

# M40e Multiservice Edge Router

## End-of-Life PIC Guide

August 2010

This guide provides an overview and description of the PICs supported by the Juniper Networks M40e Multiservice Edge Router that are end-of-life and can no longer be ordered.

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## M40e PICs Description

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PICs physically connect the M40e Multiservice Edge Router to network media. They are housed in Flexible PIC Concentrators (FPCs); for more information about FPCs, see M40e Flexible PIC Concentrators (FPCs) Description.

PICs receive incoming packets from the network and transmit outgoing packets to the network, performing framing and line-speed signaling for their media type as required. PICs also encapsulate outgoing packets received from the FPCs before transmitting them. The controller ASIC on each PIC performs additional control functions specific to the PIC media type.

The router supports various PICs, including ATM, Channelized, Gigabit Ethernet, IP Services, and SONET/SDH interfaces. For a complete list of supported PICs, see M40e PICs Supported. For a complete list of end-of-life PICs, see “End-of-Life PICs Supported (M40e Router)” on page 5.

Some PICs accept small form-factor pluggables (SFPs), which are fiber-optic transceivers that can be removed from the PIC. Various SFPs have different reach characteristics. You can mix them in a single PIC and change the combination dynamically. SFPs are hot-removable and hot-insertable, as described in M40e Field-Replaceable Units (FRUs). For SFP replacement instructions, see Replacing an SFP in an M40e PIC. For information about PICs that use SFPs, see the *M40e Multiservice Edge Router PIC Guide*.

### M40e PIC Slots

The number of ports on a PIC depends on the type of PIC. You can install up to four PICs in each Type 1 FPC and one PIC in each Type 2 FPC. Blank PICs resemble other PICs but do not provide any physical connection or activity. When a slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system.

PICs installed on Type 1 FPCs and Type 2 FPCs are hot-removable and hot-insertable, as described in M40e Field-Replaceable Units (FRUs). For PIC replacement instructions, see Replacing a PIC in an M40e Router.

### M40e PIC Components

Most PICs supported on the M40e Multiservice Edge Router have the following components. For complete specifications, see the *M40e Multiservice Edge Router PIC Guide*.

- One or more cable connector ports—Accept a network media connector.
- LEDs—Indicate PIC and port status. Most PICs have an LED labeled **STATUS** on the PIC faceplate. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the *M40e Multiservice Edge Router PIC Guide*.
- Offline button—Prepares the PIC for removal from the FPC when pressed. For the PICs that install on an Type 1 FPCs, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an Type 2 FPCs, the offline button is on the PIC faceplate.

- Related Topics**
- [M40e Fast Ethernet PIC 48-port Cable Pinouts](#)
  - [M40e X.21 and V.35 Cable Pinouts for EIA-530 PIC](#)
  - [RJ-48 Cable Pinouts for E1 and T1 PICs on the M40e Router](#)
  - [Connecting the M40e PIC Cables](#)
  - [Troubleshooting PICs on the M40e Router](#)
  - [Replacing a PIC in an M40e Router](#)

## End-of-Life PICs Supported (M40e Router)

Table 1 on page 5 lists the end-of-life PICs. The PICs are listed alphabetically by PIC family.

**Table 1: End-of-Life PICs Supported in the M40e Router**

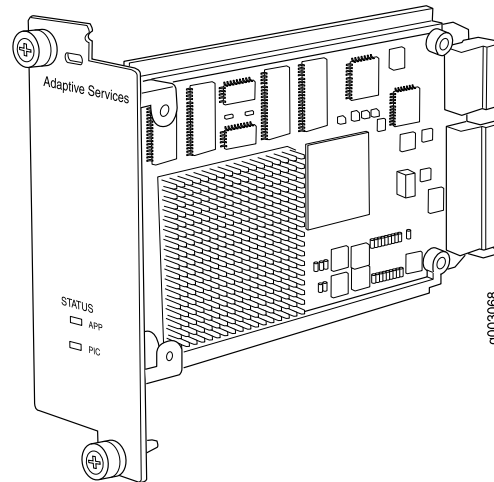
PIC Family and Type	Model Number	Ports	First Junos OS Release Support
<b>ATM</b>			
“ATM DS3 PIC (M40e Router)” on page 15	PB-4DS3-ATM	4	5.4
“ATM E3 PIC (M40e Router)” on page 17	PB-4E3-ATM	4	5.4
“ATM OC3 PIC (M40e Router)” on page 19	PB-2OC3-ATM-MM PB-2OC3-ATM-SMIR	2	5.2
“ATM OC12 PIC (M40e Router)” on page 21	PB-1OC12-ATM-MM PB-1OC12-ATM-SMIR	1	5.2
<b>Channelized</b>			
“Channelized DS3 PIC (M40e Router)” on page 23	PB-4CHDS3	4	5.2
“Channelized E1 PIC (M40e Router)” on page 25	PB-10CHE1-RJ48	10	5.2
“Channelized OC12 IQ PIC (M40e Router)” on page 29	PB-1CHOC12SMIR-QPP	1	5.6
“Channelized STM1 to E1 PIC (M40e Router)” on page 32	PB-1CHSTM1-SMIR	1	5.2
“Multichannel DS3 PIC (M40e Router)” on page 44	PB-2MCDS3	2	5.2
<b>Channelized IQ</b>			
“Channelized E1 IQ PIC (M40e Router)” on page 27	PB-10CHE1-RJ48-QPP	10	6.2
<b>DS3/E3</b>			
“DS3 PIC (M40e Router)” on page 34	PB-2DS3	4	5.2
“E3 PIC (M40e Router)” on page 36	PB-4E3	4	5.2
<b>Ethernet</b>			
<b>“Gigabit Ethernet PICs (M40e Router)” on page 38</b>			
• Gigabit Ethernet PIC	PB-1GE-LH PB-1GE-LX PB-1GE-SX	1	5.2
• Gigabit Ethernet PIC	PB-2GE-LX PB-2GE-SX	2	5.3

Table 1: End-of-Life PICs Supported in the M40e Router (*continued*)

PIC Family and Type	Model Number	Ports	First Junos OS Release Support
• Gigabit Ethernet PIC	PB-4GE-SX	4	5.2
<b>Services</b>			
“Adaptive Services PIC (M40e Router)” on page 7	PB-AS	0	6.0
“Adaptive Services II PIC (M40e Router)” on page 9	PB-AS2	0	7.5
“Adaptive Services II Layer 2 Services PIC (M40e Router)” on page 12	PB-AS2-LAYER2SERVICES	0	7.5
“Link Services PIC (M40e Router)” on page 40	PE-LS-4 PE-LS-32 PE-LS-128	0	5.6
“Monitoring Services PIC (M40e Router)” on page 42	PB-PM	0	5.6
“Multilink Services PIC (M40e Router)” on page 46	PB-ML-32 PB-ML-128	0	4.3
<b>SONET/SDH</b>			
“SONET/SDH OC3c/STM1 PICs (M40e Router)” on page 48	PB-4OC3-SON-MM PB-4OC3-SON-SMIR	4	5.2
“SONET/SDH OC12c/STM4 PICs (M40e Router)” on page 51			
• SONET/SDH OC12c/STM4 PIC	PB-1OC12-SON-MM PB-1OC12-SON-SMIR	1	5.2
• SONET/SDH OC12c/STM4 PIC	PB-4OC12-SON-MM PB-4OC12-SON-SMIR	4	5.2
“SONET/SDH OC48c/STM16 PIC (M40e Router)” on page 54	PB-OC48-SON-SMLR PB-OC48-SON-SMSR	1	5.2
“SONET/SDH OC48c/STM16 PIC with SFP (M40e Router)” on page 57	PB-1OC48-SON-SFP	1	6.1

**Related Topics** • M40e PICs Description on page 3

## Adaptive Services PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 6.0 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Supports tunnel services. This feature is included with the PIC and does not require an individual license.</li> <li>Individual licenses must be purchased for additional services such as Network Address Translation (NAT), stateful firewall, intrusion detection services (IDS), IPSec, J-Flow accounting, and voice services. For information about which services are supported by PIC and platform type, see the <i>Junos Services Interfaces Configuration Guide</i>.</li> <li>Power requirement: 0.4 A @ 48 V (19 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Throughput speeds up to 800 Mbps of unidirectional traffic or 400 Mbps of bidirectional traffic, determined by packet size</li> <li>Active monitoring on any interface up to 250,000 packets per second</li> <li>Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces</li> </ul>

**Software features**

For a list of the software features available for services PICs, see the *Junos Services Interfaces Configuration Guide*.

