Overview

This chapter describes the OC12 POS line cards and contains the following sections:

Line Card Overview

The OC12 POS line cards provide the Cisco 7304 router with single or dual 622.080-Mbps POS interfaces on a single card. You must use the appropriate optical fiber cables to connect the OC12 POS line card with an external OC-12 network. (See the "OC12 POS Line Card Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-8 for more information on optical fiber cables.)

Six models of the OC12 POS line card are available:

- 7300-1OC12POS-MM—Multimode (See Figure 1-1.)
- 7300-1OC12POS-SMI—Single-mode, intermediate reach (See Figure 1-2.)
- 7300-1OC12POS-SML—Single-mode, long reach (See Figure 1-3.)
- 7300-2OC12POS-MM—Multimode (See Figure 1-4.)
- 7300-2OC12POS-SMI—Single-mode, intermediate reach (See Figure 1-5.)
- 7300-2OC12POS-SML—Single-mode, long reach (See Figure 1-6.)

Figure 1-1 7300-1OC12POS-MM—Faceplate View

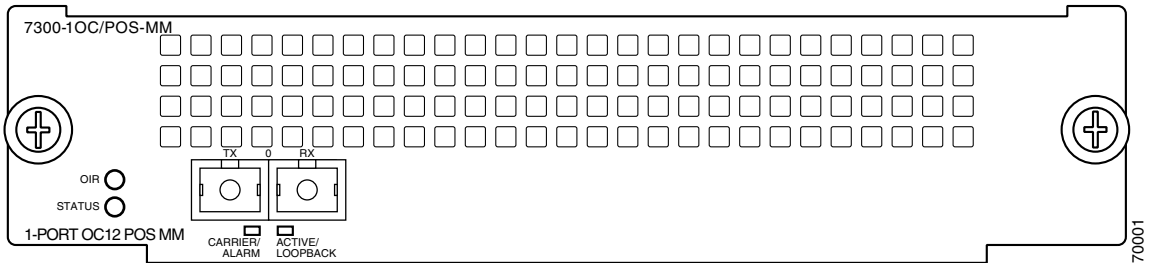


Figure 1-2 7300-1OC12POS-SMI—Faceplate View

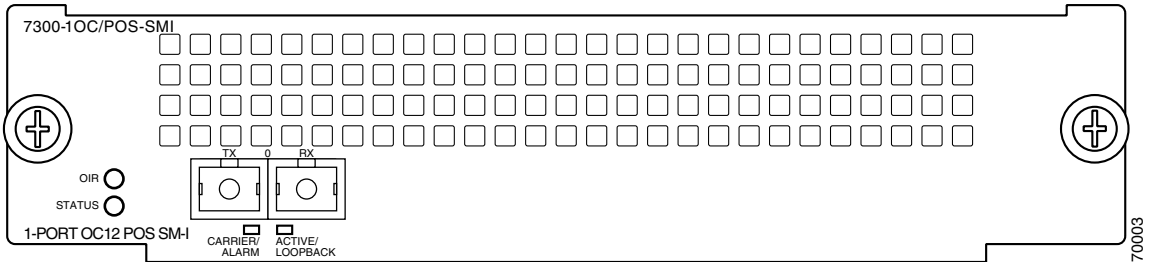


Figure 1-3 7300-1OC12POS-SML—Faceplate View

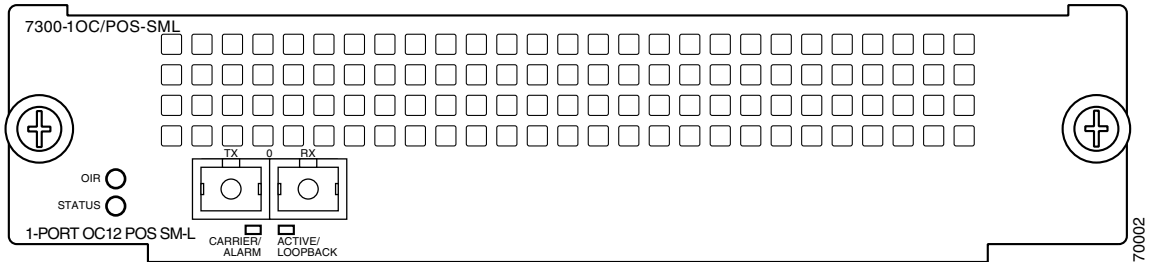


