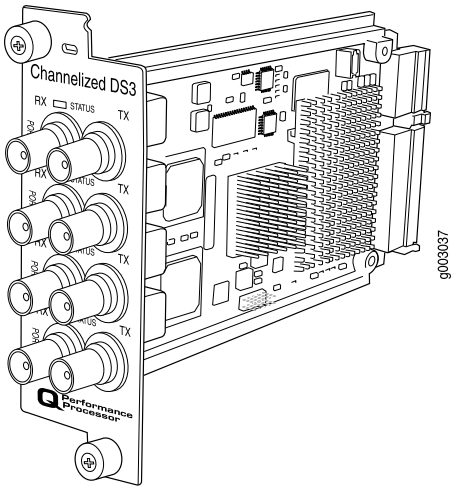
Software features	• Multiprotocol Label Switching (MPLS) circuit cross-connect for leveraging ATM access networks
	• User-configurable virtual circuit (VC) and virtual path (VP) support
	• Support for idle cell or unassigned cell transmission
	• OAM fault management processes alarm indication signal (AIS), remote defect indicator (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):
	  ◦ 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	• Duplex LC/PC connector (RX and TX) • SONET/SDH OC48/STM16 SFPs: ◦ 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: • 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) • 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized DS3 IQ EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four DS3 ports • Power requirement: 0.32 A @ 48 V (15.6 W) • Fine-grained queuing per logical interface • Channelization: DS3, DS0

Hardware features	• Data service unit (DSU) functionality
	• Subrate and scrambling:
	  ◦ 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

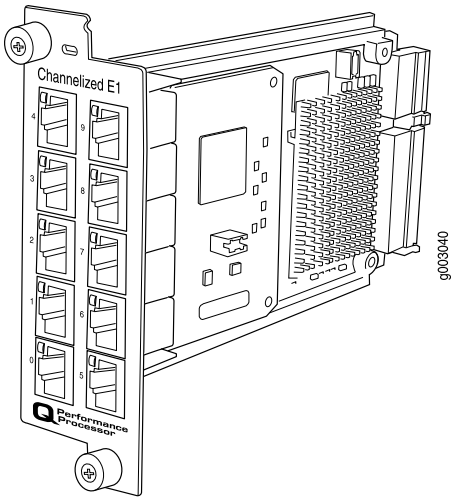
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB
	• Dynamic, arbitrary channel configuration
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Standard DS3 BNC coaxial cable interfaces
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) • 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)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M120 PICs Description*

Channelized E1 IQ EOL PIC (M120 Router)



Software release	• PB-10CHE1-RJ48-QPP: Junos OS Release 8.0R2 and later End-of-life (see notification PSN-2008-10-038) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Ten E1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Fine-grained queuing per logical interface. • Channelization: E1, DS0
Hardware features	• 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	• 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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

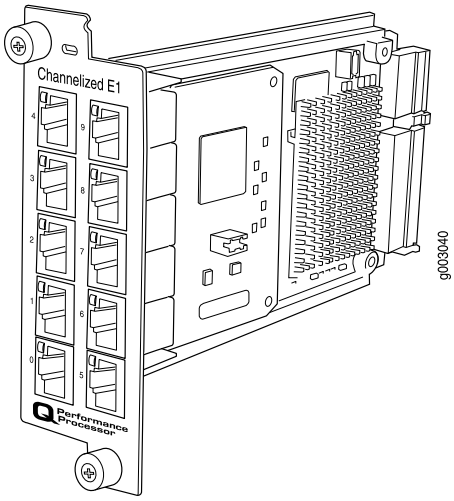
Cables and connectors	• 120-ohm RJ-48C

LEDs	One bicolor per E1 port: • 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	• Alarm indication signal (AIS) • Loss of frame (LOF) • Out of frame (OOF) • Failed signal rate (FSR)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

Channelized E1 IQ EOL PIC (M120 Router)



Software release	• PB-10CHE1-RJ48-QPP-N: Junos OS Release 9.1R4, 9.2R3, 9.3R1 and later End-of-life (see notification PSN-2013-03-892)
Description	• Ten E1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Fine-grained queuing per logical interface. • Channelization: E1, DS0

Hardware features	• 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

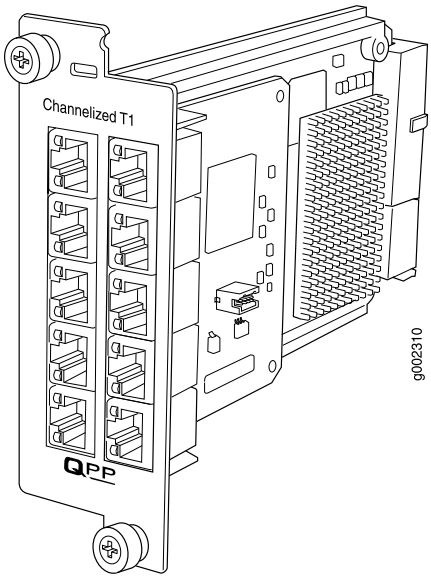
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): E1 MIB, DS0 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 120-ohm RJ-48C
LEDs	One bicolor per E1 port: • 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	• Alarm indication signal (AIS) • Loss of frame (LOF) • Out of frame (OOF) • Failed signal rate (FSR)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized T1 IQ EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Ten T1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Fine-grained queuing per logical interface. • Channelization: T1, FT1, *N*xDS0

Hardware features	• 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:
	  ◦ 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:
	  ◦ 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:
	  ◦ 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	• 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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

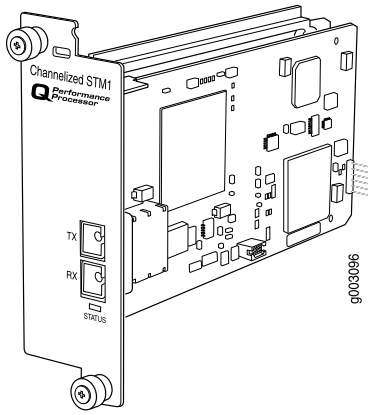
Cables and connectors	• 120-ohm RJ-48C connector (female)
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• Alarm indication signal (AIS) • Remote defect indication (RDI) • Loss of frame (LOF) • Loss of signal (LOS) • Bipolar violation (BPV) • Excessive zero (EXZ) • Line code violation (LCV) • 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized STM1 IQ EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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
Hardware features	• Packet buffering, Layer 2 parsing • Local and remote loopback testing