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 loopback tunnel interface for VRF table lookup
- IPSec encryption
- Voice services:
  - Compressed Real-Time Transport Protocol (CRTP)
  - Compressed User Datagram Protocol (CUDP)
- Encapsulations:
  - High-Level Data Link Control (HDLC)
  - Point-to-Point Protocol (PPP)

**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.

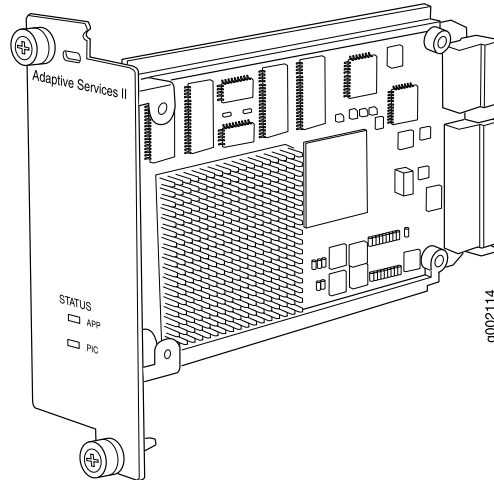
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**Related Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5



## Adaptive Services II PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 6.4 and later (Type 1)</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Supports tunnel services. This feature is included with the PIC and does not require an individual license.</li> <li>Individual licenses must be purchased for additional services.</li> <li>Power requirement: 0.4 A @ 48 V (19 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Support for up to 2000 service sets</li> <li>Active monitoring on up to 1 million flows</li> <li>Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces</li> </ul>
<b>Software features</b>	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 2 on page 10. For more information about the software features available for services PICs, see the <i>Junos Services Interfaces Configuration Guide</i> .
<b>LEDs</b>	<p>Status LED, one tricolor:</p> <ul style="list-style-type: none"> <li>Off—PIC is offline and it is safe to remove it from the chassis.</li> <li>Green—PIC is operating normally.</li> <li>Yellow—PIC is initializing.</li> <li>Red—PIC has an error or failure and no further harm can be done by removing it from the chassis.</li> </ul> <p>Application LED, one bicolor:</p> <ul style="list-style-type: none"> <li>Off—Service is not running.</li> <li>Green—Service is running under acceptable load.</li> <li>Yellow—Service is overloaded.</li> </ul>

Table 2: Adaptive Services PICs Software Features

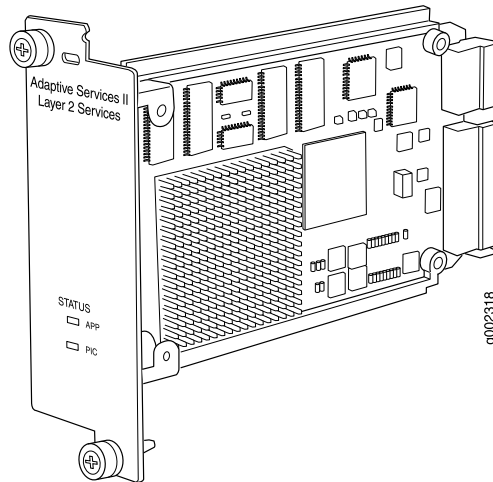
Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE Key	7.1	—
GRE dont-fragment	7.0	—
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	6.4	—
Network Address Translation (NAT) for IP addresses	6.4	—
Port Address Translation (PAT) for port numbers	6.4	—
IP Security (IPSec) encryption	6.4	—
Active flow monitoring exports cflowd version 5 and version 8 records	7.0	—
Active flow monitoring exports version 9 records, based on RFC 3954 (IP v4 templates only)	8.3	—
Passive flow monitoring	—	—
Passive flow collection	—	—
Flow-tap	8.1	—
Dynamic flow capture	—	—
Real-time performance monitoring	8.1	—
Link services	7.1	7.5
Tunnel services:	6.4	7.5
<ul style="list-style-type: none"> <li>• IP-IP unicast tunneling</li> <li>• GRE unicast tunneling—Supports GRE fragmentation</li> <li>• Protocol Independent Multicast (PIM) sparse mode unicast tunneling</li> </ul>		
Virtual tunnel interface for Layer 3 VPNs	6.4	—
Layer 2 Tunneling Protocol (L2TP)	—	—

Table 2: Adaptive Services PICs Software Features *(continued)*

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Voice services: <ul style="list-style-type: none"><li>Compressed Real-Time Transport Protocol (CRTP)</li></ul>	7.2	7.5
Encapsulations: <ul style="list-style-type: none"><li>Multilink Frame Relay (MLFR)</li><li>Multilink Point-to-Point Protocol (MLPP)</li></ul>	7.1	—

- Related Topics**
- [M40e PICs Description on page 3](#)
  - [End-of-Life PICs Supported \(M40e Router\) on page 5](#)

## Adaptive Services II Layer 2 Services PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 7.5 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Supports Layer 2 Service package only. Tunnel services are included with the PIC. Other services require an individual license.</li> <li>Power requirement: 0.4 A @ 48 V (19 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Support for up to 2000 service sets</li> <li>Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces</li> </ul>
<b>Software features</b>	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 3 on page 12. For more information about the software features available for services PICs, see the <i>Junos Services Interfaces Configuration Guide</i> .
<b>LEDs</b>	<p>Status LED, one tricolor:</p> <ul style="list-style-type: none"> <li>Off—PIC is offline and it is safe to remove it from the chassis.</li> <li>Green—PIC is operating normally.</li> <li>Yellow—PIC is initializing.</li> <li>Red—PIC has an error or failure and no further harm can be done by removing it from the chassis.</li> </ul> <p>Application LED, one bicolor:</p> <ul style="list-style-type: none"> <li>Off—Service is not running.</li> <li>Green—Service is running under acceptable load.</li> <li>Yellow—Service is overloaded.</li> </ul>

**Table 3: Adaptive Services PICs Software Features**

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE Key	7.1	—

Table 3: Adaptive Services PICs Software Features (*continued*)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE dont-fragment	7.0	—
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	6.4	—
Network Address Translation (NAT) for IP addresses	6.4	—
Port Address Translation (PAT) for port numbers	6.4	—
IP Security (IPSec) encryption	6.4	—
Active flow monitoring exports cflowd version 5 and version 8 records	7.0	—
Active flow monitoring exports version 9 records, based on RFC 3954 (IP v4 templates only)	8.3	—
Passive flow monitoring	—	—
Passive flow collection	—	—
Flow-tap	8.1	—
Dynamic flow capture	—	—
Real-time performance monitoring	8.1	—
Link services	7.1	7.5
Tunnel services: <ul style="list-style-type: none"> <li>• IP-IP unicast tunneling</li> <li>• GRE unicast tunneling—Supports GRE fragmentation</li> <li>• Protocol Independent Multicast (PIM) sparse mode unicast tunneling</li> </ul>	6.4	7.5
Virtual tunnel interface for Layer 3 VPNs	6.4	—
Layer 2 Tunneling Protocol (L2TP)	—	—
Voice services: <ul style="list-style-type: none"> <li>• Compressed Real-Time Transport Protocol (CRTP)</li> </ul>	7.2	7.5

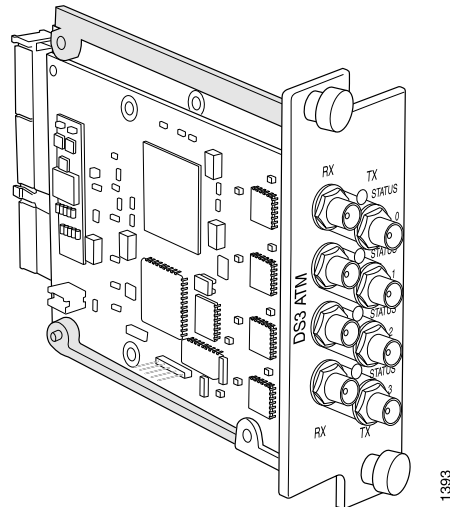
**Table 3: Adaptive Services PICs Software Features** *(continued)*

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Encapsulations:	7.1	—
<ul style="list-style-type: none"><li>• Multilink Frame Relay (MLFR)</li><li>• Multilink Point-to-Point Protocol (MLPP)</li></ul>		

**Related Topics**

- [M40e PICs Description on page 3](#)
- [End-of-Life PICs Supported \(M40e Router\) on page 5](#)

## ATM DS3 PIC (M40e Router)

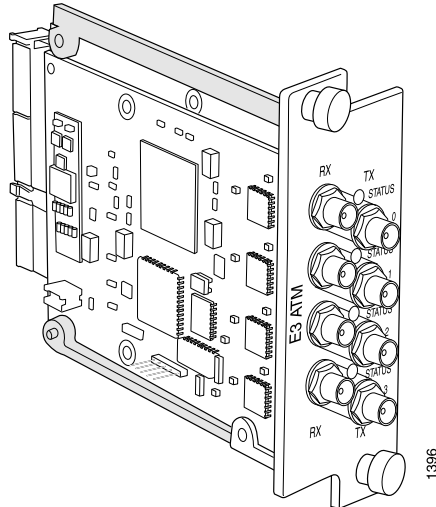


<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.4 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four DS3 ports</li> <li>Power requirement: 0.39 A @ 48 V (19 W)</li> <li>Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1</li> <li>Asynchronous Transfer Mode (ATM) standards compliant</li> <li>Alarm and event counting and detection</li> <li>Compatible with well-known ATM switches</li> <li>ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells</li> <li>ASIC-based packet segmentation and reassembly (SAR) management and output port queuing</li> <li>16-MB SDRAM memory for ATM SAR</li> <li>Packet buffering, Layer 2 parsing</li> <li>Configurable framing options:             <ul style="list-style-type: none"> <li>C-bit with ATM direct mapping</li> <li>C-bit with PLCP framing (default)</li> <li>M23 ATM direct mapping</li> <li>M23 with PLCP framing</li> </ul> </li> </ul>

