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T1600 Routing Node

PIC Guide

End-of-Life PICs

Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

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This guide provides an overview and description of the Physical Interface Cards (PICs) supported by the Juniper Networks T1600 Internet router that are end-of-life and can no longer be ordered. The PICs are described alphabetically. Table 1 on page 3 lists the end-of-life PICs supported by the T1600 Internet router by PIC family.

PICs provide the physical connection to various network media types. The PICs are mounted on Flexible PIC Concentrators (FPCs), which are inserted into a slot in a routing node. A PIC typically occupies a single slot on an FPC. PICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each PIC performs framing and high-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs. Each PIC is equipped with a media-specific ASIC that performs control functions tailored to the PIC's media type. For complete information about installing PICs and transceivers, see the *PIC and Transceiver Installation Instructions* located at http://www.juniper.net/techpubs/.

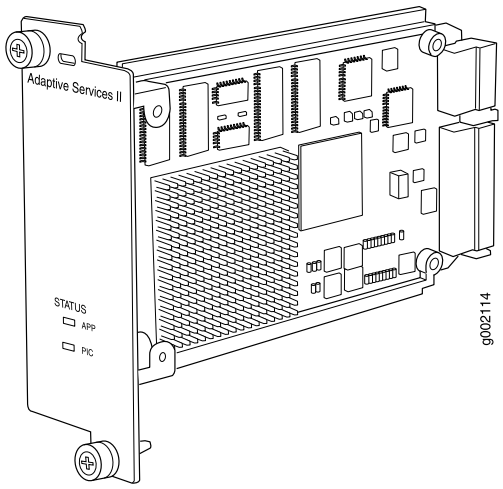
Blank PICs resemble other PICs but do not provide any physical connection or activity. When a slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system.

For a complete list of end-of-life FPCs and end-of-life Enhanced FPCs for M-series and T-series routing platforms, see the *M-series and T-series Routing Platform End-of-Life FPC Guide* located at http://www.juniper.net/techpubs/.

Table 1: End-of-Life PICs Supported in the T1600 Routing Node

PIC Family and Type	Ports	First JUNOS Support	PIC Slots Required	Page
Services				
Adaptive Services II	0	8.5	1 slot	4
SONET/SDH				
SONET/SDH OC3c/STM1 MM and SMIR (Type 1 and Type 2)	4	8.5	1 slot	7
SONET/SDH OC12c/STM4	1	8.5	1 slot	11
SONET/SDH OC12c/STM4	4	8.5	1 slot	11
SONET/SDH OC48c/STM16 with SFP	1	8.5	1 slot	15

Adaptive Services II PIC



Software release	■ JUNOS 8.5 and later (Type 1)
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 release and individual licenses, software features for this PIC can include the features listed in Table 2 on page 5. For more information about the software features available for services PICs, see the *JUNOS Services Interfaces Configuration Guide*.
LEDs	Status LED, one tricolor: ■ Off—PIC is offline and it is safe to remove it from the chassis. ■ Green—PIC is operating normally. ■ Amber—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. ■ Amber—Service is overloaded.

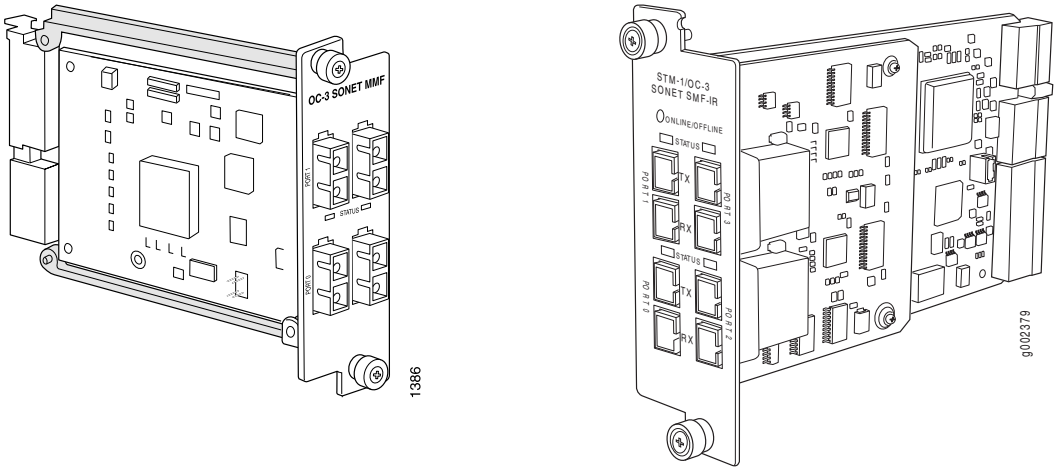
Table 2: Adaptive Services PICs Software Features

