



Clear Channel 6-Port T3 (DS3) Line Card Installation and Configuration

Product Numbers: 7300-6T3
Platform Supported: Cisco 7304

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Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services. This preface contains the following sections:

- [Objectives, page vii](#)
- [Organization, page vii](#)
- [Related Documentation, page viii](#)
- [Obtaining Documentation, page viii](#)
- [Obtaining Technical Assistance, page x](#)
- [Obtaining Additional Publications and Information, page xi](#)

Objectives

This document describes how to install and configure the clear channel 6-port T3 (DS3) line card (7300-6T3[=]), hereafter referred to as the 6T3 line card, which is used in the Cisco 7304 router.

Organization

This document contains the following chapters:

Section	Title	Description
Chapter 1	Overview	Describes the 6T3 line card and its LED displays, cables, and receptacles.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
Chapter 3	Removing and Installing Line Cards	Describes the procedures for installing and removing the 6T3 line card in the supported platform.
Chapter 4	Configuring the 6T3 Line Card	Provides instructions for configuring the 6T3 line card on the supported platform.

Related Documentation

Your router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- Cisco IOS software:

For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.



Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at <http://www.cisco.com>. Translated documentation is available at the following URL: http://www.cisco.com/public/countries_languages.shtml.

- Cisco 7304 router:
 - For hardware installation and maintenance information, refer to the *Cisco 7304 Router Installation and Configuration Guide* that shipped with your Cisco 7304 router.
 - *Cisco 7304 Router Quick Start Guide*
- For international agency compliance, safety, and statutory information for WAN interfaces:
 - *Site Preparation and Safety Guide*
 - *Regulatory Compliance and Safety Information for Cisco 7304 Routers*
- To view Cisco documentation or obtain general information about the documentation, refer to the following sources:
 - “[Obtaining Documentation](#)” section on page viii.
 - “[Obtaining Technical Assistance](#)” section on page x.
 - “[Obtaining Additional Publications and Information](#)” section on page xi
 - Customer service at 800 553-6387 or 408 526-7208. Customer service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding Cisco-observed holidays).

The *Cisco Information Packet* that shipped with your router.

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

<http://www.cisco.com/univercd/home/home.htm>

You can access the Cisco website at this URL:

<http://www.cisco.com>

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated regularly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual or quarterly subscription.

Registered Cisco.com users can order a single Documentation CD-ROM (product number DOC-CONDOCCD=) through the Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/ordering_place_order_ordering_tool_launch.html

All users can order monthly or quarterly subscriptions through the online Subscription Store:

<http://www.cisco.com/go/subscription>

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You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpk/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products Marketplace:
<http://www.cisco.com/en/US/partner/ordering/index.shtml>
- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

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You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
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170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

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- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

<http://tools.cisco.com/RPF/register/register.do>

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The type of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration. There is little or no impact to your business operations.
- Priority level 3 (P3)—Operational performance of the network is impaired, but most business operations remain functional. You and Cisco are willing to commit resources during normal business hours to restore service to satisfactory levels.
- Priority level 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively impacted by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.
- Priority level 1 (P1)—An existing network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Cisco TAC Website

The Cisco TAC website provides online documents and tools to help troubleshoot and resolve technical issues with Cisco products and technologies. To access the Cisco TAC website, go to this URL:

<http://www.cisco.com/tac>

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

<http://tools.cisco.com/RPF/register/register.do>

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

<http://www.cisco.com/tac/caseopen>

If you have Internet access, we recommend that you open P3 and P4 cases online so that you can fully describe the situation and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

Before calling, please check with your network operations center to determine the Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary*, *Internetworking Technology Handbook*, *Internetworking Troubleshooting Guide*, and the *Internetworking Design Guide*. For current Cisco Press titles and other information, go to Cisco Press online at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access *Packet* magazine at this URL:

<http://www.cisco.com/go/packet>

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

- Internet Protocol Journal is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html



Overview

This chapter describes the 6T3 line card and contains the following sections:

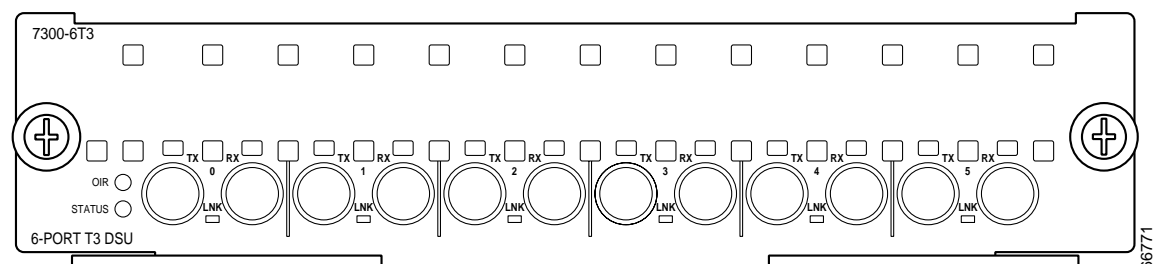
- [Line Card Overview, page 1-1](#)
- [Features, page 1-2](#)
- [Interoperability Guidelines for 6T3 Line Card DSUs, page 1-3](#)
- [LEDs, page 1-3](#)
- [T3 SMB Cables, page 1-4](#)
- [Management Information Base, page 1-7](#)
- [Line Card Slot Locations on the Supported Platform, page 1-7](#)
- [Identifying Interface Addresses, page 1-9](#)

Line Card Overview

The 6T3 line card provides a full-duplex operation at T3 (45 Mbps) speed. It supports both 16- and 32-bit cyclic redundancy checks (CRCs); the default is 16-bit CRC. You can change the default setting with software commands.

The 6-port 6T3 line card, shown in [Figure 1-1](#), provides up to 24 network interfaces per Cisco 7304 router.

Figure 1-1 6T3 Line Card



Features

The 6T3 line card provides the following features:

- Single-wide line card for the Cisco 7304 router
- Full-duplex synchronous serial DS3 interface
- High-Level Data Link Control (HDLC) data
- Integrated data service unit (DSU) functionality
- Support for 16- and 32-bit cyclic redundancy checks (CRCs)
- Support for Frame Relay, HDLC, and PPP serial encapsulations
- Support for DS3 MIB (RFC 1407)
- Support for remote and local loopbacks
- Six independent T3 ports
- Subrate DS3 support for Cisco, Kentrox, Larscom, and Digital Link formats along with the associated scrambling. In some modes, the scrambling is optional.
- Clear-channel DS3 (framed but unchanneled)
- M23 and C-bit-parity DS3 frame formats
- Extraction of BOCs on the C-bit far-end alarm and control (FEAC) code
- Detects and counts remote alarm indication (RAI), parity errors, far-end block error (FEBE), line code violation (LCV), loss of light (LOL), out of frame (OOF), framing errors, loss of frame (LOF), loss of signal (LOS)
- One-second performance monitoring counters
- Generates AIS and FEAC
- Generates F-, X-, P-, and M-bit errors; LCVs; all zeros; RAI; and FEBE for testing
- Line, payload, and diagnostic loopbacks
- One bicolor LED per T3 port
- Drives up to 900 feet of 75-ohm coaxial cable RG-59U or equivalent, 450 feet to DSX-3 demarcation point (DSX)
- 75-ohm SMB-type coaxial connections over ATT 734/728, 75-ohm coaxial cable
- B3ZS line coding
- Maintenance data link (MDL) messages
- Bit error rate testing

Interoperability Guidelines for 6T3 Line Card DSUs

The 6T3 line card supports several types of integrated data service units (DSUs). [Table 1-1](#) lists the feature compatibilities of 6T3 line card DSUs.