<b>Software features</b>	<ul style="list-style-type: none"><li>• Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks</li><li>• Support for user-configurable virtual circuits (VC) and virtual paths (VP)</li><li>• 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)</li><li>• Unspecified bit rate (UBR) traffic shaping</li><li>• Fine-grained variable bit rate (VBR) traffic shaping</li><li>• Outbound PIC queues cells on a per-VC basis</li><li>• Encapsulations—AAL5 subnetwork attachment point (SNAP)</li></ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"><li>• 10-ft (3.05-m) posilock SMB to BNC</li><li>• Four pairs of RX and TX coaxial cables</li></ul>
<b>LEDs</b>	One tricolor per port: <ul style="list-style-type: none"><li>• Off—Not enabled</li><li>• Green—Online with no alarms or failures</li><li>• Yellow—Online with alarms for remote failures</li><li>• Red—Active with a local alarm; router has detected a failure</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>• Alarm indication signal (AIS)</li><li>• Far-end block error (FEBE)</li><li>• Frame error</li><li>• Idle code</li><li>• Idle received</li><li>• Local and remote loopback</li><li>• Loss of signal (LOS)</li><li>• Out of frame (OOF)</li><li>• Path parity error</li><li>• Yellow alarm</li></ul>
<b>Related Topics</b>	<ul style="list-style-type: none"><li>• M40e PICs Description on page 3</li><li>• End-of-Life PICs Supported (M40e Router) on page 5</li></ul>



## ATM E3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.4 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four E3 ports</li> <li>Power requirement: 0.43 A @ 48 V (20.8 W)</li> <li>Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1</li> <li>Asynchronous Transfer Mode (ATM) standards compliant</li> <li>Alarm and event counting and detection</li> <li>Compatible with well-known ATM switches</li> <li>ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells</li> <li>ASIC-based packet segmentation and reassembly (SAR) management and output port queuing</li> <li>16-MB SDRAM memory for ATM SAR</li> <li>Packet buffering, Layer 2 parsing</li> <li>Configurable framing options: <ul style="list-style-type: none"> <li>G.751 direct mapping</li> <li>G.751 with PLCP encapsulation (default)</li> <li>G.832 ATM direct mapping</li> </ul> </li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks</li> <li>Support for user-configurable virtual circuits (VC) and virtual paths (VP)</li> <li>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)</li> <li>Unspecified bit rate (UBR) traffic shaping</li> <li>Fine-grained variable bit rate (VBR) traffic shaping</li> <li>Outbound PIC queues cells on a per-VC basis</li> <li>Encapsulations—AAL5 subnetwork attachment point (SNAP)</li> </ul>

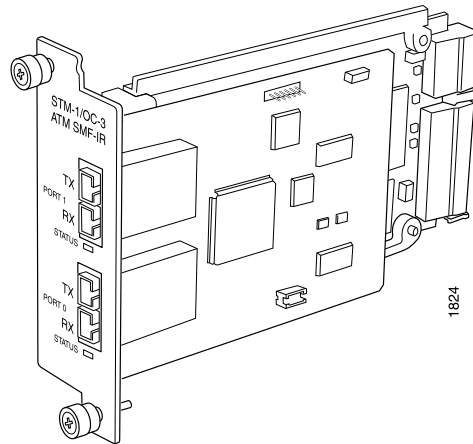
- Cables and connectors**
- 10-ft (3.05-m) posilock SMB to BNC
  - Four pairs of RX and TX coaxial cables

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

- |                                   |   |
|-----------------------------------|---|
| <b>Alarms, errors, and events</b> | <ul style="list-style-type: none"><li>• Alarm indication signal (AIS)</li><li>• Frame Error</li><li>• Line code violation</li><li>• Local and remote loopback</li><li>• Loss of signal (LOS)</li><li>• Out of fFrame (OOF)</li><li>• Yellow alarm</li></ul> |
|-----------------------------------|---|

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- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5

## ATM OC3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Two OC3 ports</li> <li>Power requirement: 0.49 A @ 48 V (23.7 W)</li> <li>Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1</li> <li>ATM and SONET/SDH standards compliant</li> <li>Alarm and event counting and detection</li> <li>Compatible with well-known ATM switches</li> <li>ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Dual 3010 SAR for segmentation and reassembly into 53-byte ATM cells</li> <li>High-performance parsing of SONET/SDH frames</li> <li>OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells</li> <li>ASIC-based packet segmentation and reassembly (SAR) management and output port queuing</li> <li>16-MB SDRAM memory for ATM SAR</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks</li> <li>Support for user-configurable virtual circuits (VC) and virtual paths (VP)</li> <li>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)</li> <li>Unspecified bit rate (UBR) traffic shaping</li> <li>Fine-grained variable bit rate (VBR) traffic shaping</li> <li>Outbound PIC queues cells on a per-VC basis</li> <li>Encapsulations—AAL5 subnetwork attachment point (SNAP)</li> </ul>

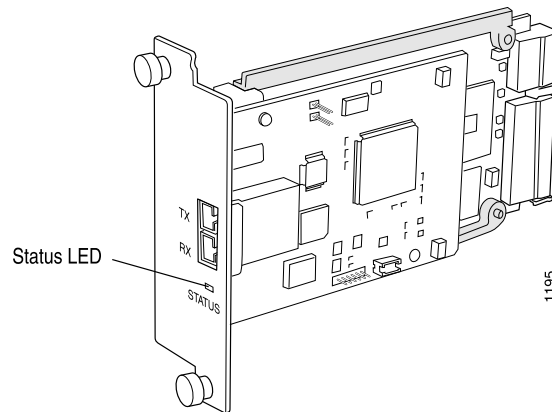
- Cables and connectors**
- Duplex SC/PC connector (RX and TX)
  - SONET/SDH OC3/STM1 fixed transceivers:
    - Intermediate Reach
    - Multimode
- Optical interface support—See SONET/SDH OC3/STM1 Optical Interface Specifications

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| <b>LEDs</b> | One tricolor per port: <ul style="list-style-type: none"><li>• Off—Not enabled</li><li>• Green—Online with no alarms or failures</li><li>• Yellow—Online with alarms for remote failures</li><li>• Red—Active with a local alarm; router has detected a failure</li></ul> |
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| <b>Alarms, errors, and events</b> | <ul style="list-style-type: none"><li>• Alarm indication signal (AIS-L, AIS-P)</li><li>• Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF)</li><li>• Bit interleaved parity errors B1, B2, B3</li><li>• 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)</li><li>• Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS)</li><li>• Payload mismatch (PLM-P), payload unequipped (UNEQ-P)</li><li>• Remote defect indication (RDI-L, RDI-P)</li><li>• 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)</li></ul> |
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- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5
  - SONET/SDH OC3/STM1 Optical Interface Specifications

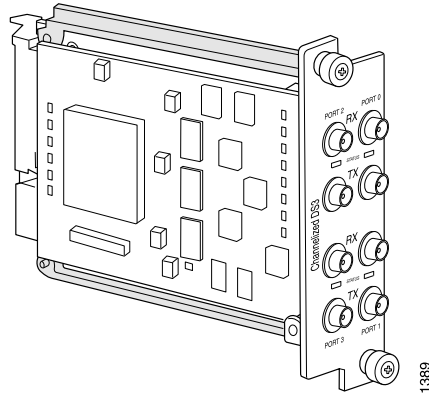
## ATM OC12 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One OC12 port</li> <li>Power requirement: 0.43 A @ 48 V (20.8 W)</li> <li>Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1</li> <li>ATM and SONET/SDH standards compliant</li> <li>Alarm and event counting and detection</li> <li>Compatible with well-known ATM switches</li> <li>ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>High-performance parsing of SONET/SDH frames</li> <li>OAM fault management processes Alarm indication signal (AIS) and remote defect indicator (RDI) cells</li> <li>ASIC-based packet segmentation and reassembly (SAR) management and output port queuing</li> <li>16-MB SDRAM memory for ATM SAR</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks</li> <li>Support for user-configurable virtual circuits (VC) and virtual paths (VP)</li> <li>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)</li> <li>Unspecified bit rate (UBR) traffic shaping</li> <li>Fine-grained variable bit rate (VBR) traffic shaping</li> <li>Outbound PIC queues cells on a per-VC basis</li> <li>Encapsulations—AAL5 subnetwork attachment point (SNAP)</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Duplex SC/PC connector (RX and TX)</li> <li>SONET/SDH OC12/STM4 fixed transceivers:             <ul style="list-style-type: none"> <li>Intermediate Reach</li> <li>Multimode</li> </ul> </li> </ul> <p>Optical interface support—See SONET/SDH OC12/STM4 Optical Interface Specifications</p>