Figure 1-4 7300-2OC12POS-MM—Faceplate View

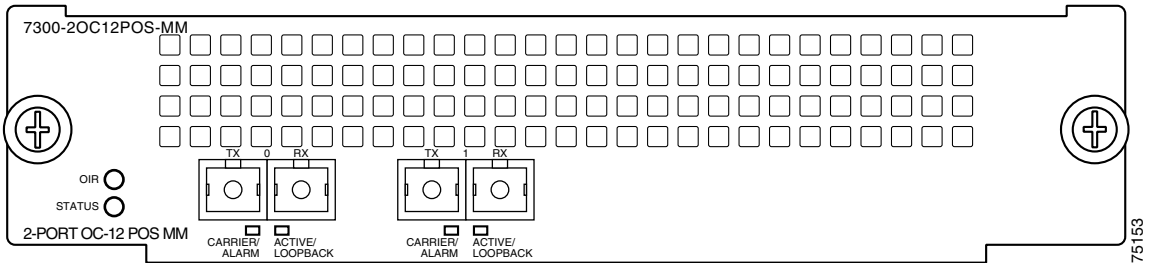


Figure 1-5 7300-2OC12POS-SMI—Faceplate View

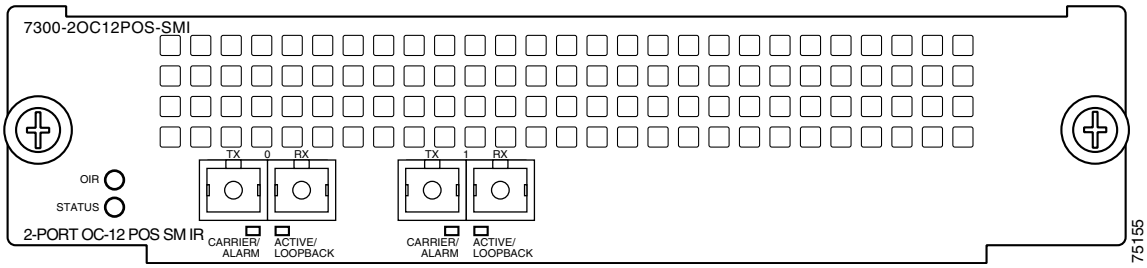
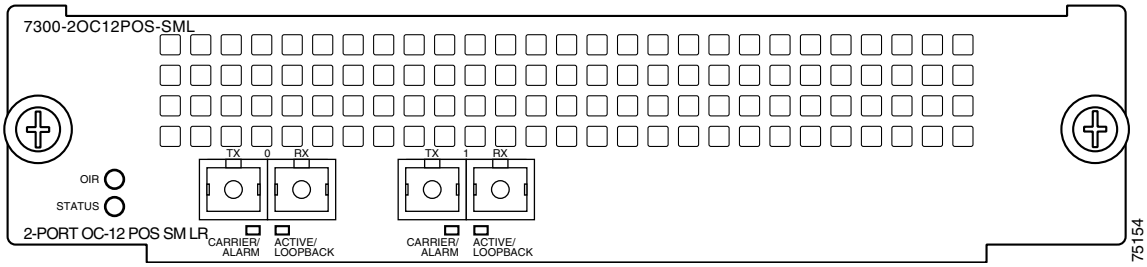


Figure 1-6 7300-2OC12POS-SML—Faceplate View



SONET/SDH Overview

The POS specification addresses the use of PPP encapsulation over SONET/Synchronous Digital Hierarchy (SDH) links. SONET is an American National Standards Institute (ANSI) standard (T1.1051988) for optical digital transmission at hierarchical rates from 51.840 Mbps (STS-1) to 622.080 Mbps (STS-12) and greater. SDH is the international standard for optical digital transmission at hierarchical rates from 155.520 Mbps (STM-1) to 2.488 Gbps (STM-16) and greater.

SONET is an octet-synchronous multiplex scheme that defines a family of standard rates and formats. The basic rate for POS is that of STS-3c/STM-1, which is 155.520 Mbps. The available information bandwidth is 149.760 Mbps, which is the STS-3c/STM-1 Synchronous Payload Envelope (SPE), the payload portion of the SONET frame into which the octet-oriented user data is mapped. (Octet boundaries are aligned with the SPE octet boundaries.)