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	8.5	–
Network Address Translation (NAT) for IP addresses	8.5	–
Port Address Translation (PAT) for port numbers	8.5	–
IP Security (IPSec) encryption	8.5	–
Active flow monitoring exports cflowd version 5 and version 8 records	8.5	–
Active flow monitoring exports version 9 records, based on RFC 3954 (IP v4 templates only)	8.5	–
Passive flow monitoring	–	–
Passive flow collection	–	–
Flow-tap	8.5	–
Dynamic flow capture	–	–
Real-time performance monitoring	8.5	–
Link Services	8.5	8.5
Tunnel services: ■ IP-IP unicast tunneling ■ GRE unicast tunneling—Supports GRE fragmentation ■ Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.5	8.5
Virtual tunnel interface for Layer 3 VPNs	8.5	–
Layer 2 Tunneling Protocol (L2TP)	–	–
Voice services: Compressed Real-Time Transport Protocol (CRTP)	8.5	8.5

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

Encapsulations ■ Multilink Frame Relay (MLFR) ■ Multilink Point-to-Point Protocol (MLPP)	8.5	8.5

SONET/SDH OC3c/STM1 PICs



Left: SONET/SDH OC3c/STM1 PIC (MMF); Right: SONET/SDH OC3c/STM1 PIC (SMF-IR)

Software release	■ JUNOS 8.5 (Type 1 and Type 2) multimode and single-mode intermediate reach
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) ■ Optical interface support—See Table 3 on page 9 **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 ■ Amber—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)

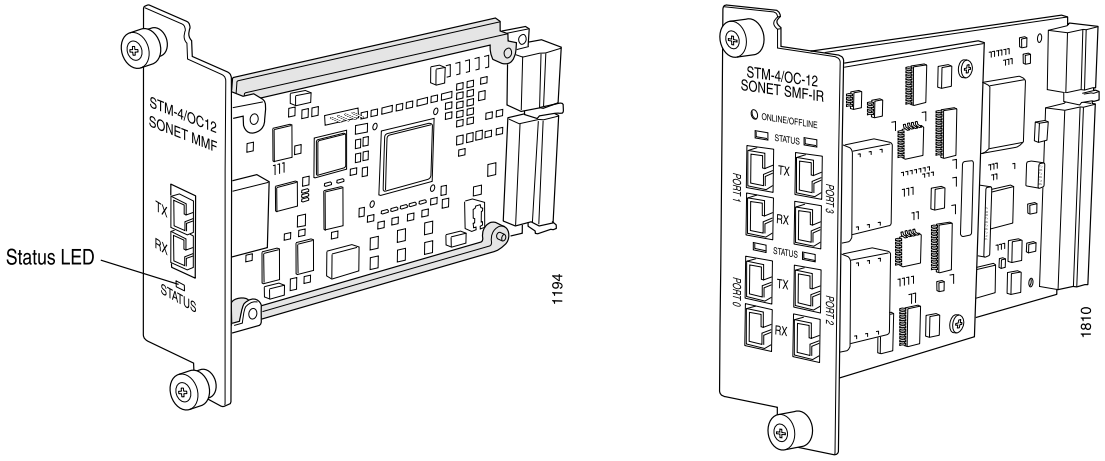
Table 3: Optical Interface Support for SONET/SDH OC3c/STM1 PICs

Parameter	Intermediate Reach	Multimode
Optical interface	Single-mode	Multimode
Transceiver type	Fixed	Fixed