<b>LEDs</b>	<p>One tricolor per port:</p> <ul style="list-style-type: none"><li>• Off—Not enabled</li><li>• Green—Online with no alarms or failures</li><li>• Yellow—Online with alarms for remote failures</li><li>• Red—Active with a local alarm; router has detected a failure</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>• Alarm indication signal (AIS-L, AIS-P)</li><li>• Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF)</li><li>• Bit interleaved parity errors B1, B2, B3</li><li>• 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)</li><li>• Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS)</li><li>• Payload mismatch (PLM-P), payload unequipped (UNEQ-P)</li><li>• Remote defect indication (RDI-L, RDI-P)</li><li>• 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)</li></ul>
<b>Related Topics</b>	<ul style="list-style-type: none"><li>• M40e PICs Description on page 3</li><li>• End-of-Life PICs Supported (M40e Router) on page 5</li><li>• SONET/SDH OC12/STM4 Optical Interface Specifications</li></ul>

## Channelized DS3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four DS3 ports</li> <li>Power requirement: 0.32 A @ 48 V (15.6 W)</li> <li>Supports up to 28 T1 channels per port</li> <li>Data Service Unit (DSU) functionality</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Each T1 channel supports a single High-Level Data Link Control (HDLC) framer that can be configured for speeds ranging from DS0 (64 Kbps) through full T1 (1.54 Mbps)</li> <li>Predictable throughput on all ports at 1.54 Mbps, full duplex</li> <li>Rate limiting on input and output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>DS3 alarm and event counting</li> <li>DS3 alarm and event detection</li> <li>DS3 diagnostics and loopback control</li> <li>B3ZS line encoding</li> <li>M13 or C-bit parity</li> <li>DS3 Simple Network Management Protocol (SNMP) support (DS3 MIB)</li> <li>Per-packet counts and byte counts</li> <li>Local and remote loopback testing</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Custom 10-ft (3.05-m) posilock to BNC male cable, separate RX and TX</li> </ul>

**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 (BER)
- Equipment failure (Does not affect service)
- Excessive zeros (EXZ)
- Far-end block error (FEBE)
- Frame error
- Idle code, Idle received
- Line code violation (LCV)
- Local and remote loopback
- Loss of signal (LOS)
- Out of frame (OOF)
- Parity bit (P-bit) disagreements
- Path parity error
- Yellow alarm bit (X-bit) disagreements

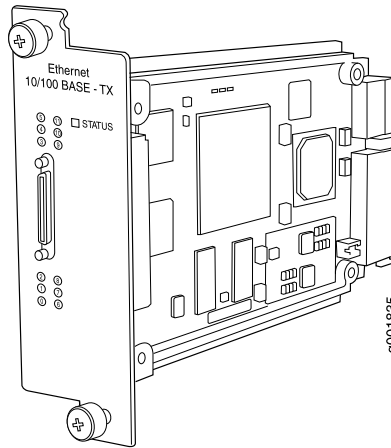
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**Related Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5



## Channelized E1 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.4 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Ten E1 ports</li> <li>Power requirement: 0.15 A/48 V @ 7.2 W</li> <li>Supports up to 24 NxDS0 channels per port</li> <li>Data Service Unit (DSU) functionality</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Ports configurable as clear channel E1 interfaces with 2.048-Mbps connectivity</li> <li>Rate limiting on input and output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Four data-link connection identifiers (DLCIs) per logical customer channel</li> <li>Unframed E1 G.703 and G.704 framing modes</li> <li>HDB3 line coding</li> <li>CRC4 configurable</li> <li>Per-packet counts and byte counts</li> <li>Local and remote loopback testing</li> <li>Encapsulations:             <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>128-ohm RJ-48C</li> </ul>
<b>LEDs</b>	<p>One bicolor per port:</p> <ul style="list-style-type: none"> <li>Off—Port not enabled</li> <li>Green—Physical E1 link is up; individual subchannels can be down</li> <li>Red—Physical E1 link is down</li> </ul>

**Alarms, errors, and events**

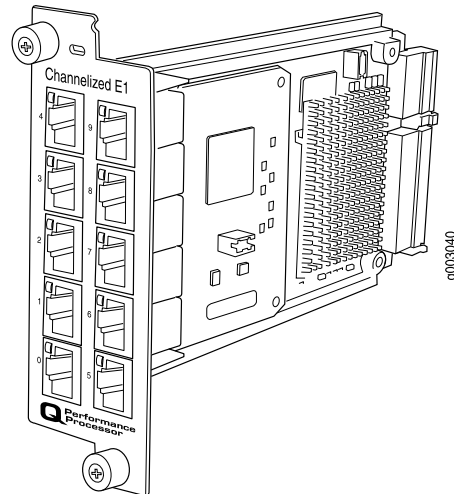
- Alarm indication signal (AIS)
- Loss of frame (LOF)
- Out of frame (OOF)
- Failed signal rate (FSR)

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**Related Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5

## Channelized E1 IQ PIC (M40e Router)

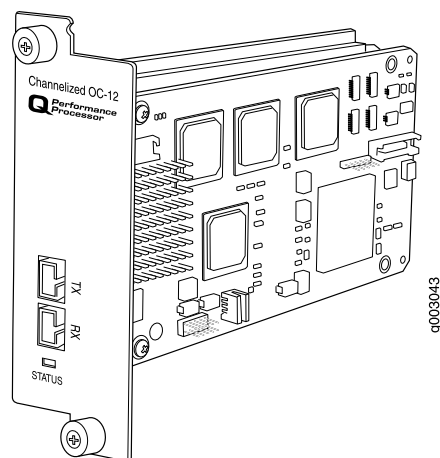


<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.6 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Ten E1 ports</li> <li>Power requirement: 0.15 A @ 48 V (7.2 W)</li> <li>Fine-grained queuing per logical interface</li> <li>Channelization: E1, DS0</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Data service unit (DSU) functionality</li> <li>Ports configurable as clear channel E1 interfaces with 2.048-Mbps connectivity</li> <li>Supports unframed E1 G.703 and G.704 framing modes</li> <li>Supports HDB3 line coding</li> <li>CRC4 configurable</li> <li>Local and remote loopback testing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)</li> <li>Simple Network Management Protocol (SNMP): E1 MIB, DS0 MIB</li> <li>Dynamic, arbitrary channel configuration</li> <li>Full bit error rate test (BERT)</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Frame Relay</li> <li>High-Level Data Link Control (HDLC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>120-ohm RJ-48C</li> </ul>