Table 1-1 Feature Compatibilities of 6T3 Line Card DSUs

DSU	Full Rate Support	Scrambling Support	Subrate Support	MDL ¹ Support
Adtran	Yes	No	Yes	No
DL3100	Yes	Yes	Yes	No
Kentrox	Yes	Yes ²	Yes ²	No
Larscom	Yes	Yes	Yes	No

1. MDL (Maintenance Data Link)
2. The 6T3 line card supports scrambling and Kentrox subrate at the same time.

Maintenance Data Link Messages

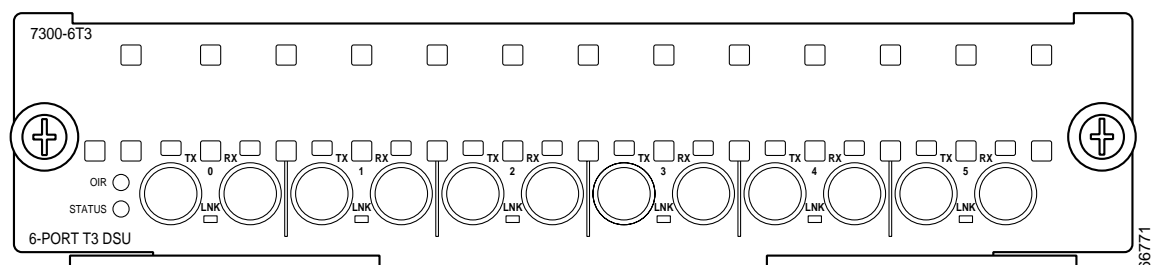
T3 maintenance data link (MDL) messages are used to communicate identification information between local and remote ports. The type of information included in MDL messages includes the equipment identification code (EIC), location identification code (LIC), frame identification code (FIC), unit, Path Facility Identification (PFI), port number, and Generator Identification numbers. The values for each piece of MDL message identification can be defined only by a network administrator and are discussed in ANSI T1.107.

For information on transporting MDL messages between source and destination T3 ports on a Cisco 7304 router, refer to [T3 Maintenance Data Link Messages on the Cisco 7304 Router](#).

LEDs

The 6-port 6T3 line card has six LNK LEDs, one for each port, as well as one OIR LED and one STATUS LED. (See [Figure 1-2](#).)

Figure 1-2 LEDs on the 6T3 Line Card



After system initialization, the STATUS LED goes on to indicate that power is received and that the 6T3 line card is enabled for operation.

The following conditions must all be met before the 6T3 line card is enabled:

- The 6T3 line card is correctly connected and receiving power.
- The Network Services Engine 100 (NSE-100) recognizes the 6T3 line card.
- The Cisco IOS image on the NSE-100 is 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 6T3 line card LED colors and indications.

Table 1-2 6T3 Line Card LEDs

LED Label	Color	State	Meaning
OIR	Green	On	Line card is ready to be removed in CLI-controlled OIR.
		Off	Line card is online.
STATUS	Green/Yellow	Green	Indicates line card is online.
		Yellow	Indicates line card bootstrapping is in progress.
		Off	Indicates line card is offline or deactivated.
LNK	Green/Yellow	Green	Line card port is enabled.
		Yellow	Line card port is in loopback mode or is receiving or transmitting alarms.
		Off	Line card port is disabled.

T3 SMB Cables

The cables used to connect the 6T3 line card are presented in the following sections:

- [Ordering Cables, page 1-6](#)
- [Building Your Own Cables, page 1-6](#)

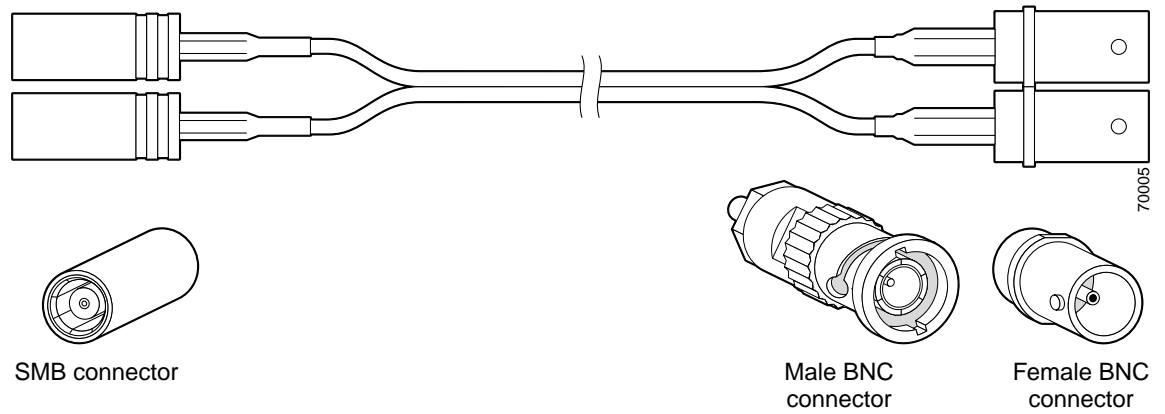
We recommend using six T3 SMB cables. The cables are 10 feet (3.048 meters) long and have two female SMB connectors on one end, and two female or male bayonet coupling (BNC) connectors on the other end. Use the female SMB cable connectors to connect the local line card RX and TX ports. Use the BNC cable connectors to connect the line card RX and TX ports to other devices. See [Figure 3-2](#).



Note

Cisco does not automatically provide the six T3 SMB cables recommended for your 6T3 line card.