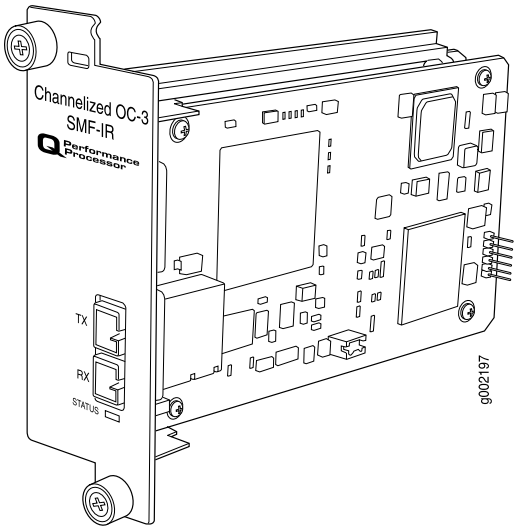
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• SNMP: SONET/SDH MIB, T1/E1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT) patterns at E1 and DS0 levels
	• Encapsulations:
	  ◦ 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); single-mode intermediate-reach fiber
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-L, 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) • 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 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)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized OC3 IQ EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• One OC3 port • Power requirement: 0.39 A @ 48 V (8.6 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface. • Channelization: DS3, DS1, DS0

Hardware 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 and remote loopback testing

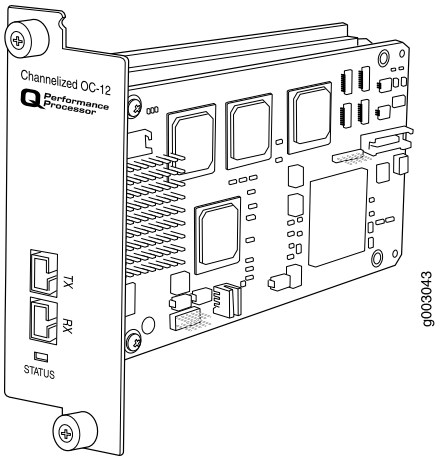
Software features	• Quality of Service (QoS) per channel: weighted round-Robin (WRR), random early drop (RED), weighted random early drop (WRED)
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• Full Bit Error Rate Testing (BERT)
	• Encapsulations:
	  ◦ 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); single-mode intermediate-reach fiber • SONET/SDH OC3/STM1 fixed transceivers: ◦ Intermediate reach (IR-1) Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 24
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-L, 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) • 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), Sseverely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P) • Yellow alarm bit (X-bit) disagreements

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

Channelized OC12 IQ EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) • End-of-life (see notification PSN-2009-04-327) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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	• 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 and remote loopback testing

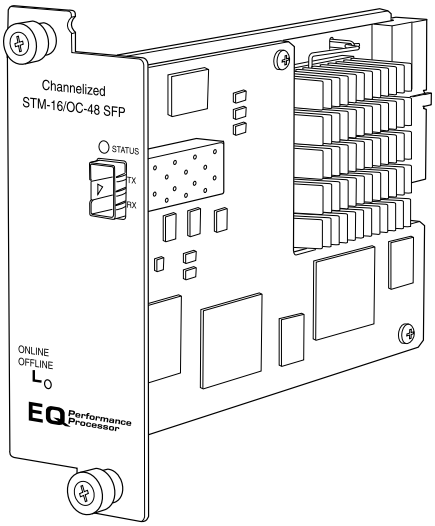
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ 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); single-mode fiber • SONET/SDH OC12/STM4 fixed transceivers: ◦ Intermediate reach (IR-1) Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 26
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-L, 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) • 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
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.4 and later (Type 2) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.

Description	• One OC48/STM16 port
	• SONET or SDH is configurable on a per-port granularity
	• Channelization: OC12, OC3, DS3, DS1, DS0, E3, E1
	• SONET channelization:
	  • 4 OC12 channel
	  • 16 OC3 channels
	  • 48 DS3 channels
	  • 672 DS1 channels
	  • 975 DS0 channels
	• SDH channelization:
	  • 4 STM4 channel
	  • 16 STM1 channels
	  • 48 E3 channels
	  • 504 E1 channels
	  • 975 DS0 channels
	• Power requirement: 1.10 A @ 48V (53 W)
	• Model number: PB-1CHOC48-STM16-IQE-SFP

Hardware features	• 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/PC connector (Rx and Tx); single-mode fiber
	• SONET/SDH OC48/STM16 SFPs:
	  • 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 (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

NOTE: Do not install Type 2 IQE PICs in both PIC slot number 2 and PIC slot number 3 of the M120-FPC2. You can install one 4-port Channelized OC12/STM4 IQE PIC or one 1-port Channelized OC48/STM4 IQE PIC into either PIC slot number 2 or PIC slot number 3. In the other slot, you can install any Type 2 PIC except the 8-port Gigabit Ethernet IQ2 PIC or 8-port Gigabit Ethernet IQ2E PIC.

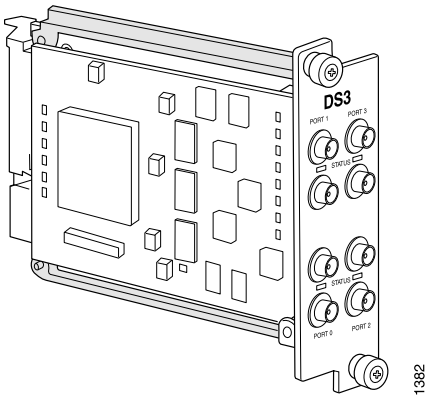
Table 38: PICs Supported in Fourth Slot of M120-FPC2 with Type 2 IQE PICs on M120 Routers

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

DS3 EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) • End-of-life (see notification PSN-2009-04-327) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Four DS3 ports • Power requirement: 0.47 A @ 48 V (22.5 W) • Integrated DSU interoperability with leading DSU vendors

Hardware features	• High-performance throughput on each port at speeds up to 44.736 Mbps, full duplex
	• C-bit framing
	• B3ZS line encoding
	• Subrate and scrambling:
	  ◦ Digital Link
	  ◦ Kentrox
	  ◦ Larscom
	• Per-port rate policing on input
	• Per-port rate shaping on output
	• Packet buffering, Layer 2 parsing

Software features	• DS3 functionality:
	  ◦ 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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

E1 EOL PICs (M120 Router)