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

- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5

## Channelized OC12 IQ PIC (M40e Router)



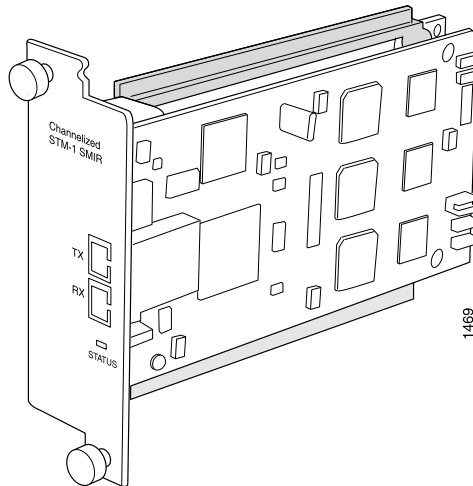
<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.6 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One OC12 port</li> <li>Power requirement: 0.23 A @ 48 V (10.8 W)</li> <li>Fine-grained queuing per logical interface</li> <li>Channelization: OC3, DS3, DS1, DS0</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Subrate and scrambling: <ul style="list-style-type: none"> <li>Digital Link/Quick Eagle</li> <li>Kentrox</li> <li>Larscom</li> <li>ADTRAN</li> <li>Verilink</li> </ul> </li> <li>Packet buffering, Layer 2 parsing</li> <li>M13/C-bit parity encoding</li> <li>DS3 far-end alarm and control (FEAC) channel support</li> <li>Local and remote loopback testing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)</li> <li>Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB</li> <li>Dynamic, arbitrary channel configuration</li> <li>Full bit error rate test (BERT)</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Frame Relay</li> <li>High-Level Data Link Control (HDLC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Duplex SC/PC connector (Rx and Tx); single-mode fiber</li> <li>SONET/SDH OC12/STM4 fixed transceivers: <ul style="list-style-type: none"> <li>Intermediate Reach (IR-1)</li> </ul> </li> </ul> <p>Optical interface support—See SONET/SDH OC12/STM4 Optical Interface Specifications</p>
<b>LEDs</b>	<p>One tricolor per port:</p> <ul style="list-style-type: none"> <li>Off—Not enabled</li> <li>Green—Online with no alarms or failures</li> <li>Yellow—Online with alarms for remote failures</li> <li>Red—Active with a local alarm; router has detected a failure</li> </ul>
<b>Alarms, errors, and events</b>	<p>Alarms:</p> <ul style="list-style-type: none"> <li>Alarm indication signal—line (AIS-L)</li> <li>Alarm indication signal—path (AIS-P)</li> <li>Bit error rate—signal degrade (BERR-SD)</li> <li>Bit error rate—signal fail (BERR-SF)</li> <li>Frame error</li> <li>Idle code, Idle received</li> <li>Loss of frame (LOF)</li> <li>Loss of pointer (LOP-P)</li> <li>Loss of signal (LOS)</li> <li>Out of frame (OOF)</li> <li>Payload mismatch (PLM-P)</li> <li>Payload unequipped (unequipped STS at path level) (UNEQ-P)</li> <li>Parity bit (P-bit) disagreements</li> <li>Path parity error</li> <li>Remote defect indication—line (RDI-L)</li> <li>Remote defect indication—path (RDI-P)</li> <li>Yellow alarm bit (X-bit) disagreements</li> </ul> <p>Error detection:</p> <ul style="list-style-type: none"> <li>Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)</li> <li>Errored seconds (ES-S, ES-L, ES-P)</li> <li>Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)</li> <li>Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (CV-PFE)</li> <li>Far-end errored seconds (ES-LFE, ES-PFE)</li> <li>Far-end severely errored seconds (SES-LFE, SES-PFE)</li> <li>Far-end unavailable seconds (UAS-LFE, UAS-PFE)</li> <li>Severely errored framing (SEF)</li> <li>Severely errored framing seconds (SEFS-S)</li> <li>Severely errored seconds (SES-S, SES-L, SES-P)</li> <li>Unavailable seconds (UAS-L, UAS-P)</li> </ul>
<b>Instrumentation (counters)</b>	<ul style="list-style-type: none"> <li>Layer 2 per-queue and per-channel packet and byte counters</li> </ul>

**Related Topics**    • M40e PICs Description on page 3

- End-of-Life PICs Supported (M40e Router) on page 5

## Channelized STM1 to E1 PIC (M40e Router)

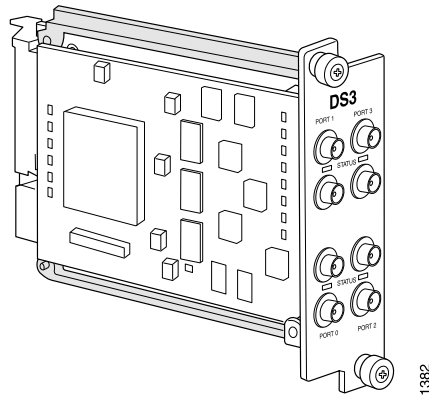


<b>Software release</b>	<ul style="list-style-type: none"><li>• Junos OS Release 5.2 and later</li></ul>
<b>Description</b>	<ul style="list-style-type: none"><li>• One E3 port</li><li>• Power requirement: 0.32 A/48 V @ 15.3 W</li><li>• 63 E1 channels</li></ul>
<b>Hardware features</b>	<ul style="list-style-type: none"><li>• Each E1 channel supports a single High-Level Data Link Control (HDLC) framer that can be configured for speeds from DS0 (64 Kbps) through full E1 (2 Mbps) in 64-Kbps increments</li><li>• Onboard DSU functionality for E1 and fractional E1 connectivity</li><li>• Integrated support for G.703 and unframed mode and G.704 framed mode with CRC; this feature is user-configurable</li><li>• Configurable clock source: Internal or loop</li><li>• Per-port loop timing</li><li>• Rate limiting on input and output</li><li>• Nx E1 service with Multilink Point-to-Point Protocol (MLPPP, RFC 1990) delivered by the Link Services and Multilink Services PICs</li></ul>



<b>Software features</b>	<ul style="list-style-type: none"> <li>• SDH mapping: <ul style="list-style-type: none"> <li>• Tributary Unit Group 3 (TUG-3)</li> </ul> </li> <li>• E1 support: <ul style="list-style-type: none"> <li>• Full instrumentation per E1 channel</li> <li>• Integrated support for G.703 unframed mode and G.704 framed mode</li> <li>• 4-bit CRC for G.704 framed mode</li> <li>• HDB3 coding</li> <li>• Local E1 line loopback and remote line loopback</li> <li>• Per-channel BERT testing</li> </ul> </li> <li>• Encapsulations: <ul style="list-style-type: none"> <li>• Cisco High-Level Data Link Control (HDLC)</li> <li>• Frame Relay</li> <li>• Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC)</li> <li>• MPLS translational cross-connect (TCC)</li> <li>• Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>• Single-mode fiber</li> <li>• Duplex SC/PC connector (RX and TX)</li> </ul>
<b>LEDs</b>	<p>One tricolor per port:</p> <ul style="list-style-type: none"> <li>• Off—Not enabled</li> <li>• Green—Online with no alarms or failures</li> <li>• Yellow—Online with alarms for remote failures</li> <li>• Red—Active with a local alarm; router has detected a failure</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>• Alarm indication signal (AIS)</li> <li>• Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF)</li> <li>• Bit error rate testing (BERT) per E1 channel</li> <li>• Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P)</li> <li>• Loss of frame (LOF), loss of pointer (LOP-P), loss of Signal (LOS)</li> <li>• Payload mismatch (PLM-P), payload unequipped (UNEQ-P)</li> <li>• Remote defect indication (RDI-L, RDI-P)</li> <li>• Errored seconds (ES-S, ES-L, ES-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)</li> <li>• Yellow alarm bit (X-bit) disagreements</li> </ul>
<b>Related Topics</b>	<ul style="list-style-type: none"> <li>• M40e PICs Description on page 3</li> <li>• End-of-Life PICs Supported (M40e Router) on page 5</li> </ul>

## DS3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four DS3 ports</li> <li>Power requirement: 0.47 A @ 48 V (22.5 W)</li> <li>Integrated DSU interoperability with leading DSU vendors</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>High-performance throughput on each port at speeds up to 44.736 Mbps, full duplex</li> <li>C-bit framing</li> <li>B3ZS line encoding</li> <li>Subrate and scrambling:               <ul style="list-style-type: none"> <li>Digital Link</li> <li>Kentrox</li> <li>Larscom</li> </ul> </li> <li>Per-port rate policing on input</li> <li>Per-port rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>DS3 functionality:               <ul style="list-style-type: none"> <li>C-bit framing</li> <li>B3ZS line encoding</li> </ul> </li> <li>DS3 diagnostics and loopback control</li> <li>DS3 alarm and event counting and detection</li> <li>Per-packet counts and byte counts</li> <li>Local and remote loopback testing, as well as BERT testing per DS3</li> <li>DS3 far-end alarm and control (FEAC) channel support</li> <li>Encapsulations:               <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Custom 10-ft (3.05-m) posilock SMB to BNC male cable, separate Rx and Tx (provided)</li> </ul>

**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

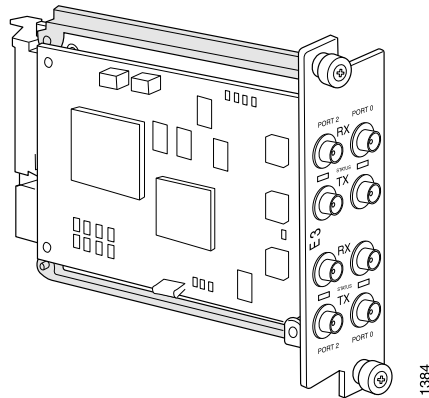
**Alarms, errors, and events**

- 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 Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5

## E3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four E3 ports</li> <li>Power requirement: 0.47 A @ 48 V (22.5 W)</li> <li>Integrated DSU interoperability</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>High-density E3 (34.368-Mbps) connectivity</li> <li>High-performance throughput on each port at speeds up to 34.368 Mbps, full duplex</li> <li>Scrambling support</li> <li>Subrate clocking support</li> <li>Rate policing on input</li> <li>Rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> <li>Large MTUs, up to 9192 bytes</li> <li>Local and remote loopback</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Supports G-751 framing</li> <li>E3 diagnostics and loopback control</li> <li>E3 alarm and event counting and detection</li> <li>DS3 diagnostics and loopback control</li> <li>Bit error rate test (BERT); you can configure one port in BERT mode and configure the remaining channels to transmit and receive normal traffic</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Custom 10 ft (3.05 m) posilock to BNC male cable, separate RX and TX</li> </ul>