Figure 1-3 T3 SMB Cables (SMB Terminates into BNC)



Note

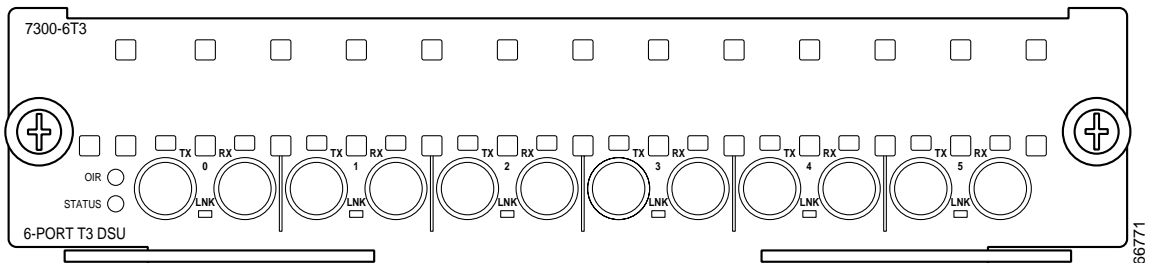
Electromagnetic compliance (EMC) was verified with the 10-foot (3.048 meters) shielded cables that are orderable through Cisco. We recommend that you use only the 10-foot (3.048 meters) shielded T3 SMB cables; otherwise, EMC is not guaranteed.

If you use cables other than those ordered from Cisco, it is your responsibility to ensure that you have a compliant system that meets local EMC requirements. To order additional cables, use the product numbers: 2CBLE-SMB-BNC-M (male) and 2CBLE-SMB-BNC-F (female).

Note

When you connect the 10-foot (3.048 meters) shielded T3 SMB cables to the 6T3 line card, be careful not to bend the male cable connector pin when you connect or disconnect the cables. Observe the receive (RX) and transmit (TX) cabling relationship shown in [Figure 1-4](#).

Figure 1-4 Connecting T3 SMB Cables



After you connect the cables to a configured port on the line card, it takes up to 35 seconds to initialize the line card and light the green LNK LED.

Ordering Cables

You must order cables separately with the 6T3 line card when you order a Cisco 7304 router. Cables are *not* automatically included with the 6T3 line card. Be sure to specify the type of cable you want shipped with your card (2CBLE-SMB-BNC-M [male] or 2CBLE-SMB-BNC-F [female]).

Building Your Own Cables

You can build your own cables for the 6T3 line card by using the cable components listed in [Table 1-3](#). All three cables have an SMB connector at one end to connect to the 6T3 line card. The two SMB-to-BNC cables in [Table 1-3](#) differ only in that one terminates in a male BNC connector, while the other terminates in a female BNC connector. You can use the back-to-back cable for directly connecting two closely-spaced 6T3 line cards back-to-back. These cables should be shielded and have SMB connectors on both ends.



Note

Back-to-back configurations, (6T3 line card serial-to-6T3 line card serial port configurations) require a specially built SMB-to-SMB cable. [Table 1-3](#) provides cable connector specifications. Or you can use the 2CBLE-SMB-BNC-M 10-foot (3.048 meters) shielded cable and the 2CBLE-SMB-BNC-F 10-foot (3.048 meters) shielded cable connected together.

You can order the SMB-to-BNC cables from Cisco as product numbers 2CBLE-SMB-BNC-F (female) or 2CBLE-SMB-BNC-M (male) BNC terminations, respectively. Cisco does not sell the SMB-to-SMB cable.

Table 1-3 Cable Connector Specifications

Cable Configuration	Line Card End	Remote End	RG-179 Cable
SMB-to-BNC Male	ITT-Cannon 051-124-9859-C9A	Radial R142076000 (or equivalent) Amp 41360-4 (or equivalent)	Double-shielded Harbour Ind. H6233-1 (or equivalent)
SMB-to-BNC Female	ITT-Cannon 051-124-9859-C9A	Amp 413760-8 (or equivalent)	Double-shielded Harbour Ind. H6233-1 (or equivalent)
SMB-to-SMB Back-to-Back	ITT-Cannon 051-124-9859-C9A	ITT-Cannon 051-124-9859-C9A	Double-shielded Harbour Ind. H6233-1 (or equivalent)

**Caution**

Cisco assumes no responsibility for system operation with other than Cisco-supplied adapter cables. The customer is responsible for ensuring that any customer-built cables meet all of the applicable compliance requirements (see the [“Related Documentation” section on page viii](#)).

T3 systems are designed for cable lengths of 450 feet (137 meters) between the transmitter and the DSX-3 demarcation point where the standard pulse mask must be met. From the DSX-3 point, another run of 450 feet (137 meters) is allowed to the receiver, making a total of 900 feet (274 meters) between transmitter and receiver. This limitation is due to signal attenuation in the cable.

Although the American National Standards Institute (ANSI) standard T1.404-1994 stipulates the Western Electric or equivalent 728A SMB cable, it has been replaced by the Lucent (formerly AT&T) 734A cable. Cisco tested more than 900 feet (274 meters) of 734A SMB cable from transmitter to receiver including the SMB-to-BNC adapter cables to verify high signal attenuation.

[Table 1-4](#) lists some approximate attenuation values from the ANSI standard, and shows the RG-179 attenuation. RG-179 has a much higher attenuation, so take this information into account if you plan long runs of RG-179 cable.

Table 1-4 ANSI Standard Cable-Attenuation Values

Approximate Cable Attenuation, dB ¹ from ANSI Standard T1.404-1994				
Frequency	100 ft (30 meters)	DSX-3 Point		RG-179
		450 ft (137 meters)	Transmitter-to-receiver distance (max)	100 ft (30 meters)
1 MHz	0.27	1.2	900 ft (274 meters)	3.0
10 MHz	0.80	3.6		5.3
50 MHz	1.82	8.2		8.5
100 MHz	2.64	11.9		10.0

1. dB = decibels

Management Information Base

Management Information Base (MIB) attributes are readable and writable across Integrated Local Management Interface (ILMI) through use of the Simple Network Management Protocol (SNMP).

The 6-port 6T3 line card supports the DS3 interface MIB (RFC 1407).