Figure 29: E1 RJ-48 PIC

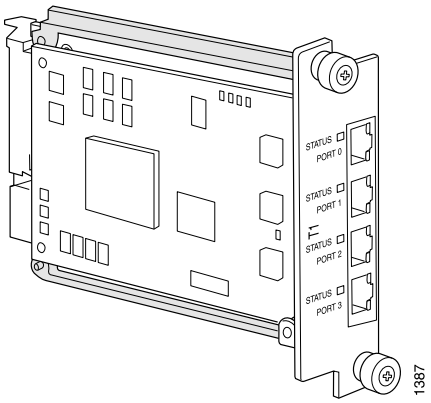
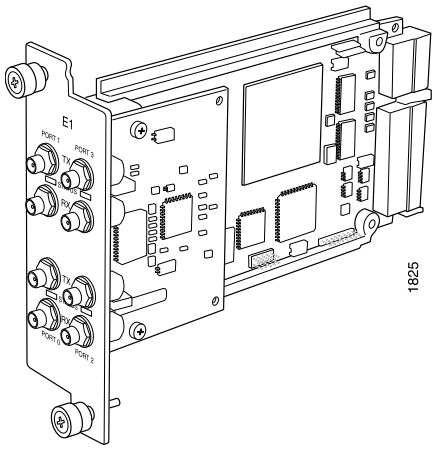


Figure 30: E1 Coaxial PIC



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) NOTE: These PICs are not supported in Junos OS Release 8.1R1.

Description	• Four E1 or coaxial ports
	• Power requirement: 0.08 A @ 48 V (3.74 W)
	• Two versions:
	  ◦ 4-port, 120-ohm, RJ-48
	  ◦ 4-port, 75-ohm, coaxial
	• Onboard DSU functionality for E1 connectivity

Hardware features	• High-performance throughput on each port at speeds up to 2.048 Mbps, full duplex • Maximum transmission units (MTUs) of up to 4500 bytes • Per-interface diagnostics and loopback control • Per-interface shaping on output • Per-interface alarm and event counting and detection • HDB3 line coding • 4-bit CRC for G.704 framed mode • Per-port loop timing • Balanced and unbalanced modes • Packet buffering, Layer 2 parsing • Full 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)

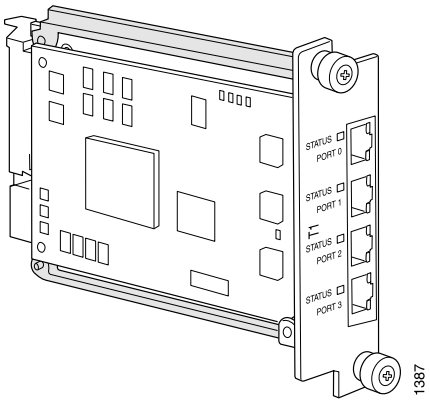
Cables and connectors	• Two versions:
	  ◦ Four RJ-48 connectors (one per port)
	  ◦ Four coaxial connectors
	• Custom 10-ft (3.05-m) posilock to BNC male cable, separate Rx and Tx

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

T1 EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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
Hardware features	• Per-port loop timing • Onboard DSU functionality for T1 connectivity

Software features	• 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:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 100-ohm RJ-48 connector
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) • Yellow alarm bit (X-bit) disagreements

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

Fast Ethernet PICs (M120 Router)

Figure 31: 4-Port Fast Ethernet PIC

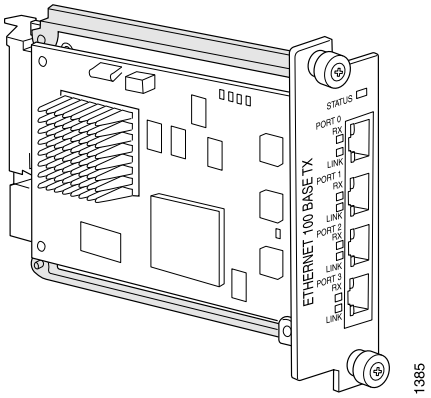


Figure 32: 8-Port Fast Ethernet PIC

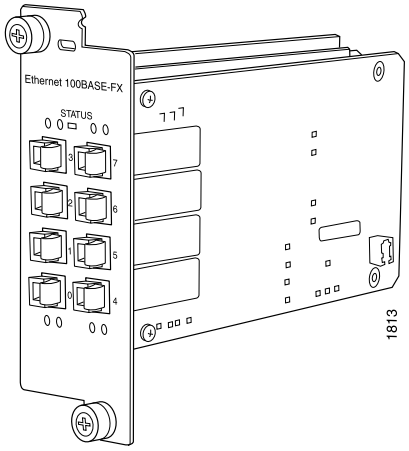


Figure 33: 12-Port Fast Ethernet PIC

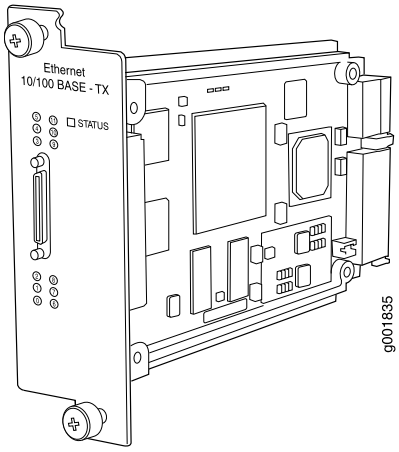


Figure 34: 48-Port Fast Ethernet PIC

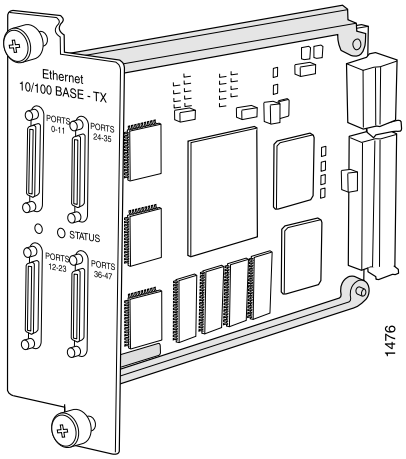
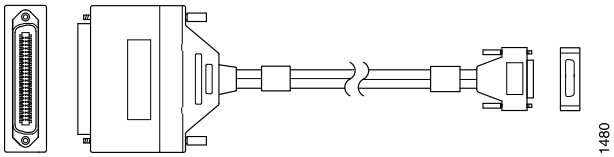