The International Telecommunication Union Telecommunication Standardization Sector (ITU-T) defines a series of SDH transmission rates beginning at 155.520 Mbps as follows:

SONET[1]	SDH Equivalent
STS-3c	STM-1
STS-12c[2]	STM-4c
STS-48c	STM-16c

1. ANSI-defined SONET specifications.
2. Currently supported by the OC12 POS line card.

Despite the name, SONET is not limited to optical links. Electrical specifications have been defined for CATV 75-ohm coaxial cable. Transmission rates are integer multiples of 51.840 Mbps, which can be used to carry T3/E3 bit-synchronous signals.

The following transmission multiples are currently specified and commonly used:

- STS-3c—155.520 Mbps
- STS-12c—622.080 Mbps (the OC12 POS line card conforms to STS-12c)
- STS-48c—2.488 Gbps

The following references discuss concepts and specifications of POS and PPP:

- Simpson, W., Editor, *The Point-to-Point Protocol (PPP)*, RFC 1512, Daydreamer, December 1993.
- Simpson, W., Editor, *PPP in HDLC Framing*, RFC 1662, Daydreamer, July 1994.
- Simpson, W., Editor, *PPP Over SONET/SDH*, RFC 1619, Daydreamer, May 1995.
- *American National Standard for Telecommunications - Digital Hierarchy - Optical Interface Rates and Formats Specification*, ANSI T1.105-1991.
- *American National Standard for Telecommunications - Synchronous Optical Network (SONET) Payload Mappings*, ANSI T1.105.02-1993 draft.
- ITU-T Recommendation G.707, *Synchronous Digital Hierarchy Bit Rates*, June 1992.
- Telecordia GR-253-CORE SONET: Common generic criteria, September 2000.

Features

The OC12 POS line card has the following features:

- Short-reach (7300-1OC12POS-MM and 7300-2OC12POS-MM), intermediate-reach (7300-1OC12POS-SMI and 7300-2OC12POS-SMI), and long-reach (7300-1OC12POS-SML and 7300-2OC12POS-SML) optical interface with single-mode optical fiber

  Note For information on the type of cables to use with the OC12 POS line card, see the "OC12 POS Line Card Optical Fiber Specifications" section on page 1-5, and the "Cables and Connectors" section on page 1-8.

- Online insertion and removal (OIR) in the Cisco 7304 router, allowing you to remove, add, or replace an OC12 POS line card online
- Support for 16-bit and 32-bit cyclic redundancy checking (CRC-16 and CRC-32)
- Support for Synchronous Payload Envelope (SPE) scrambling
- Supports HDLC encapsulation

Interface Specifications

The physical layer interface for the OC12 POS line card is Optical Carrier-12 (OC-12c, the specification for SONET STS-12c and SDH STM-4 transmission rates), and the OC12 POS line card is designed to comply with Packet-over-SONET specifications. The OC12 POS line card provides a single 622.080-Mbps Packet OC-12 network interface for all supported platforms.

Each OC12 POS line card has one pair of SC-type fiber receptacles to allow connection to single-mode optical fiber. (For more information on the optical fiber cables you should use with this line card, see the "OC12 POS Line Card Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-8.)

Packet data is transported using Point-to-Point Protocol (PPP) and is mapped into the STS-12c/STM-4 frame. (RFC-1619)

The management of the OC12 POS line card interface is compliant with RFC 1595.

OC12 POS Line Card Optical Fiber Specifications

The OC12 POS line card specification for optical fiber transmission is single-mode.

Modes can be thought of as bundles of light rays entering the fiber at a particular angle. Single-mode fiber allows only one mode of light to propagate through the fiber, and multimode fiber allows multiple modes of light to propagate through the fiber.

Multiple modes of light propagating through the fiber travel different distances depending on the entry angles, which causes them to arrive at the destination at different times (a phenomenon called *modal dispersion*); therefore, single-mode fiber is capable of higher bandwidth and greater cable run distances than multimode fiber. Table 1-1 lists nominal OC-12 optical parameters for single-mode optical fiber transmission.

Note If the distance between two connected stations is greater than the maximum distances listed, significant signal loss can result, making transmission unreliable.

Table 1-1 lists the OC-12 optical parameters.