Line Card Slot Locations on the Supported Platform

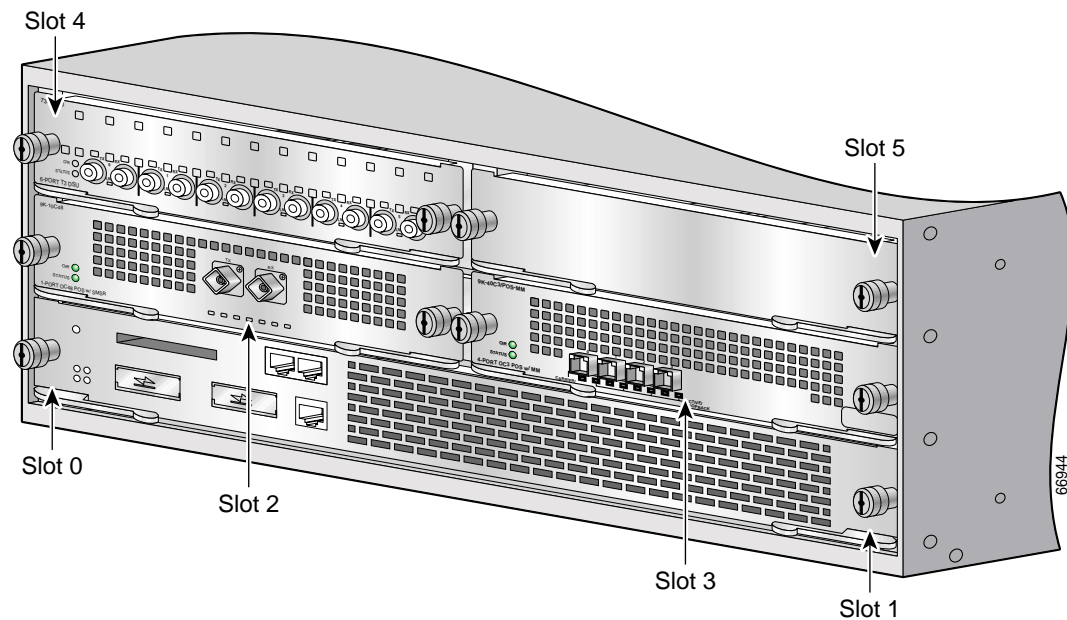
This section discusses line card slot locations on the supported platform. The illustration that follows summarizes slot location conventions on the Cisco 7304 router:

- [Cisco 7304 Router Slot Numbering, page 1-8](#)

Cisco 7304 Router Slot Numbering

Figure 1-5 shows a Cisco 7304 with the network services engine (NSE) installed in slots 0 and 1 and line cards installed in slots 2 through 4. In the Cisco 7304, slot 0 is in the lower left position, and slot 5 is in the upper right position.

Figure 1-5 Slots in the Cisco 7304 Router



Identifying Interface Addresses

This section describes how to identify interface addresses for the 6T3 line card in the Cisco 7304 router. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on the 6T3 line card installed in a router maintain the same 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 1-5 explains how to identify interface addresses.

Table 1-5 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7304 router	Slot-number/interface-port-number	Slot—2 through 5 ¹ Interface port— 0 through 5)	4 / 0

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

Cisco 7304 Router Interface Addresses

This section describes how to identify the interface addresses used for the 6T3 line card in the Cisco 7304 router. The interface address is composed of a two-part number in the format *slot-number/interface-port-number*. See Table 1-5 for the interface address format.

In the Cisco 7304 router, slots are numbered from the lower left to the upper right, beginning with slot 0 and continuing through slot 5. (Slot 0 and slot 1 are reserved for the NSE.)

The interface address of the interfaces on a 6-port 6T3 line card in slot 2 are 2/0 through 2/5 (slot 2 and interfaces 0 through 5). If the 6T3 line card was in slot 4, these same interfaces would be numbered 4/0 through 4/5 (slot 4 and interfaces 0 through 5).



Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the 6T3 line card. This chapter contains the following sections:

- [Required Tools and Equipment, page 2-1](#)
- [Software and Hardware Requirements, page 2-2](#)
- [75-Ohm In-Line Coaxial Attenuator \(Optional\), page 2-2](#)
- [Safety Guidelines, page 2-2](#)

Required Tools and Equipment

You need the following tools and parts to install a line card. If you need additional equipment, contact a service representative for ordering information.

- 6T3 line card
- T3 SMB interface cables
- Number 2 Phillips screwdriver
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares
- Antistatic mat
- Antistatic container
- Attenuator kit (optional)

Software and Hardware Requirements

Table 2-1 lists the recommended minimum Cisco IOS software release required to use the 6-port 6T3 line card in the 7304 router platform.

Table 2-1 6T3 Line Card Software Requirements

Router Platform	Recommended Minimum Cisco IOS Release
Cisco 7304 Router ¹	Cisco IOS Release 12.1(10)EX or a later release of Cisco IOS Release 12.1 EX

1. The 6T3 line card requires a Network Services Engine 100 (NSE-100) to operate.

75-Ohm In-Line Coaxial Attenuator (Optional)

A 75-ohm in-line coaxial attenuator may be required to tune the signal between the 6T3 line card and the far-end equipment if the line card is experiencing line code violations (LCVs). LCVs occur when the far-end equipment transmit signal saturates the front-end receiver of the 6T3 line card.

Cisco offers an attenuator kit (ATTEN-KIT-PA=) that contains five attenuators with fixed values ranging from 3 dB to 20 dB. For more information on the attenuator kit, go to the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/core/7206/fru/12884att.htm>

Safety Guidelines

This section provides safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.



Caution

The 6T3 line card is not intended for direct connection to outside telecommunication lines. If connected to an outside telecommunication line, suitable protection devices need to be provided.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.

Warning Definition



Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Waarschuwing

BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus

TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung WICHTIGE SICHERHEITSANWEISUNGEN

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem! FONTOS BIZTONSÁGI ELŐÍRÁSOK

Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielőtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ŐRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban található.

Avvertenza IMPORTANTI ISTRUZIONI SULLA SICUREZZA

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

Varning! VIKTIGA SÄKERHETSANVISNINGAR

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

Предупреждение ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ

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警告 有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意 保存这些说明

注意 本文件应与本产品附带的特定安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注 これらの注意事項を保管しておいてください。

注 この資料は、製品に付属のインストレーションガイドと併用してください。詳細は、インストレーションガイド、コンフィギュレーションガイド、または添付されているその他のマニュアルを参照してください。

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Примечание СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ

Примечание Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告 有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意 保存这些说明

注意 本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注 これらの注意事項を保管しておいてください。

注 この資料は、製品に付属のインストラクション ガイドと併用してください。詳細は、インストラクション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedure requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.

- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe; carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Line cards and processor modules consist of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed board component-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap protects components from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.



Caution

For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).



Removing and Installing Line Cards

This chapter describes how to remove the 6T3 line card from supported platforms and also how to install a new or replacement line card. This chapter contains the following sections:

- [Installation Overview, page 3-1](#)
- [Handling Line Cards, page 3-2](#)
- [Online Insertion and Removal, page 3-2](#)
- [Warnings and Cautions, page 3-3](#)
- [Line Card Removal and Installation, page 3-3](#)
- [Connecting a T3 SMB Cable, page 3-5](#)

Installation Overview

Each line card circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.



Note

When a line card slot is not in use, a blank line card must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the line cards. If you plan to install a new line card in a slot that is not in use, you must first remove the blank line card.