Figure 35: VHDCI to RJ-21 Cable



Software release	• 4-port: Junos OS Release 8.0R2 and later (Type 1) • 8-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) • 12-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-891) • 48-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2009-04-327) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.
Description	• 4 100Base-TX ports • 8 100Base-FX ports • 12 100Base-TX ports • 48 100Base-TX ports • Power requirement: ◦ 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)
Hardware features	• 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 9,192 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	• 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	4-port PIC: • Connector: Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector • Pinout: MDI noncrossover 8-port PIC: • Connector: MT-RJ female FX optical interface—see "Fast Ethernet 100BASE-FX Optical Interface Specifications" on page 18 12-port PIC: • 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.
	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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Gigabit Ethernet PICs with SFP (M120 Router)

Figure 36: 1-Port Gigabit Ethernet PIC

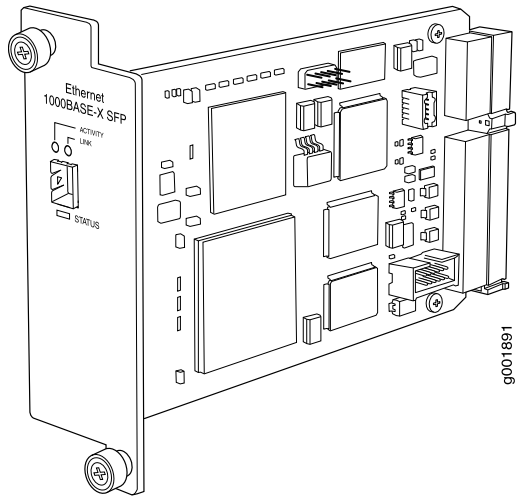


Figure 37: 2-Port Gigabit Ethernet PIC

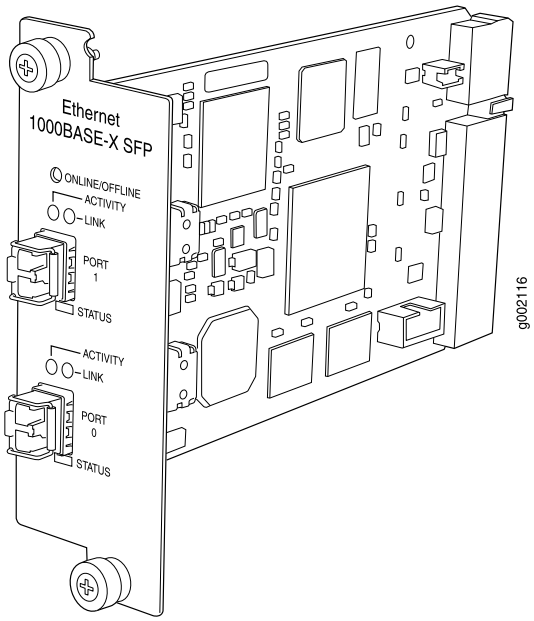


Figure 38: 4-Port Gigabit Ethernet PIC

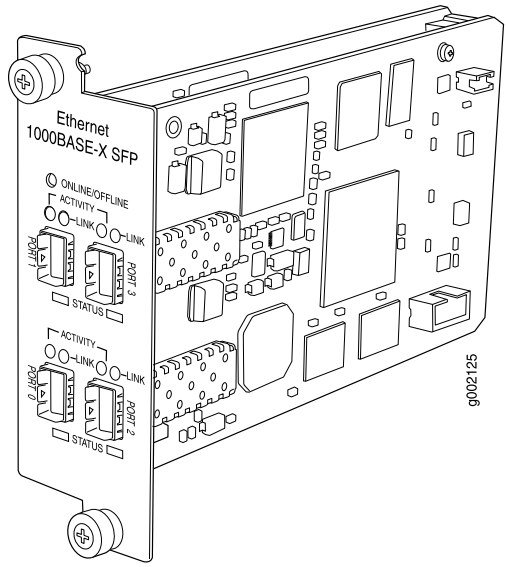
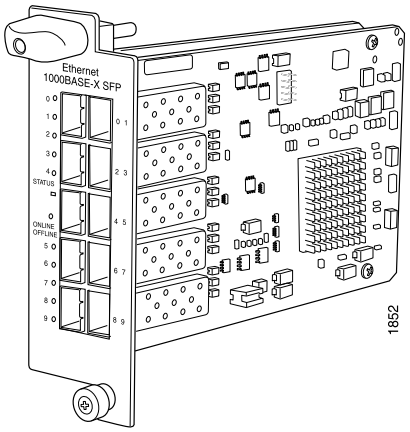


Figure 39: 10-Port Gigabit Ethernet PIC



Software release	• 1-port: Junos OS Release 8.0R2 and later (Type 1) • 2-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-891) • 4-port: Junos OS Release 8.0R2 and later (Type 2) • 10-port: Junos OS Release 8.0R2 and later (Type 3) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• One, two, four, or ten Gigabit Ethernet ports
	• Power requirement:
	  • 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

Hardware features	• 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	• 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 NOTE: The 10-port Gigabit Ethernet PIC with SFP does not support MAC accounting and policing, MAC learning, TPID, or flexible Ethernet encapsulation.

Cables and connectors	• You can install any transceiver supported by the PIC.
	• Fiber-optic SFP transceivers:
	  • Duplex LC/PC connector (Rx and Tx)
	  • Small form-factor pluggable (SFP) transceivers:
	  • 1000Base-LH (model number: SFP-1GE-LH)
	  • 1000Base-LX (model number: SFP-1GE-LX)
	  • 1000Base-SX (model number: SFP-1GE-SX)
	  • 1000Base-T (model number: SFP-1GE-T)
	  Optical interface specifications—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)
	  Optical 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, one bicolor: • Off—PIC is not enabled. • Green—PIC is operating normally. • Red—PIC has an error or failure. 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Gigabit Ethernet IQ EOL PICs with SFP (M120 Router)

Figure 40: 1-Port Gigabit Ethernet IQ PIC

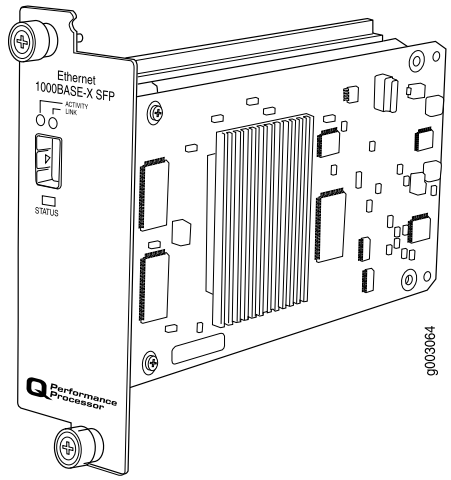
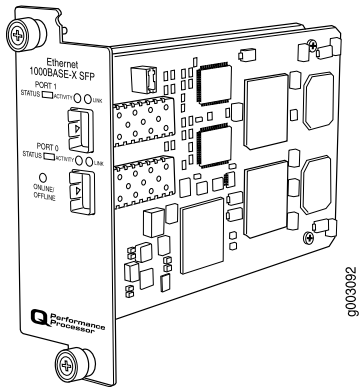