Table 1-1 OC-12 Optical Parameters

Transceiver Type[1]	Transmit Power	Maximum Power to Receiver[2]	Receiver Sensitivity	Loss Budgets	Nominal Distance Between Stations
Single-mode[3] long reach	–5 dBm min. to 0 dBm max. at 1280–1335 nm[4]	–10 dBm	–34 dBm	10 to 28 dB	Up to 25 mi. (40 km)
Single-mode[5] intermediate reach	–15 dBm min. to –8 dBm max. at 1280–1335 nm[4]	–8 dBm	–31 dBm	0 to 12 dB	Up to 9 mi. (15 km)
Multimode short reach	–20 dBm min. to –14 dBm max. at 1280–1335 nm[4]	–8 dBm	–30 dBm	0 to 7 dB	Up to 1.2 mi. (2 km)

1. This table gives nominal OC-12 optical parameters.
2. This value represents the maximum power to which any receiver can be exposed.
3. Complies with Bellcore GR-253-CORE Long Reach Specification (LR-1).
4. Nominal wavelength is 1310 nm.
5. Complies with Bellcore GR-253-CORE Intermediate Reach Specification (IR-1).

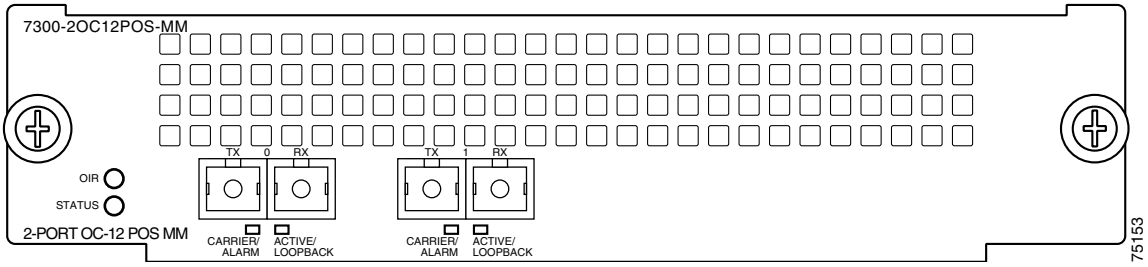
To calculate link losses and dispersion losses for your application, refer to the following specifications and documents:

- EIA/TIA-IVa Dispersion Unshifted Single-Mode Fiber
- EIA/TIA-IVb Dispersion Shifted Single-Mode Fiber
- GR-20-CORE *Generic Requirements for Optical Fiber and Fiber-Optic Cable*
- ITU-T Recommendation G.957 *Optical Interfaces for Equipments and Systems Relating to the Synchronous Digital Hierarchy*

LEDs

The OC12 POS line card faceplate has two LEDs that indicate line card status and two LEDs per port that indicate interface status. (See Figure 1-7.)

Figure 1-7 LEDs on the OC12 POS Line Card



After system initialization, the STATUS LED goes on to indicate that power is received and that the OC12 POS line card is enabled for operation.

The following conditions must all be met before the OC12 POS line card is enabled:

- The OC12 POS line card is correctly connected and receiving power.
- The system bus recognizes the OC12 POS line card.
- A valid version of microcode is loaded and running.

If any one of these conditions is not met, or if the initialization fails, the STATUS LED does not go on.

Table 1-2 lists LED colors and indications.

Table 1-2 OC12 POS Line Card LEDs

LED Label	Color	State	Function
STATUS	Green/Yellow	Green	Indicates line card is online.
		Yellow	Indicates line card bootstrapping is in progress.
		Off	Indicates line card is offline and deactivated.
OIR	Green	On	Line card is ready to be removed in CLI-controlled OIR.
		Off	Line card is online.

Table 1-2 OC12 POS Line Card LEDs (continued)

LED Label	Color	State	Function
CARRIER/ALARM	Green/Yellow	Green	Indicates that a valid SONET signal has been detected with no alarm conditions.
		Yellow	Indicates that an alarm condition is present. See Table 1-3 for alarm definitions.
		Off	No valid SONET signal has been detected.
ACTIVE/ LOOPBACK	Green/Yellow	Green	Indicates that the port has been configured and is enabled.
		Yellow	Indicates that the port is in diagnostic loopback mode.
		Off	Indicates that the port has not been configured.

Alarms

A yellow CARRIER/ALARM LED indicates the presence of an alarm condition. Table 1-3 lists the alarm conditions that might be present. Use the **show controllers** command to show the specific alarm condition.