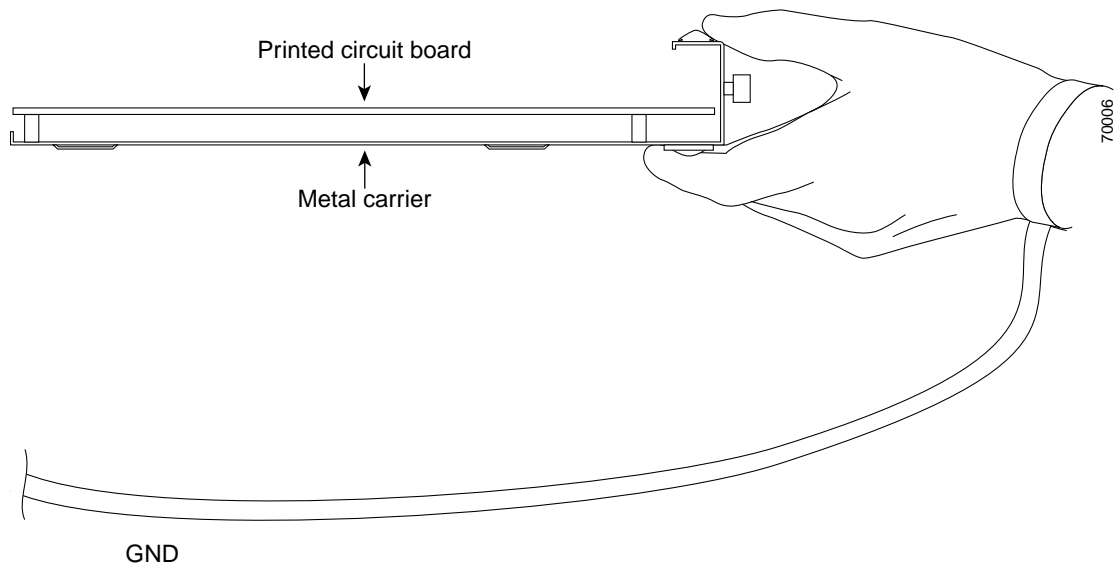
Handling Line Cards



Caution

Always handle the line card by the carrier edges and handle; never touch the line card components or connector pins. (See [Figure 3-1](#).)

Figure 3-1 Handling a Line Card



Online Insertion and Removal

The Cisco 7304 router supports online insertion and removal (OIR) of line cards; therefore, you do not have to power down the router when removing and replacing a 6T3 line card on a Cisco 7304 router. The Cisco 7304 router also supports *CLI-controlled OIR* (see the [“CLI-Controlled OIR”](#) section on [page 4-17](#)), which allows for the completion of data traffic before the active interfaces are shut down.



Note

CLI-controlled OIR is the recommended way of performing OIR on this platform.



Note

As you disengage the line card from the router, online insertion and removal (OIR) administratively shuts down all active interfaces on the line card.



Note

Before you begin installation, read [Chapter 2, “Preparing for Installation,”](#) for a list of parts and tools required for installation.

Warnings and Cautions

Observe the following warnings and cautions when installing or removing line cards.

**Caution**

Do not slide a line card all the way into the slot until you have connected all required cables. Trying to do so disrupts normal operation of the router or switch.

**Note**

If a line card lever or other retaining mechanism does not move to the locked position, the line card is not completely seated in the backplane. Carefully pull the line card halfway out of the slot, reinsert it, and move the line card levers to the locked position.

**Caution**

To prevent jamming the carrier between the upper and the lower edges of the line card slot, and to ensure that the edge connector at the rear of the line card mates with the connection at the rear of the line card slot, make certain that the carrier is positioned correctly, as shown in the cutaway in the following illustrations.

**Warning**

When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.

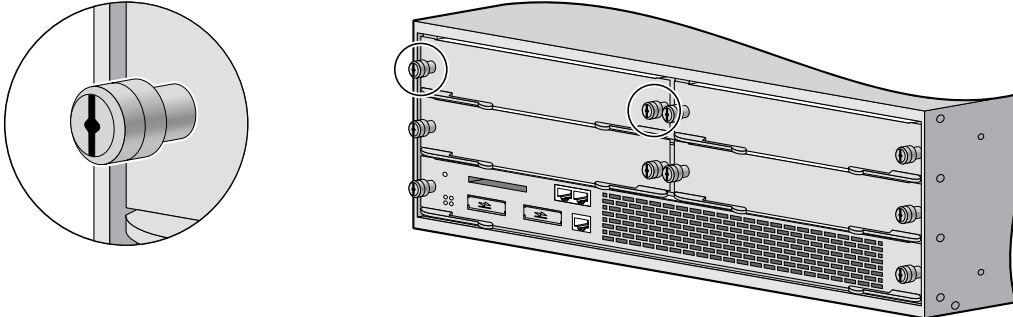
Line Card Removal and Installation

In this section, the illustrations that follow give step-by-step instructions on how to remove and install line cards. This section contains the following illustrations:

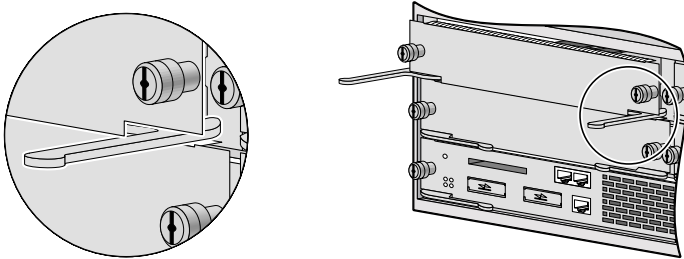
- [Cisco 7304—Removing and Installing a Line Card, page 3-4](#)

Cisco 7304—Removing and Installing a Line Card

1. To remove the line card, loosen the locking thumbscrews on both sides of the line card.

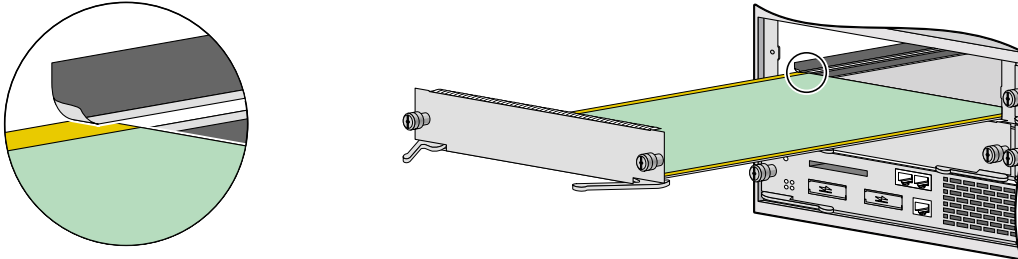


2. Pull out the line card levers and carefully slide the line card halfway out of the slot. If you are removing a blank line card, pull the blank line card completely out of the chassis slot.