Figure 41: 2-Port Gigabit Ethernet IQ PIC



Software release	• 1-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) • 2-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-892) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.
Description	• One or two Gigabit Ethernet ports • Power requirement: 0.46 A @ 48 V (22 W) • Fine-grained queuing per logical interface
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)
	  • Small form-factor pluggable (SFP) transceivers:
	  • 1000Base-LH (model number: SFP-1GE-LH)
	  • 1000Base-LX (model number: SFP-1GE-LX)
	  • 1000Base-SX (model number: SFP-1GE-SX)
	  • 1000Base-T (model number: SFP-1GE-T)
	  Optical interface specifications—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)
	  Optical 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router)

Figure 42: 4-Port Gigabit Ethernet IQ2 PIC (Type 1)

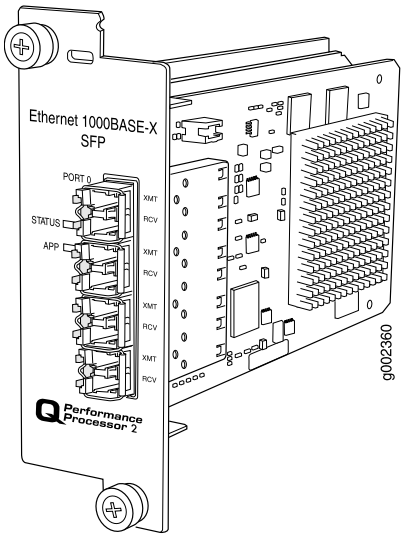


Figure 43: 8-Port Gigabit Ethernet IQ2 PIC (Type 2)

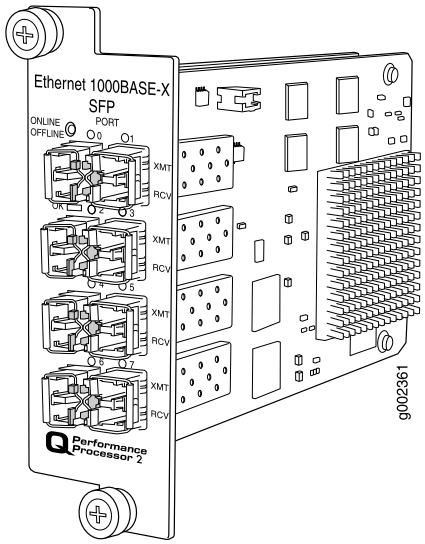
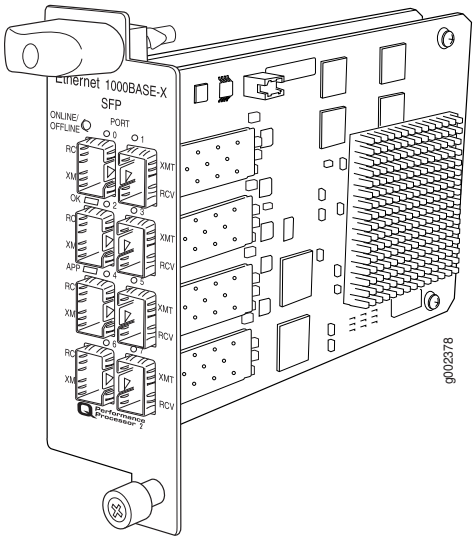


Figure 44: 8-Port Gigabit Ethernet IQ2 PIC (Type 3)



Software release	• 4-port: Junos OS Release 8.0R2 and later (Type 1) End-of-life (see notification PSN-2013-03-892) • 8-port: Junos OS Release 8.0R2 and later (Type 2) End-of-life (see notification PSN-2013-03-892) • 8-port: Junos OS Release 8.5 and later (Type 3) End-of-life (see notification PSN-2013-03-892) NOTE: These PICs are not supported in Junos OS Release 8.1R1. For information on which FPCs support these PICs, see"M120 PIC/FPC Compatibility" on page 11.

Description	• Four or eight Gigabit Ethernet ports
	• Power requirement:
	  • 4-port: 0.65 A @ 48 V (31W)
	  • 8-port (Type 2): 0.89 A @ 48 V (42.5W)
	  • 8-port (Type 3): 1.25 A @48 V (60 W)

Hardware features	• High-performance throughput on each port:
	  • 4-port with SFP: speeds up to 1 Gbps
	  • 8-port with SFP: speeds up to 4 Gbps (Type 2)
	  • 8-port with SFP: speeds up to 8 Gbps (Type 3)
	• Full-duplex mode
	• Large maximum transmission units (MTUs) of up to 9192 bytes

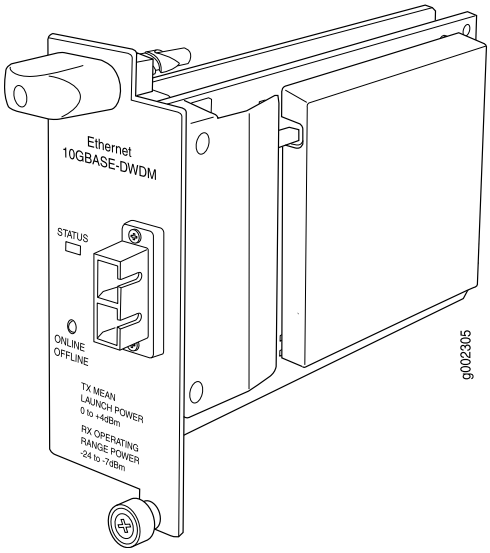
Software features	• Intelligent handling of oversubscribed traffic for Type 1 and Type 2 PICs • Optical diagnostics and related alarms • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Virtual Router Redundancy Protocol (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 • Point-to-Point Protocol over Ethernet (PPPoE) over VLAN (Junos OS Release 8.5 and later.) • 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 SFPs: ◦ Duplex LC/PC connector (Rx and Tx) ◦ Small form-factor pluggable (SFP) transceivers: ▪ 1000Base-LH (model number: SFP-1GE-LH) ▪ 1000Base-LX (model number: SFP-1GE-LX) ▪ 1000Base-SX (model number: SFP-1GE-SX) ▪ 1000Base-T (model number: SFP-1GE-T) Optical interface specifications—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) Optical 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.