<b>LEDs</b>	One tricolor per port: <ul style="list-style-type: none"><li>• Off—Not enabled</li><li>• Green—Online with no alarms or failures</li><li>• Yellow—Online with alarms for remote failures</li><li>• Red—Active with a local alarm; router has detected a failure</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>• Alarm indication signal (AIS)</li><li>• Equipment failure (does not affect service)</li><li>• Frame error</li><li>• Line code violation</li><li>• Loss of signal (LOS)</li><li>• Out of frame (OOF)</li><li>• Yellow alarm bit (A-bit) disagreements</li></ul>
<b>Related Topics</b>	<ul style="list-style-type: none"><li>• M40e PICs Description on page 3</li><li>• End-of-Life PICs Supported (M40e Router) on page 5</li></ul>

## Gigabit Ethernet PICs (M40e Router)

Figure 1: 1-Port Gigabit Ethernet PIC

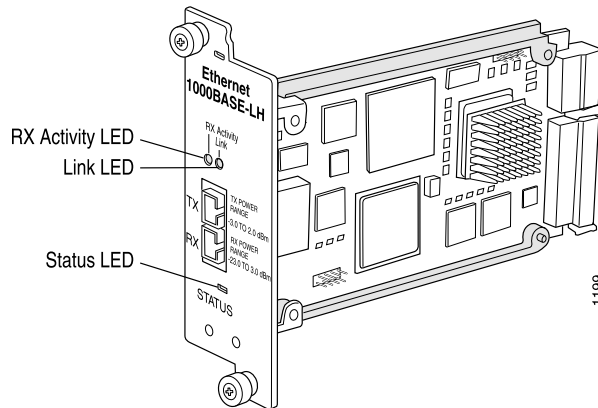


Figure 2: 2-Port Gigabit Ethernet PIC

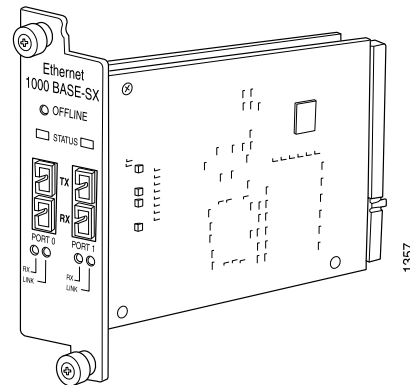
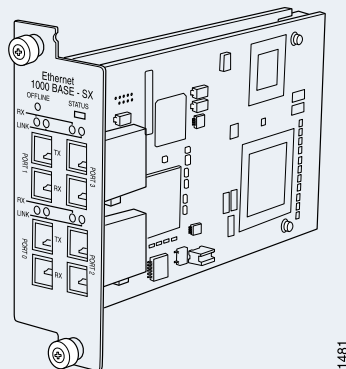


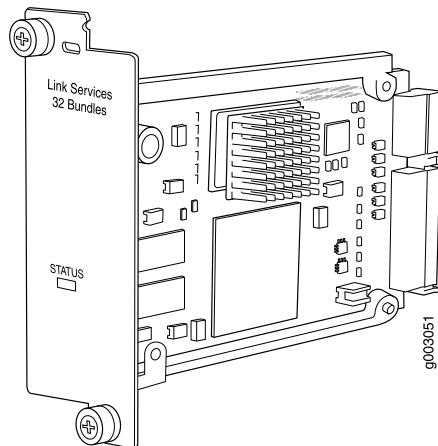
Figure 3: 4-Port Gigabit Ethernet PIC



<b>Software release</b>	<ul style="list-style-type: none"> <li>1-port, 4-port: Junos OS Release 5.2 and later</li> <li>2-port: Junos OS Release 5.3 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One, two, or four Gigabit Ethernet ports</li> <li>Power requirements: <ul style="list-style-type: none"> <li>1-port: 0.27 A @ 48 V (13.2 W)</li> <li>2-port: 0.35 A @ 48 V (17 W)</li> <li>4-port: 0.40 A @ 48 V (19.2 W)</li> </ul> </li> <li>Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>High-performance throughput on all ports at speeds up to 1 Gbps</li> <li>Autonegotiation between Gigabit Ethernet circuit partners</li> <li>Full-duplex mode</li> <li>Maximum transmission units (MTUs) of up to 9192 bytes</li> </ul>

<b>Software features</b>	<ul style="list-style-type: none"> <li>• Virtual Router Redundancy Protocol (VRRP) support</li> <li>• 802.1Q virtual LANs (VLANs) support</li> <li>• 64 source MAC address filters per port</li> <li>• 960 destination MAC filters per port</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>• Duplex SC connector (TX and RX)</li> <li>• LH, LX and SX fixed transceivers: <ul style="list-style-type: none"> <li>• 1000Base-LH (model number: SFP-1GE-LH)</li> <li>• 1000Base-LX (model number: SFP-1GE-LX)</li> <li>• 1000Base-SX (model number: SFP-1GE-SX)</li> </ul> </li> </ul> <p>Optical interface specifications—see Ethernet 10BASE, 100BASE, and 1000BASE Copper and Optical Specifications</p>
<b>LEDs</b>	<p>Status LEDs, one bicolor:</p> <ul style="list-style-type: none"> <li>• Off—PIC not enabled</li> <li>• Green—PIC is operating normally</li> <li>• Red—PIC has an error or failure</li> </ul> <p>Port LEDs, one pair per port:</p> <ul style="list-style-type: none"> <li>• Link—If green, the port is online; if there is no light, the port is down</li> <li>• Activity—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data</li> </ul>
<b>Related Topics</b>	<ul style="list-style-type: none"> <li>• M40e PICs Description on page 3</li> <li>• End-of-Life PICs Supported (M40e Router) on page 5</li> <li>• Ethernet 10BASE, 100BASE, and 1000BASE Copper and Optical Specifications</li> </ul>

## Link Services PIC (M40e Router)

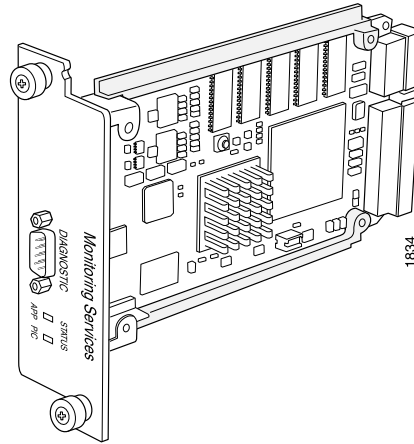


<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.6 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Power requirement: 0.17 A @ 48 V (8 W)</li> <li>Three versions:               <ul style="list-style-type: none"> <li>4 multilink bundles, 256 LFI links</li> <li>32 multilink bundles, 256 LFI links</li> <li>128 multilink bundles, 256 LFI links</li> </ul> </li> <li>Multilink bonding, link fragmentation and interleaving (LFI), and tunneling</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Rate limiting/policing per multilink bundle</li> <li>Byte-wise load balancing across multilink bundles</li> <li>Bonding T1 links enable service ranging from 1.5 Mbps through 12 Mbps</li> <li>Bonding E1 links enable service ranging from 2 Mbps through 16 Mbps</li> <li>Loopback function that encapsulates and de-encapsulates packets</li> </ul>
<b>Software features</b>	<p>For a list of the software features available for services PICs, see the <i>Junos Services Interfaces Configuration Guide</i>.</p> <ul style="list-style-type: none"> <li>Protocol support:               <ul style="list-style-type: none"> <li>Multilink PPP (MLPPP)</li> <li>Multilink Frame Relay (MLFR)—FRF.15 and FRF.16</li> <li>Link fragmentation and interleaving (LFI)—FRF.12</li> <li>LFI over MLPPP</li> </ul> </li> <li>IP-IP unicast tunneling</li> <li>GRE unicast tunneling</li> <li>PIM sparse mode unicast tunneling</li> </ul>
<b>LEDs</b>	<p>One bicolor:</p> <ul style="list-style-type: none"> <li>Off—PIC is offline</li> <li>Green—PIC is online and at least one configured bundle is operating</li> <li>Yellow—PIC is online, but one or more configured bundles are not operating</li> </ul>



- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5

## Monitoring Services PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.4 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Active traffic monitoring</li> <li>Power requirement: 0.19 A @ 48 V (9 W)</li> <li>Monitors IPv4 packets</li> <li>Support for collecting and exporting cflowd records</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Monitors up to 100,000 packets per second</li> <li>Support for MTUs up to 4474 bytes for SONET interfaces</li> </ul>
<b>Software features</b>	<p>For a list of the software features available for services PICs, see the <i>Junos Services Interfaces Configuration Guide</i>.</p> <ul style="list-style-type: none"> <li>Load distribution across multiple PICs</li> <li>cflowd version 5 support</li> <li>Provides start and end times of each export</li> <li>Supports firewall filtering and filter-based forwarding (FBF)</li> <li>Encapsulations:             <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>DB-9 diagnostic serial console port</li> </ul>