Table 1-3 Alarm Definitions

Alarm	Definition
Section	
LOF	loss of frame
LOS	loss of signal
BIP(B1)	Bit Interleaved Parity N
Line	
AIS	alarm indication signal
RDI	remote defect indication
FEBE	far end block error
BIP(B2)	Bit Interleaved Parity N
Path	
AIS	alarm indication signal
RDI	remote defect indication
FEBE	far end block error
BIP(B3)	Bit Interleaved Parity N
PLM	Path Payload Label Mismatch
UNEQ	Path Unequipped
TIM	Trace Identifier Mismatch
TIU	Trace Identifier Unstable
LOP	loss of pointer

Table 1-3 Alarm Definitions (continued)

Alarm	Definition
NEWPTR	new pointer
PSE	Positive Stuff Event
NSE	Negative Stuff Event
PLM-P	STS Path Payload Label Mismatch
UNEQ-P	STS Path Unequipped

Cables and Connectors

Use single-mode (for short-, intermediate- or long-reach configurations) optical fiber cable to connect your router to a network or to connect two OC12 POS line card-equipped routers back to back. For SONET/SDH single-mode optical fiber connections, use two simplex SC-type cables (see Figure 1-8), or one duplex SC-type cable (see Figure 1-9).

Figure 1-8 Simplex SC-Type Cable and Connector

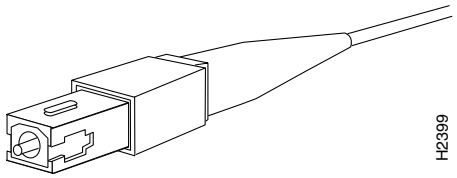
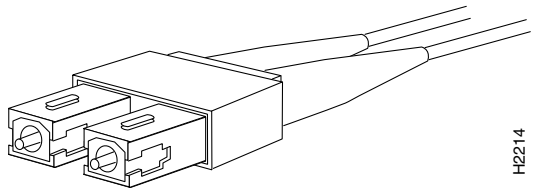


Figure 1-9 Duplex SC-Type Cable and Connector



Note For maximum cable lengths between stations, see Table 1-1 on page 1-5. Single-mode optical fiber cables for the OC12 POS line card are not available from Cisco Systems; they are available from commercial cable vendors.

Attach one pair of simplex fiber cables between the line card and the device to which the line card is connected. Observe the receive (RX) and transmit (TX) cable relationship shown in Figure 1-10.

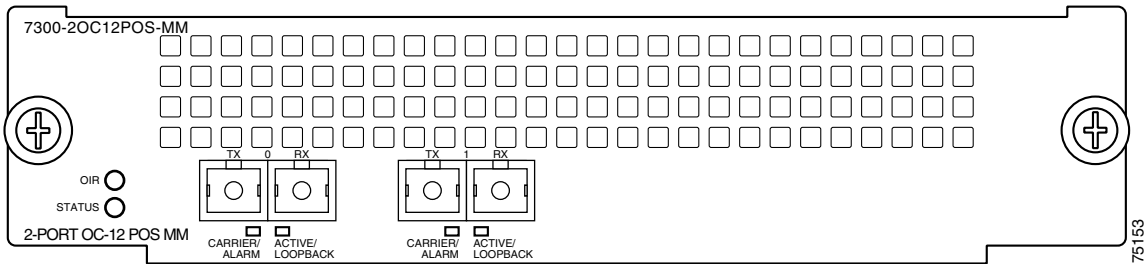
Note For important laser safety information, see the "Laser Safety" section on page 2-5.

Warning **Invisible laser radiation can be emitted from the aperture of the port when no cable is connected. Avoid exposure to laser radiation and do not stare into open apertures.**

Warning **Class 1 laser product (single-mode).**

Note The optical fiber connectors must be free of dust, oil, or other contaminants. Carefully clean the optical fiber connectors using an alcohol wipe or other suitable cleanser.

Figure 1-10 Transmit (TX) and Receive (RX) Ports on the OC12 POS Line Card



Encapsulation Method Support

The following encapsulation methods are supported by the OC12 POS line card:

- High-Level Data Link Control (HDLC)
- Frame Relay
- PPP

Using Statistics to Estimate Link Loss and Power Budget

Statistical models more accurately determine the power budget than standard worst-case methods. Determining the link loss with statistical methods requires accurate knowledge of variations in the data link components. Statistical power budget analysis is beyond the scope of this document. For further information, refer to ITU-T standards and your equipment specifications.