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

10-Gigabit Ethernet DWDM EOL PIC (M120 Router)



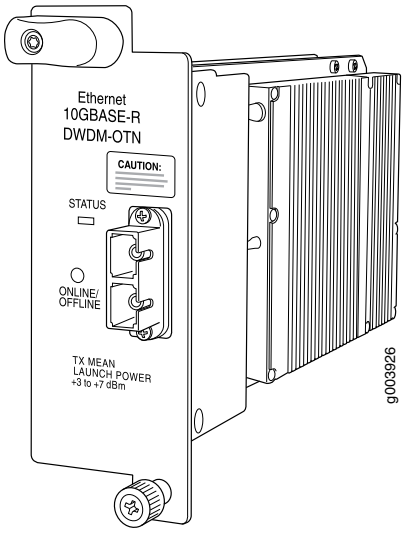
Software release	• Junos OS Release 8.0R2 and later (Type 3) End-of-life (see notification PSN-2010-08-887) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11. NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• One 10-Gigabit Ethernet port • Power requirement: 0.55 A @ 48 V (26.6 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network

Hardware features	• 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	• 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	• Duplex SC/PC connector (Rx and Tx) • Fiber-optic 10–Gigabit DWDM transceivers: ◦ Extra-Long Wavelength Serial DWDM, LAN Rate Optical interface specifications—see "10-Gigabit Ethernet DWDM PIC (PC-1XGE-DWDM-CBAND) Optical Interface Specifications" on page 18
LEDs	Status LED, one bicolor: • Off—PIC is 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router)



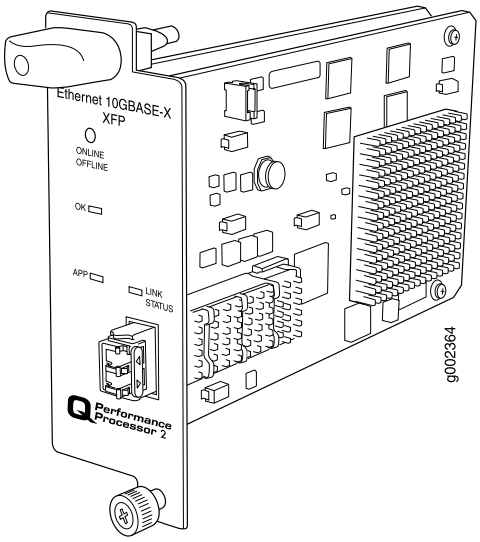
Software release	• Junos OS Release 9.4 and later (Type 3) End-of-life (see notification PSN-2012-02-506) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• One 10-Gigabit Optical Transport Network (OTN) port for transport of 10-Gigabit Ethernet (10GBASE-R) traffic • 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-OTN
Hardware features	• C-band ITU-Grid with 50 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 • 89 individual wavelengths
Software features	• Enhanced optical monitoring capabilities • CLI configurable wavelength support • Virtual Router Redundancy Protocol (VRRP) support • 802.1q virtual LANs (VLANs) support • IEEE 802.3ad Link Aggregation • RMON EtherStats

Cables and connectors	• Duplex SC/PC connector (RX and TX) • Fixed transceiver • Dense wavelength division multiplexing (DWDM) optical transport network (OTN) transceiver. Optical interface specifications—see "10-Gigabit Ethernet DWDM OTN PIC (PC-1XGE-DWDM-OTN) Optical Interface Specifications" on page 19
LEDs	**Status** LED, one bicolor: • Off—PIC is not enabled. • Green—PIC is operating normally. • Red—PIC has an error or is in line-side loopback.

Related Documentation

- *M120 PICs Description*
- M120 PICs Supported on page 3

10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router)



Software release	• Junos OS Release 8.2 and later (Type 3) End-of-life (see notification PSN-2013-03-892) For information on which FPCs support these PICs, see "M120 PIC/FPC Compatibility" on page 11.
Description	• One 10-Gigabit Ethernet port • Power requirements: 1.2 A @48 V (56 W)
Hardware features	• 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	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Configurable WAN-PHY mode options:
	  ◦ 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)
	• Point-to-Point Protocol over Ethernet (PPPoE) over VLAN (Junos OS Release 8.5 and later.)
	• 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

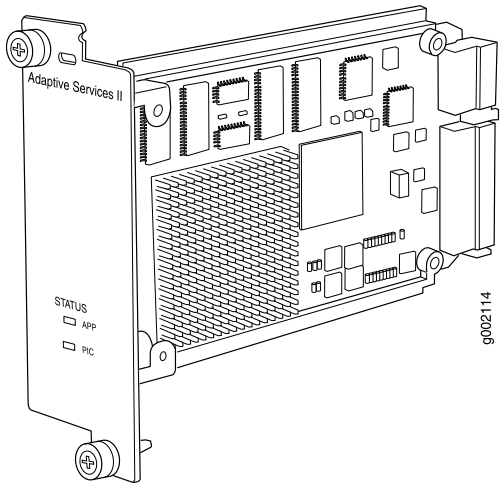
Cables and connectors	• You can install any transceiver supported by the PIC.
	• Fiber-optic 10–Gigabit small form-factor pluggable (XFP) transceivers:
	  ◦ Duplex LC/PC connector (Rx and Tx)
	  ◦ 10-Gigabit Ethernet XFP transceivers:
	  ▪ 10GBase-S (model number: XFP-10G-S)
	  ▪ 10GBase-L (model number: XFP-10G-L-OC192-SR1)
	  ▪ 10GBase-E (model number: XFP-10G-E-OC192-IR2)
	  ▪ 10GBase-Z (model number: XFP-10G-Z-OC192-LR2)
	Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/

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

- *M120 PICs Description*
- M120 PICs Supported on page 3

Adaptive Services II EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later • End-of-life (see notification PSN-2007-12-036) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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	• 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	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 39 on page 184. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
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—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 39: Adaptive Services PICs Software Features Supported by the M120 Router

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	8.0R2	–
Network Address Translation (NAT) for IP addresses	8.0R2	–
Port Address Translation (PAT) for port numbers	8.0R2	–
IP Security (IPSec) encryption	8.0R2	–
Active flow monitoring exports cflowd version 5 and version 8 records	8.0R2	–
Active 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	–	–
Dynamic flow capture	–	–
Real-time performance monitoring	8.3	–
Link services	8.0R2	8.0R2
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.0R2	8.0R2
Virtual tunnel interface for Layer 3 VPNs	8.0R2	–
Layer 2 Tunneling Protocol (L2TP)	8.0R2	8.0R2