3. With the line card halfway out of the slot, disconnect all cables from the line card. After disconnecting the cables, pull the line card out of the chassis slot.

4. To insert the line card, carefully align the edges of the carrier or printed circuit board between the upper and the lower edges of the chassis slot.



5. Carefully slide the new line card halfway into the line card slot and connect all required cables.

6. With the cables connected, carefully slide the line card into the slot until the line card makes contact with the backplane.

NOTE: The line card levers must be positioned at a 45-degree angle before the line card makes contact with the backplane.

7. Push the line card levers in until the line card is fully seated in the router backplane.

NOTE: When the chassis is fully populated, seating a new line card may be difficult. In order to properly seat the line card and avoid physical damage, loosen the thumbscrews on the neighboring line cards.

CAUTION: Use of excessive force to seat the line card may damage the router or line card.

8. Tighten the locking thumbscrews on both sides of the line card.

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Connecting a T3 SMB Cable

On a 6T3 line card, you can use six T3 SMB cables (one for each T3 link).

Each T3 link requires separate receive and transmit connections to your external T3 equipment.

To connect the T3 SMB cables to the 6T3 line card, follow these steps:

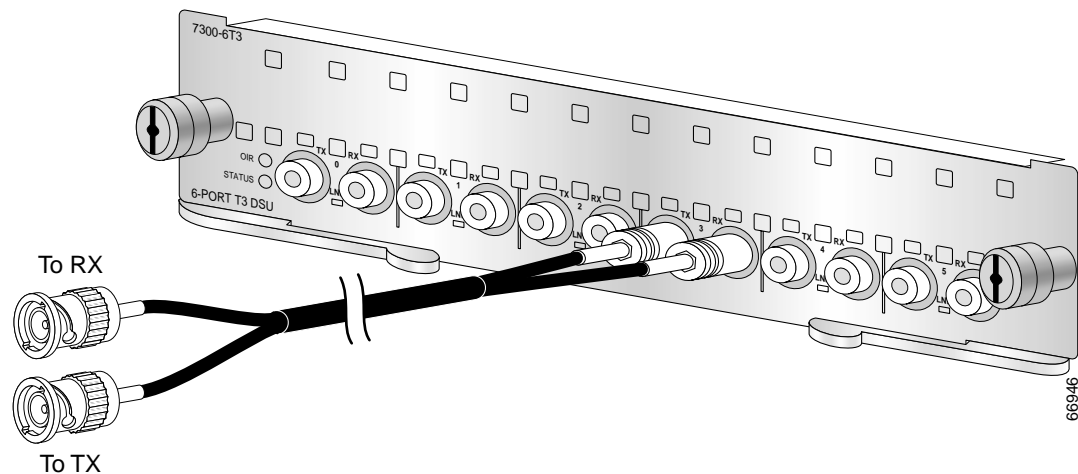
- Step 1** Attach the T3 SMB cables directly to the SMB ports on the 6T3 line card. Attach the SMB ends of the cable to the ports labeled TX and RX. (See [Figure 3-2](#).)



Note

If you build your own cables, we strongly recommend that you fasten together your transmit and receive cables along their entire length, as shown in [Figure 3-2](#). Doing so reduces the effects of EMI. You can use shielded jacketing or tubing for this purpose.

Figure 3-2 Attaching T3 SMB Cables to a 6T3 Line Card



Caution

To prevent system problems and to maintain the proper cable connection sequences, connect the receive and transmit ports on your 6T3 line card as indicated in Step 2.

- Step 2** Attach the BNC ends of your T3 SMB cables to your external T3 equipment as follows:
- Attach the T3 cable from the 6T3 line card TX port to the RX port on your external T3 equipment.
 - Attach the T3 cable from the 6T3 line card RX port to the TX port on your external T3 equipment.



Configuring the 6T3 Line Card

To continue your 6T3 line card installation, you must configure the serial interfaces.

This chapter contains the following sections:

- [Using the EXEC Command Interpreter, page 4-1](#)
- [Configuring the Interfaces, page 4-2](#)
- [Checking the Configuration, page 4-9](#)
- [CLI-Controlled OIR, page 4-17](#)
- [Line Card Crash Recovery, page 4-17](#)

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC* (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

-
- Step 1** At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password as follows:

```
Router> enable
```

```
Password:
```

- Step 2** Enter the password (the password is case sensitive). For security purposes, the password is not displayed. When you enter the correct password, the system displays the privileged-level system prompt (#):

```
Router#
```

To configure the new interfaces, proceed to the [“Configuring the Interfaces” section on page 4-2](#).

Configuring the Interfaces

After you verify that the new 6T3 line card is installed correctly (the STATUS LED goes on), use the privileged-level **configure** command to configure the new interfaces. Have the following information available:

- T3 information such as clock source and framing type
- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing
- Bridging protocols you plan to use
- Timing source for each new interface

If you installed a new 6T3 line card or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a 6T3 line card that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configuration.

For a summary of the configuration options available and instructions for configuring interfaces on a 6T3 line card, refer to the appropriate configuration publications listed in the [“Related Documentation” section on page viii](#).

You execute configuration commands from the privileged level of the EXEC command interpreter, which usually requires password access. Contact your system administrator, if necessary, to obtain password access. (See the [“Using the EXEC Command Interpreter” section on page 4-1](#) for an explanation of the privileged level of the EXEC.)

This section contains the following subsections:

- [Shutting Down an Interface, page 4-2](#)
- [Performing a Basic Configuration, page 4-4](#)
- [Customizing the 6T3 Line Card Configuration, page 4-6](#)

Shutting Down an Interface

Before you remove an interface that you will not replace, or replace line cards, use the **shutdown** command to shut down (disable) the interfaces to prevent anomalies when you reinstall the new or reconfigured interface processor. When you shut down an interface, it is designated *administratively down* in the **show** command displays.