The following publications contain information on determining attenuation and power budget:

- T1E1.2/92-020R2 ANSI, the Draft American National Standard for Telecommunications entitled *Broadband ISDN Customer Installation Interfaces: Physical Layer Specification*.
- *Power Margin Analysis, AT&T Technical Note,* TN89-004LWP, May 1989.

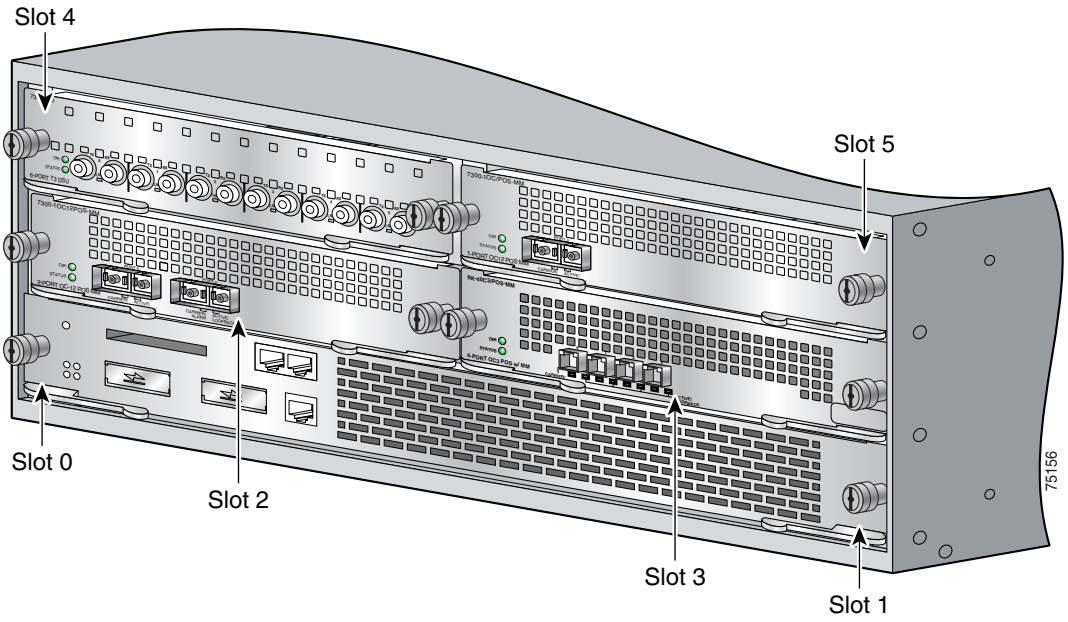
Slot Locations on the Cisco 7304 Router

The following section describes the slot locations in the Cisco 7304 router. This section includes the following subsection:

Cisco 7304 Router Slot Numbering

The OC12 POS line card can be installed in slots 2 through 5 in Cisco 7304 routers. Figure 1-11 shows a Cisco 7304 with an OC12 POS line card installed in slot 2 and slot 5.

Figure 1-11 Slots in the Cisco 7304 Router



Note Slot 0 and slot 1 are for the network services engine (NSE) only.

Identifying Interface Addresses

This section describes how to identify the interface address for the OC12 POS line card in a Cisco 7304 router. Interface addresses specify the actual physical location of each interface on a router.

The interfaces on the OC12 POS line card installed in a Cisco 7304 router maintain the same interface address regardless of whether other line cards are installed or removed. However, when you move a line card to a different slot, the first number in the interface address changes to reflect the new slot number.

Table 1-4 explains how to identify interface addresses.

Table 1-4 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7304 router	Slot-number/interface-port-number	Slot—0 through 5 [1]	`2/0`

1. Slot 0 and slot 1 are reserved for the network services engine (NSE).

Cisco 7304 Router Interface Addresses

This section describes how to identify the interface addresses used for the OC12 POS line card in a Cisco 7304 router. The interface address is composed of a two-part number in the format *slot-number/interface-port-number*. See Table 1-4 for the interface address format.

In a Cisco 7304 router, slots are numbered, beginning with slot 0 (a dual-width slot reserved for the NSE-100) on the bottom, and continuing from the lower left to the upper right through slot 5.

Note The NSE-100 is the only card supported in slot 0.

The interface address of the interface on an OC12 POS line card in slot 2 is 2/0 (slot 2 and interface 0). If the OC12 POS line card was in slot 4, this same interface would be numbered 4/0 (slot 4 and interface 0).