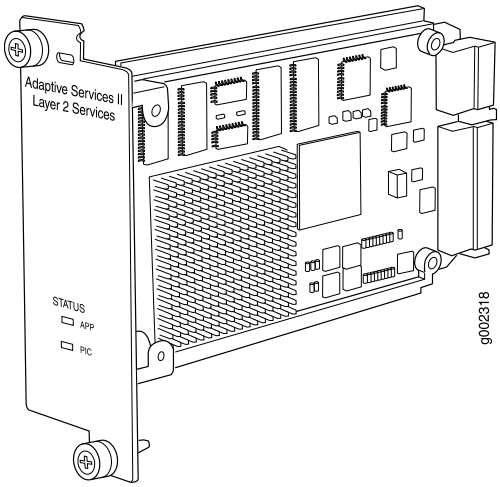
Table 39: Adaptive Services PICs Software Features Supported by the M120 Router (continued)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	8.0R2	8.0R2
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	8.0R2	–

Related Documentation

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

Adaptive Services II Layer 2 Services EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) • End-of-life (see notification PSN-2008-11-080) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• 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	• 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 40 on page 186. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
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—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 40: 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	8.0R2	–
Network Address Translation (NAT) for IP addresses	8.0R2	–
Port Address Translation (PAT) for port numbers	8.0R2	–
IP Security (IPSec) encryption	8.0R2	–
Active flow monitoring exports cflowd version 5 and version 8 records	8.0R2	–
Active 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	–	–
Dynamic flow capture	–	–

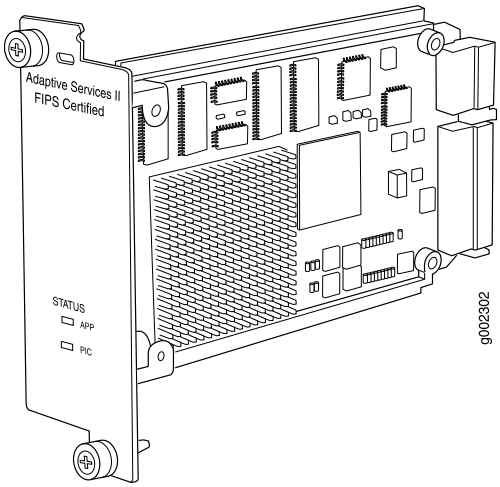
Table 40: Adaptive Services PICs Software Features (continued)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Real-time performance monitoring	8.3	–
Link services	8.0R2	8.0R2
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.0R2	8.0R2
Virtual tunnel interface for Layer 3 VPNs	8.0R2	–
Layer 2 Tunneling Protocol (L2TP)	8.0R2	8.0R2
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	8.0R2	8.0R2
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	8.0R2	–

Related Documentation

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

Adaptive Services II FIPS EOL PIC (M120 Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11. • End-of-life (see notification PSN-2011-09-381) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Junos-FIPS requires an Adaptive Services II FIPS PIC for external IPSec connections. See the *Secure Configuration Guide for Common Criteria and Junos-FIPS* for more information. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	• 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

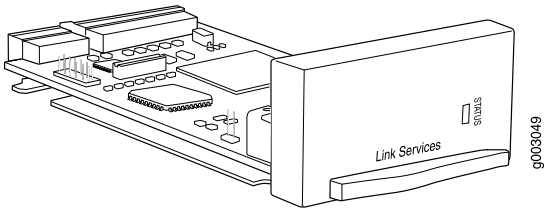
Software features	Tunnel services is included with the PIC and does not require an individual license.
	
	Individual licenses must be purchased for additional services such as Network Address Translation (NAT), stateful firewall, intrusion detection services (IDS), IPSec. J-Flow accounting, and voice services.
	
	For 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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

Link Services EOL PIC (M120 Router)



Software release	• Junos OS Release 6.0 and later • End-of-life (see notification PSN-2008-11-080)

Description	• Power requirement: 0.17 A @ 48 V (8 W)
	• Three versions:
	  ◦ 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	• 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	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
	• Protocol support:
	  ◦ 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	One bicolor: • 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	• *M120 PICs Description* • M120 End-of-Life PICs Supported on page 8

SONET/SDH OC3c/STM1 EOL PICs (M120 Router)

Figure 45: 4-Port SONET/SDH OC3c/STM1 PIC (MMF)

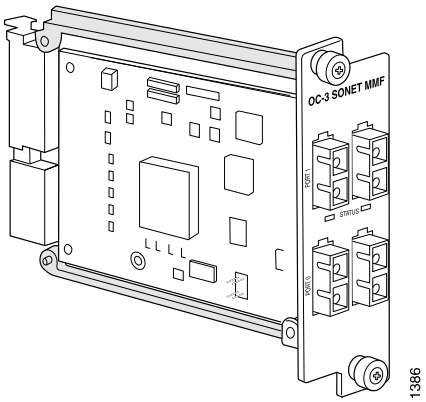
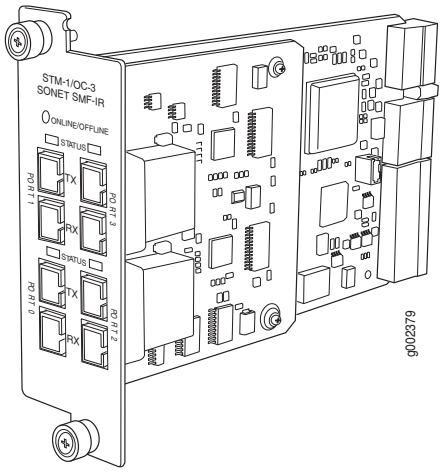


Figure 46: 4-Port SONET/SDH OC3c/STM1 PIC (SMF-IR)



Software release	• Junos OS Release 8.0R2 and later (Type 1) multimode and single-mode intermediate reach • End-of-life (see notification PSN-2007-12-037) NOTE: These PICs are not supported in Junos OS Release 8.1R1.
Description	• Four OC3 ports • Power requirement: 0.49 A @ 48 V (23.7 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ 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) (model number: SFP-OC3-IR)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 24
	
	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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8
- SONET/SDH OC3/STM1 Optical Interface Specifications on page 24