**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

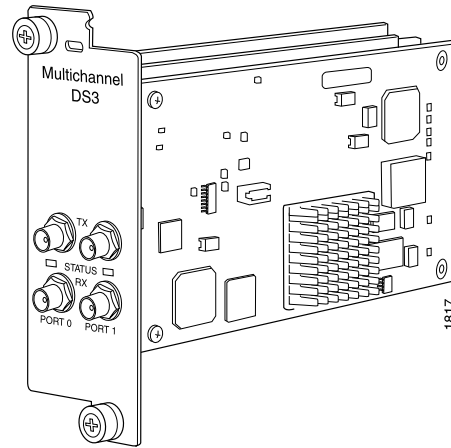
Application LED, one tricolor:

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

**Related Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5

## Multichannel DS3 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Two DS3 ports</li> <li>Power requirement: 0.31 A @ 48 V (14.9 W)</li> <li>Supports up to 128 logical customer channels per DS3 port</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Support for NxT1 by interoperating with the Link Services and Multilink Services PICs, using MLPPP and MLFR protocols</li> <li>Onboard DSU functionality</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Support for four data-link connection identifiers (DLCIs) per logical customer channel</li> <li>DS3 alarm and event counting</li> <li>DS3 alarm and event detection</li> <li>DS3 diagnostics and loopback control</li> <li>DS3 framing: M13, C-bit</li> <li>T1 framing: super frame (SF) and extended super frame (ESF)</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Custom 10 ft/3.05 m posilock to BNC male cable, separate Rx and Tx</li> </ul>
<b>LEDs</b>	<p>One tricolor per port:</p> <ul style="list-style-type: none"> <li>Off—Not enabled</li> <li>Green—Online with no alarms or failures</li> <li>Yellow—Online with alarms for remote failures</li> <li>Red—Active with a local alarm; router has detected a failure</li> </ul>

**Alarms, errors, and events**

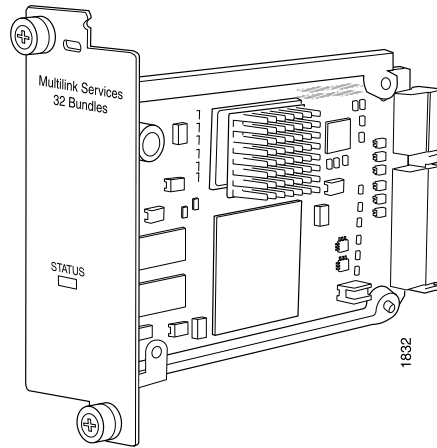
- Far-end block error (FEBE)
- Parity bit (P-bit) disagreements
- Path priority error
- Alarm indication signal (AIS)
- Loss of signal (LOS)
- Out of frame (OOF)
- Yellow alarm
- AIS received
- Simultaneous BERT functionality
- Idle received
- Local and remote loopback

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**Related Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5

## Multilink Services PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.3 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Power requirement: 0.17 A/48 V = 8 W</li> <li>Available versions:               <ul style="list-style-type: none"> <li>4 multilink bundles</li> <li>32 multilink bundles</li> <li>128 multilink bundles</li> </ul> </li> <li>Can be used as a discrete connection or as a channel</li> </ul> <p>NOTE: If you configure a unit number larger than the allowable limit on the 4-bundle or 32-bundle Multilink Services PIC, an error will be logged in <code>/var/log/messages</code> and the configuration will fail.</p>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Supports up to eight links per multilink bundle</li> <li>Bonding T1 links enable service ranging from 1.5 Mbps through 12 Mbps</li> <li>Bonding E1 links enable service ranging from 2 Mbps through 16 Mbps</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>Full configuration flexibility</li> <li>Bundles can be built from any interface within the chassis</li> <li>Enables providers to offer a scalable multimegabit access service based on T1 or E1 links</li> <li>Protocol support:               <ul style="list-style-type: none"> <li>Multilink PPP—MLPPP (RFC 1990) for T1 and E1 bonding</li> <li>Multilink Frame Relay—MLFR (FRF.15) for T1 and E1 bonding</li> </ul> </li> </ul> <p>NOTE: This PIC does not support graceful switchover. Graceful switchover can not be configured on routers that this PIC is installed in.</p>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>LEDs</b>	<p>One bicolor:</p> <ul style="list-style-type: none"> <li>Off—PIC is offline</li> <li>Green—PIC is online and at least one configured bundle is operating</li> <li>Yellow—PIC is online, but no configured bundles are operating</li> </ul>

- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5

## SONET/SDH OC3c/STM1 PICs (M40e Router)

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

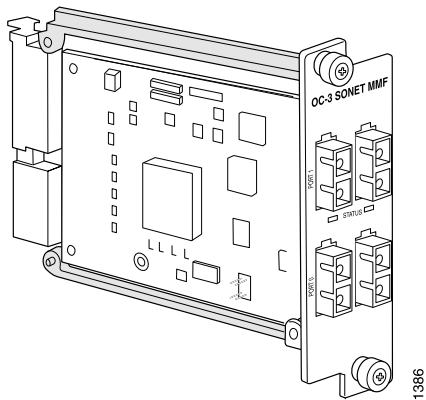
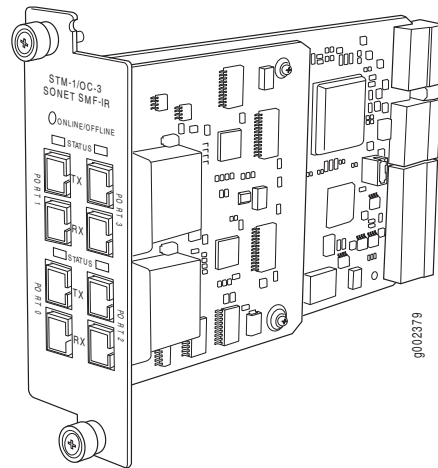


Figure 5: SONET/SDH  
OC3c/STM1 PIC  
(SMF-IR)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later (Type 1) multimode and single-mode intermediate reach</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>Four OC3 ports</li> <li>Power requirement: 0.49 A @ 48 V (23.7 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Multiplexing and demultiplexing</li> <li>Rate policing on input</li> <li>Rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>SONET/SDH framing</li> <li>Link aggregation</li> <li>Alarm and event counting and detection</li> <li>Dual-router automatic protection switching (APS)</li> <li>Multiprotocol Label Switching (MPLS) fast reroute</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>



**Cables and connectors**

- Duplex SC/PC connector (Rx and Tx)
- SONET/SDH OC3c/STM1 fixed transceivers:
  - Multimode
  - Intermediate reach (IR-1)

Optical interface specifications—see SONET/SDH OC3c/STM1 Optical Interface Specifications

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

**LEDs**

One tricolor per port:

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

**Alarms, errors, and events**

- SONET alarms:
  - Alarm indication signal—line (AIS-L)
  - Alarm indication signal—path (AIS-P)
  - Bit error rate signal degrade (BERR-SD)
  - Bit error rate signal fail (BERR-SF)
  - Bit interleaved parity (BIP) error B1
  - 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)

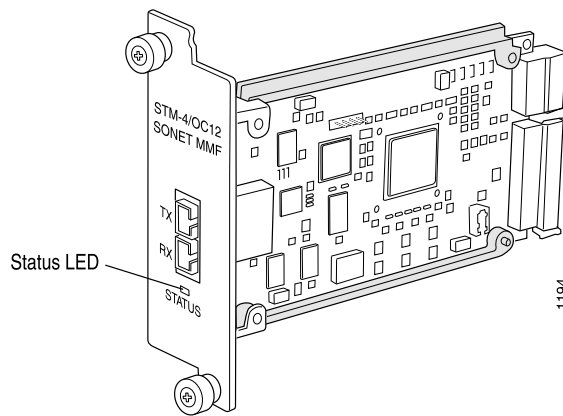
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**Related Topics**

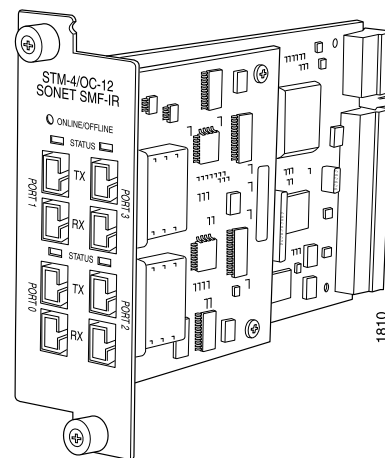
- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5
- SONET/SDH OC3/STM1 Optical Interface Specifications

## SONET/SDH OC12c/STM4 PICs (M40e Router)

**Figure 6: 1-Port  
SONET/SDH  
OC12c/STM4 PIC**



**Figure 7: 4-Port  
SONET/SDH  
OC12c/STM4 PIC**



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One or four ports</li> <li>Power requirement: 0.23 A @ 48 V (10.8 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Multiplexing and demultiplexing</li> <li>Rate policing on input</li> <li>Rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>SONET/SDH framing</li> <li>Link aggregation</li> <li>Alarm and event counting and detection</li> <li>Dual-router automatic protection switching (APS)</li> <li>Multiprotocol Label Switching (MPLS) fast reroute</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>

- 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

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*.