Follow these steps to shut down an interface:

-
- Step 1** Enter the privileged level of the EXEC command interpreter (also called enable mode). (See the [“Using the EXEC Command Interpreter” section on page 4-1](#) for instructions.)
- Step 2** At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:
- ```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```
- Step 3** Shut down interfaces by entering the **interface serial** subcommand (followed by the interface address of the interface), and then enter the **shutdown** command. [Table 4-1](#) shows the command syntax.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter.

**Table 4-1** Syntax of the shutdown Command

| Platform           | Command                                                                                                                   | Example                                                                                                                                                                                                                                                                                  |
|--------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco 7304 routers | <b>interface</b> , followed by the <i>type</i> ( <b>serial</b> ) and <i>slot/port</i> (slot-number/interface-port-number) | The example is for interface 0 and interface 1 on a 6T3 line card in slot 2.<br><br><pre>Router(config-if)# <b>interface serial 2/0</b> Router(config-if)# <b>shutdown</b> Router(config-if)# <b>interface serial 2/1</b> Router(config-if)# <b>shutdown</b> <b>Ctrl-Z</b> Router#</pre> |



**Note** If you need to shut down additional interfaces, enter the **interface serial** command (followed by the interface address of the interface) for each of the interfaces on your line card. Use the **no shutdown** command to enable the interface.

**Step 4** Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored in NVRAM.

**Step 5** Verify that new interfaces are now in the correct state (shut down) using the **show interfaces** command (followed by the interface type and interface address of the interface) to display the specific interface. [Table 4-2](#) provides examples.

**Table 4-2** Examples of the show interfaces serial Command

| Platform          | Command                                                                                          | Example                                                                                                                                                                                                                                   |
|-------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco 7304 router | <b>show interfaces serial</b> , followed by <i>slot/port</i> (slot-number/interface-port-number) | The example is for interface 0 on a 6T3 line card in slot 2.<br><br><pre>Router# <b>show interfaces serial 2/0</b>  Serial 2/0 is administratively down, line protocol is down  [Additional display text omitted from this example]</pre> |

- Step 6** Reenable interfaces by doing the following:
- Repeat Step 3 to reenable an interface. Substitute the **no shutdown** command for the **shutdown** command.
  - Repeat Step 4 to write the new configuration to memory. Use the **copy running-config startup-config** command.
  - Repeat Step 5 to verify that the interfaces are in the correct state. Use the **show interfaces** command followed by the interface type and interface address of the interface.

For complete descriptions of software configuration commands, refer to the publications listed in the “[Related Documentation](#)” section on page viii.

## Performing a Basic Configuration

Following are instructions for a basic configuration: enabling an interface and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration subcommands and the configuration options available for serial interfaces, refer to the appropriate software documentation.

In the following procedure, press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable
```

```
Router>
```

- Step 1** Enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

- Step 2** Specify the first interface to configure by entering the **interface serial** subcommand, followed by the interface address of the interface you plan to configure. [Table 4-3](#) provides an example.

**Table 4-3** Examples of the interface serial Subcommand

| Platform          | Command                                                                                    | Example                                                                                                                                       |
|-------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco 7304 router | <b>interface serial</b> , followed by <i>slot/port</i> (slot-number/interface-port-number) | The example is for the first interface of a 6T3 line card in slot 4.<br><br>Router(config)# <b>interface serial 4/0</b><br>Router(config-if)# |

- Step 3** Assign an IP address and subnet mask to the interface (if IP routing is enabled on the system) by using the **ip address** subcommand, as in the following example:

```
Router(config-if)# ip address 10.0.0.0 10.255.255.255
```

- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.



- Step 5** Reenable the interfaces using the **no shutdown** command. (See the “[Shutting Down an Interface](#)” section on page 4-2.)
- Step 6** Configure all additional line card interfaces as required.
- Step 7** After including all of the configuration subcommands to complete your configuration, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.
- Step 8** Write the new configuration to NVRAM as follows
- ```
Router# copy running-config startupup-config
[OK]
Router#
```

This completes the procedure for creating a basic configuration.

[Table 4-4](#) shows the default values for the 6T3 line card serial interfaces.

Table 4-4 6T3 Line Card Serial Interface Default Values

Parameter	Configuration Command	Default Value
Clock source	clock source [internal line]	line
Cyclic redundancy check	crc [16 32]	16
DSU mode	[no] dsu mode [adtran cisco digital-link kentrox larscom]	cisco
DSU subrate bandwidth	[no] dsu bandwidth <i>kbps</i>	44210
Encapsulation	encapsulation [hdlc ppp]	hdlc
Far-end DSU bandwidth	[no] dsu remote fullrate	subrate
Framing mode	[no] framing [c-bit m23]	c-bit
Idle character mode	[no] idle-character [flags marks]	flags
Invert data	[no] invert data	No invert data
Keepalive	[no] keepalive [seconds]	keepalive 10
Loopback mode	[no] loopback [local network line network payload remote dte]	no loopback
Maximum transmission unit	[no] mtu <i>bytes</i>	4470 bytes
Payload scrambling	[no] scramble	no scramble
Remote requests	[no] dsu remote accept	accept
Transmitter delay	[no] transmitter-delay # <i>of idle characters</i>	0–255
Cable length	cable length { 0–450 }	50

Customizing the 6T3 Line Card Configuration

There are two sides to the network, a local network side and a remote customer side, or near and far ends. The 6T3 line card supports third-party data service units (DSUs), Internet Service Provider (ISP)-provided DS3 lines, and so on. You can change the configuration parameter default values in the 6T3 line card port interfaces to match the remote DSUs on your network. Table 4-5 shows the configuration parameters.

Table 4-5 6T3 Line Card Serial Interface DSU Modes

Parameter	Configuration Command	Default Value	Command
DSU mode	[no] dsu mode [adtran cisco digital-link kentrox larscom]	cisco	Router(config-if)# dsu mode cisco
DSU subrate bandwidth	[no] dsu bandwidth <i>kbps</i>	44210	Router(config-if)# dsu bandwidth 44210
Far-end DSU bandwidth	[no] dsu remote fullrate	subrate	Router(config-if)# dsu remote fullrate
Payload scrambling	[no] scramble¹	no scramble	Router(config-if)# scramble
Remote requests	[no] dsu remote accept	accept	Router(config-if)# dsu remote accept
Cyclic redundancy check	crc [16 32]	16	Router(config-if)# crc 16

1. Adtran DSU mode does not support payload scrambling.



Note

The local port and the remote port must have matching configuration.

Verifying Local and Remote DS3 Port Settings

You can use **telnet** to determine the DSU mode settings on the remote DS3 port. Once you verify the remote DS3 port settings, you can negotiate changing configuration parameters so that DSU mode settings are the same on both the local and remote DS3 ports. You can set the DSU bandwidth to accept or reject the incoming remote requests from the local DS3 port by entering the **dsu remote accept** interface configuration command.

Selecting a DSU Mode

The DSU mode supports several third-party DSU vendors—Adtran, Digital Link, Kentrox, and Larscom—and the default DSU mode, Cisco. If you use a DSU to make the connection between the Cisco 7304 router and another device, the local DS3 port configuration must match the remote DS3 port configuration. Therefore, if the remote DS3 port uses the Kentrox vendor, a request is sent to the local DS3 port to change the DSU mode to Kentrox, either by manually entering the **dsu mode** configuration command and specifying the Kentrox DSU or by using the Cisco Remote Connection Management (CRCM) feature to remotely configure the remote DS3 port. If you make a direct connection between a Cisco 7304 router and another device, you can use the Cisco DSU mode.