Table 3: Optical Interface Support for SONET/SDH OC3c/STM1 PICs *(continued)*

Parameter	Intermediate Reach	Multimode
Standard	Telcordia GR-253	Multivendor agreement
Maximum distance	SMF cable: 9.3 miles/15 km	MMF cable: 1.2 miles/2 km
Transmitter wavelength	1260 through 1360 nm	1270 through 1380 nm
Average launch power	–15 through –8 dBm	–20 through –14 dBm
Receiver saturation	–8 dBm	–14 dBm
Receiver sensitivity	–28 dBm	–30 dBm

SONET/SDH OC12c/STM4 PICs



Left: 1-Port SONET/SDH OC12c/STM4 PIC; Right: 4-Port SONET/SDH OC12c/STM4 PIC

Software release	■ JUNOS 8.5
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) ■ Optical interface support—See Table 4 on page 13 **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 ■ Amber—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)

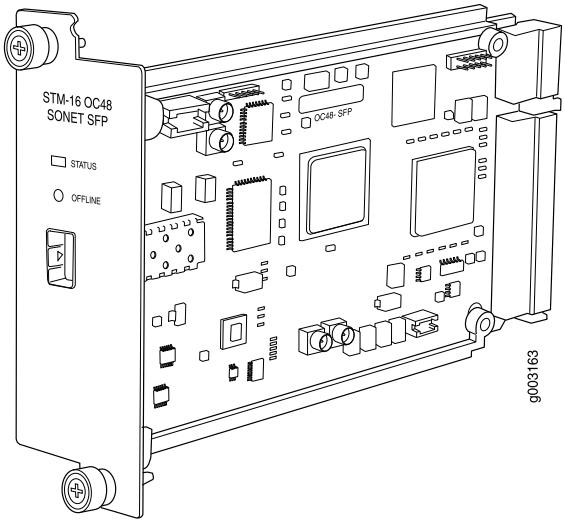
Table 4: Optical Interface Support for SONET/SDH OC12c/STM4 PICs

Parameter	Intermediate Reach	Multimode
Optical interface	Single-mode	Multimode
Transceiver type	Fixed	Fixed

Table 4: Optical Interface Support for SONET/SDH OC12c/STM4 PICs *(continued)*

Parameter	Intermediate Reach	Multimode
Standard	Telcordia GR-253	Multivendor agreement
Maximum distance	SMF cable: 9.3 miles/15 km	MMF cable: 546.8 yards/500 m
Transmitter wavelength	1274 through 1356 nm	1270 through 1380 nm
Average launch power	–15 through –8 dBm	–20 through –14 dBm
Receiver saturation	–8 dBm	–14 dBm
Receiver sensitivity	–28 dBm	–26 dBm

SONET/SDH OC48c/STM16 PIC with SFP



Software release	■ JUNOS 8.5
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) ■ Optical interface support—see Table 5 on page 18 **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 ■ Amber—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)

Table 5: Optical Interface Support for SONET/SDH OC48c/STM16 PICs with SFP

Parameter	Short Reach (SR)	Intermediate Reach (IR)	Long Reach (LR)
Optical interface	Single-mode	Single-mode	Single-mode; compatible with 1550-nm single-mode LR
Transceiver type	SFP	SFP	SFP
Maximum distance	SMF cable: 1.24 miles/2 km	SMF cable: 9.3 miles/15 km	SMF cable: 49.71 miles/80 km
Standard	Telcordia GR-253	Telcordia GR-253	Telcordia GR-253—L-16.3
Transmitter wavelength	1266 through 1360 nm	1260 through 1360 nm	1500 through 1580 nm
Average launch power	–10 through –3 dBm	–5 through 0 dBm	–2 through +3 dBm
Receiver saturation	–3 dBm	0 dBm	–9 dBm
Receiver sensitivity	–18 dBm	–18 dBm	–28 dBm

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28 July 2008—530-023890-01. Revision 2. Added EOL Adaptive Services II PIC. Added SONET/SDH OC3 and OC12 PICs.
1 February 2008—530-023890-01. Revision 1. Added SONET/SDH OC3c/STM1 PIC (PC-4OC3-SON-SMIR), SONET/SDH OC12c/STM4 PICs (PB-4OC12-SON-MM and PB-4OC12-SON-SMIR), and SONET/SDH OC48c/STM16 PIC with SFP (PB-1OC48-SON-SFP).

The information in this document is current as of the date listed in the revision history.

YEAR 2000 NOTICE

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

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