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

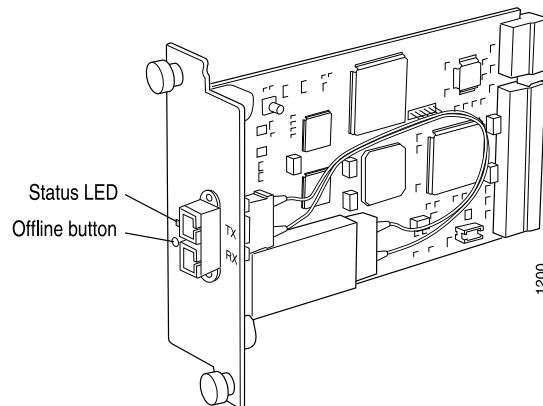
**Alarms, errors, and events**

- 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 Topics**

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5
- SONET/SDH OC12/STM4 Optical Interface Specifications

## SONET/SDH OC48c/STM16 PIC (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 5.2 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One OC48 port</li> <li>Power requirement: 0.38 A @ 48 V (18 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Multiplexing and demultiplexing</li> <li>Rate policing on input</li> <li>Rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>SONET/SDH framing</li> <li>Link aggregation</li> <li>Alarm and event counting and detection</li> <li>Dual-router automatic protection switching (APS)</li> <li>Multiprotocol Label Switching (MPLS) fast reroute</li> <li>Encapsulations:               <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>Duplex SC/PC Connector (Rx and Tx)</li> <li>SONET/SDH OC48/STM16 fixed transceivers:               <ul style="list-style-type: none"> <li>Short reach (SR-1)</li> <li>Long reach (LR-1)</li> </ul> </li> </ul> <p>Optical interface specifications—see SONET/SDH OC48/STM16 Optical Interface Specifications</p>

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

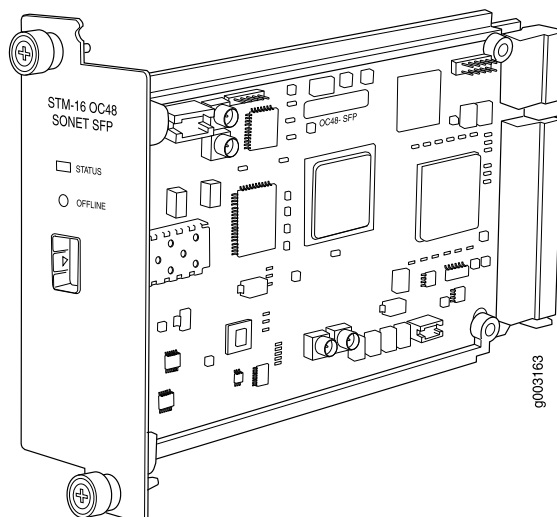
<b>LEDs</b>	<p>One tricolor per port:</p> <ul style="list-style-type: none"> <li>• Off—Not enabled</li> <li>• Green—Online with no alarms or failures</li> <li>• Yellow—Online with alarms for remote failures</li> <li>• Red—Active with a local alarm; router has detected a failure</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>• SONET alarms: <ul style="list-style-type: none"> <li>• Alarm indication signal—line (AIS-L)</li> <li>• Alarm indication signal—path (AIS-P)</li> <li>• Bit error rate signal degrade (BERR-SD)</li> <li>• Bit error rate signal fail (BERR-SF)</li> <li>• Bit interleaved parity (BIP) error B1</li> <li>• Bit interleaved parity (BIP) error B2</li> <li>• Bit interleaved parity (BIP) error B3</li> <li>• Loss of frame (LOF)</li> <li>• Loss of pointer (LOP-P)</li> <li>• Loss of signal (LOS)</li> <li>• Far-end bit error: remote error indication—line (REI-L) (CV-LFE)</li> <li>• Far-end bit error: remote error indication—path (REI-P) (CV-PFE)</li> <li>• Payload mismatch (path label mismatch) (PLM-P)</li> <li>• Payload unequipped (unequipped STS at path level) (UNEQ-P)</li> <li>• Remote defect indication—line (RDI-L)</li> <li>• Remote defect indication—path (RDI-P)</li> </ul> </li> <li>• SDH alarms: <ul style="list-style-type: none"> <li>• Multiplex section alarm indication signal (MS-AIS)</li> <li>• Administrative unit alarm indication signal (AU-AIS)</li> <li>• Bit error rate signal degrade (BERR-SD)</li> <li>• Bit error rate signal fail (BERR-SF)</li> <li>• Bit interleaved parity (BIP) error B1</li> <li>• Bit interleaved parity (BIP) error B2</li> <li>• Bit interleaved parity (BIP) error B3</li> <li>• Loss of frame (LOF)</li> <li>• Loss of pointer (HP-LOP)</li> <li>• Loss of signal (LOS)</li> <li>• Multiplex section remote error indication (MS-REI)</li> <li>• Higher path label mismatch (HP-PLM)</li> <li>• Higher path unequipped (HP-UNEQ)</li> <li>• Multiplex section remote defect indication (MS-RDI)</li> <li>• Higher path remote defect indication (HP-RDI)</li> </ul> </li> <li>• 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)</li> <li>• 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)</li> </ul>

- Related Topics**
- M40e PICs Description on page 3
  - End-of-Life PICs Supported (M40e Router) on page 5

- SONET/SDH OC48/STM16 Optical Interface Specifications



## SONET/SDH OC48c/STM16 PIC with SFP (M40e Router)



<b>Software release</b>	<ul style="list-style-type: none"> <li>Junos OS Release 6.1 and later</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>One OC48 port</li> <li>Power requirement: 0.33 A @ 48 V (16 W)</li> </ul>
<b>Hardware features</b>	<ul style="list-style-type: none"> <li>Multiplexing and demultiplexing</li> <li>Rate policing on input</li> <li>Rate shaping on output</li> <li>Packet buffering, Layer 2 parsing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>SONET/SDH framing</li> <li>Link aggregation</li> <li>Alarm and event counting and detection</li> <li>Dual-router automatic protection switching (APS)</li> <li>Multiprotocol Label Switching (MPLS) fast reroute</li> <li>Encapsulations: <ul style="list-style-type: none"> <li>High-Level Data Link Control (HDLC)</li> <li>Frame Relay</li> <li>Circuit cross-connect (CCC)</li> <li>Translational cross-connect (TCC)</li> <li>Point-to-Point Protocol (PPP)</li> </ul> </li> </ul>

- 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

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*.

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

- M40e PICs Description on page 3
- End-of-Life PICs Supported (M40e Router) on page 5
- SONET/SDH OC48/STM16 Optical Interface Specifications

## Junos OS Documentation and Release Notes

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For a list of related Junos OS documentation, see <http://www.juniper.net/techpubs/software/junos/>.

If the information in the latest release notes differs from the information in the documentation, follow the *Junos OS 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 <http://www.juniper.net/techpubs/>.

## Requesting Technical Support

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Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC 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 <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

## Self-Help Online Tools and Resources

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: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

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

## 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 <http://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 <http://www.juniper.net/support/requesting-support.html> .

## Revision History

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August 2010—Corporate rebranding.

May 2010—Added Channelized OC12 IQ 1-port and DS3 4-port PICs.

January 2010—Added model numbers to the PICs Supported table.

August 2009—Updated product names. Revised sections into modular topics for easier customer access.

10 April 2009—530-009716-01. Revision 10. Added Channelized E1 IQ PIC. Added related topics for easier customer navigation.

28 July 2008—530-009716-01. Revision 9. Added Adaptive Services II PIC. Added SONET/SDH OC3 and OC12 PICs.

1 February 2008—530-009716-01. Revision 8. Added SONET/SDH OC3c/STM1 PIC (SMF-IR), SONET/SDH OC12c/STM4 PIC (SMF-IR), SONET/SDH OC12c/STM4 PIC (MM), and SONET/SDH OC48c/STM16 PIC with SFP.

15 November 2007—530-009716-01. Revision 7. Removed Adaptive Services II PICs.

30 March 2007—530-009716-01. Revision 6. Added Adaptive Services, Monitoring Services, and Multichannel DS3 PICs.

15 January 2005—530-009716-01. Revision 5. Added Gigabit Ethernet PICs. Updated information about installing combinations of PICs on a single Enhanced FPC.

9 November 2004—530-009716-01. Revision 4.

17 May 2004—530-009716-01. Revision 3.

16 March 2004—530-009716-01. Revision 2.

24 July 2003—530-009716-01. Revision 1.

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