SONET/SDH OC12c/STM4 EOL PICs (M120 Router)

Figure 47: 1-Port SONET/SDH OC12c/STM4 PIC

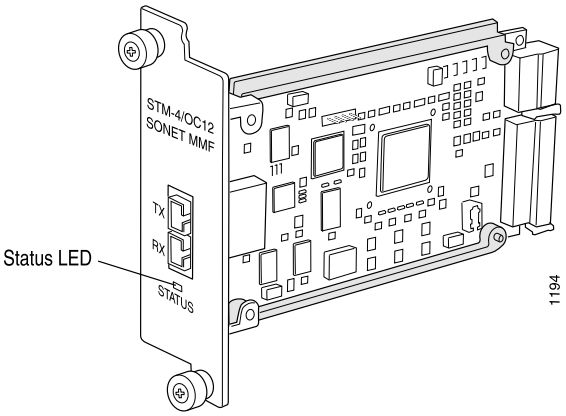
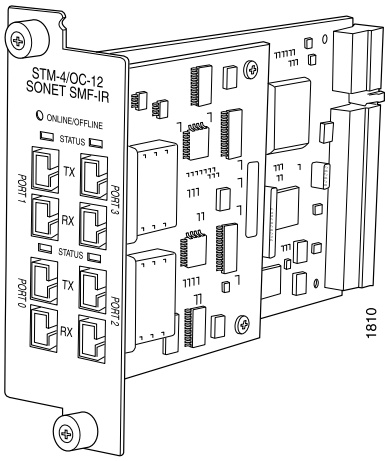


Figure 48: 4-Port SONET/SDH OC12c/STM4 PIC



Software release	• Junos OS Release 8.0R2 and later • End-of-life (see notification PSN-2013-03-891) NOTE: These PICs are not supported in Junos OS Release 8.1R1.
Description	• One or four ports • Power requirement: 0.23 A @ 48 V (10.8 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ 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.

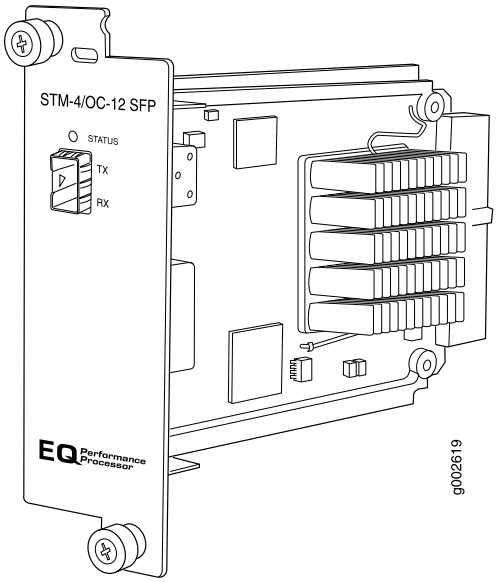
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8
- SONET/SDH OC12/STM4 Optical Interface Specifications on page 26

SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)



Software release	• Junos OS Release 9.3 and later (Type 1) End-of-life (see notification PSN-2013-03-892) For information on which FPCs support this PIC, see "M120 PIC/FPC Compatibility" on page 11.
Description	• 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	• 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.
	• Packet buffering, Layer 2 parsing
	• Local line and remote payload loopback testing
	• 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/PC connector (Rx and Tx)
	• SONET/SDH OC12/STM4 fiber-optic SFP transceivers:
	  • 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)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 26

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

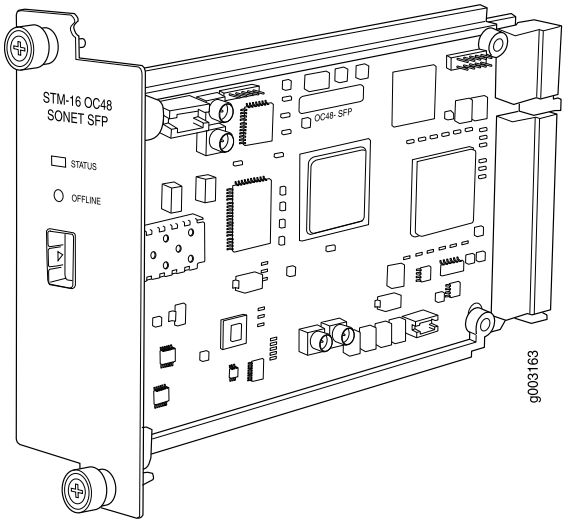
Alarms, errors, and events	• SONET alarms:
	  • Alarm indication signal—line (AIS-L)
	  • Alarm indication signal—path (AIS-P)
	  • Bit error rate signal degrade (BERR-SD)
	  • Bit error rate signal fail (BERR-SF)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of pointer (LOP)
	  • Loss 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

- *M120 PICs Description*
- M120 PICs Supported on page 3

SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router)



Software release	• Junos OS Release 8.0R2 and later • End-of-life (see notification PSN-2007-12-037) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• One OC48 port • Power requirement: 0.33 A @ 48 V (16 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ 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 small form-factor pluggable (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.

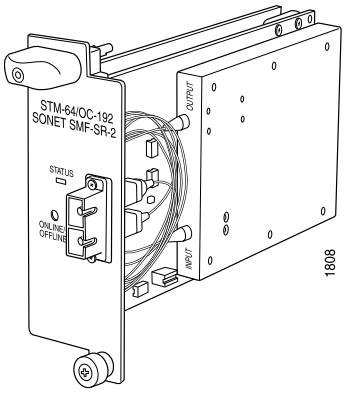
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8
- SONET/SDH OC48/STM16 Optical Interface Specifications on page 28

SONET/SDH OC192c/STM64 EOL PIC (M120 Router)



Software release	• Junos OS Release 5.4 and later (Type 3) • PC-1OC192-SON-LR: End-of-life (see notification PSN-2007-01-039) • PC-1OC192-SON-SR2: End-of-life (see notificationPSN-2007-01-039)
Description	• One OC192 port • Power requirement: 0.45 A @ 48 V (21.6 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

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

Cables and connectors	• SONET/SDH OC192c/STM64 fixed transceivers:
	  ◦ Short reach (SR-2): duplex SC/PC connector (Rx and Tx)
	  ◦ Long reach (LR-1): duplex SC/PC connector (Rx and Tx)
	Optical interface support—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
	  • 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

- *M120 PICs Description*
- M120 End-of-Life PICs Supported on page 8

- SONET/SDH OC192/STM64 Optical Interface Specifications on page 30