Setting the Sending and Receiving Rate

The local and remote DS3 ports must also agree on whether to use a subrate or fullrate sending and receiving rate, because the speed of the sending and receiving rate is regulated by the DSU mode. If the sending and receiving rates do not match, they will not work. Subrates are specific to DSU modes and must be configured appropriately. The subrate sending and receiving rate is slower and less expensive than the faster, more expensive, fullrate. You can synchronize the local and remote DS3 ports sending and receiving rates by entering the **dsu remote** interface configuration command.

Configuring the DSU Bandwidth Range

The DSU bandwidth range is from 0 to 44210 kbps. The local port and the remote port must have matching configuration. Therefore, if you reduce the effective bandwidth to 3000 on the local port, you must do the same on the remote port by entering the **dsu bandwidth** interface configuration command.

In interface configuration mode, reduce effective bandwidth (range of 0 to 44210 kbps) by entering the **dsu bandwidth** configuration subcommand, as in the following example:

```
Router(config-if)# dsu bandwidth 3000
```

Use the **no** form of this command to return to the default, 44210.



Note

The local port configuration must match the remote port configuration.

Enabling Payload Scrambling

Payload (data) scrambling converts the data received by the local or remote DS3 ports from the Digital Link, Kentrox, and Larscom third-party DSU vendor modes as well as the default, Cisco mode. The Adtran DSU mode does *not* support payload scrambling.

To enable payload scrambling on the local and remote DS3 ports, you must enter the **scramble** interface configuration command. If you do not enter the **scramble** command, payload scrambling remains disabled by default on the local and remote DS3 ports.

Configuring Cyclic Redundancy Checks

Table 4-6 summarizes cyclic redundancy check (CRC) commands. For more information, see the remainder of this section.

Table 4-6 CRC Commands

Purpose	Command	Example	Further Information
Enable 32-bit CRC.	crc size	The example enables 32-bit CRC on a serial interface: Router(config)# interface serial 3/0 Router(config-if)# crc 32	“Selecting a DSU Mode”
Return to default 16-bit CRC.	no crc size	The example disables 32-bit CRC on a serial interface and returns to the default 16-bit CRC: Router(config)# interface serial 3/0 Router(config-if)# no crc 32	“Selecting a DSU Mode”

CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. All interfaces use a 16-bit CRC (CRC-CITT) by default but also support a 32-bit CRC. The sender of a data frame calculates the frame check sequence (FCS). Before it sends a frame, the sender appends the FCS value to the message. The receiver recalculates the FCS and compares its calculation to the FCS from the sender. If there is a difference between the two calculations, the receiver assumes that a transmission error occurred and sends a request to the sender to resend the frame.

Enable 32-bit CRC using the **crc 32** command. Before you can enable 32-bit CRC, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface on which you want to enable 32-bit CRC. This command functions in the same way on all supported platforms.

In the example that follows, 32-bit CRC is specified:

```
Router(config-if)# crc 32
```

The preceding command example applies to all systems in which the 6T3 line card is supported. Use the **no crc 32** command to disable CRC-32 and return the interface to the default CRC-16 (CRC-CITT) setting.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.



Note

When enabling a 16-bit or 32-bit CRC on a local interface, ensure that the remote device is also configured for a 16-bit or 32-bit CRC.

For command descriptions, refer to the *Configuration Fundamentals Configuration Guide* publication. For more information, see the [“Obtaining Documentation”](#) section on page viii and the [“Obtaining Technical Assistance”](#) section on page x.

Configuring the Clock Source

The only exception for matching local and remote DS3 port configurations is that the clock sources must be set opposite each other. Therefore, if you enter the **clock source internal** command for the local DS3 port, you must enter **clock source line** for the remote DS3 port.

Defining the DSU Mode

In interface configuration mode, define the DSU interoperability mode by entering the **dsu mode [adtran | [cisco | digital-link | kentrox | larscom]** configuration subcommand, as in the following example:

```
Router(config-if)# dsu mode cisco
```

Use the **no** form of this command to return to the default, 0.



Note

The local port configuration must match the remote port configuration. For example, if you define the DSU interoperability mode as **cisco** on the local port, you must do the same on the remote port. You need to know what type of DSU is at the remote port to find out if it interoperates with the 6T3 line card. For T3 serial interfaces, specify **cisco** for connection from a 6T3 line card to another 6T3 line card. Specify

adtran for connection from a 6T3 line card to an Adtran DSU. Specify **digital-link** for connection to a Digital Link DSU (DL3100). Specify **kentrox** for connection from a 6T3 line card to a Kentrox DSU. Specify **larscom** for connection from a 6T3 line card to a Larscom DSU.

Also see the “[Interoperability Guidelines for 6T3 Line Card DSUs](#)” section on page 1-3 for information regarding DSU feature compatibilities.

Enabling T3 Scrambling

In interface configuration mode, enable T3 scrambling by entering the **scramble** configuration subcommand, as in the following example:

```
Router(config-if)# scramble
```

Use the **no** form of this command to restore the default value, disabled.



Note

The local port configuration must match the remote port configuration. For example, if you enable scrambling on the local port, you must do the same on the remote port.

Also see the “[Interoperability Guidelines for 6T3 Line Card DSUs](#)” section on page 1-3 for information regarding DSU feature compatibilities.

Specifying T3 Framing

In interface configuration mode, specify T3 framing by entering the **framing {c-bit | m23}** configuration subcommand, as in the following example:

```
Router(config-if)# framing c-bit
```

Use the **no** form of this command to return to the default, C-bit framing.

Setting the Cable Length

In interface configuration mode, set the cable length (0 to 450 feet), as in the following example:

```
Router(config-if)# cablelength 250
```

Use the **no** form of this command to return to the default, which is 50 feet.

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces, and use the **ping** and **loopback** commands to check connectivity. This section includes the following subsections:

- [Using show Commands to Verify the New Interface Status, page 4-10](#)
- [DS3 Alarm and Event Detection, page 4-14](#)
- [Using the ping Command to Verify Network Connectivity, page 4-15](#)
- [Using loopback Commands, page 4-15](#)
- [Bit Error Rate Testing, page 4-17](#)

Using show Commands to Verify the New Interface Status

Table 4-7 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the 6T3 line card appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the “[Related Documentation](#)” section on page viii.


Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Table 4-7 Using show Commands

Command	Function	Example
show version or show hardware	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	Router# show version
show controllers	Displays all the current interface processors and their interfaces	Router# show controllers
show diag slot	Displays types of line cards installed in your system and information about a specific chassis slot	Router# show diag 2
show interfaces type slot-number/ interface-port-number	Displays status information about a specific type of interface (for example, serial) in a Cisco 7304 router	Router# show interfaces serial 2/0
show protocols	Displays protocols configured for the entire system and for specific interfaces	Router# show protocols
show running-config	Displays the running configuration file	Router# show running-config
show startup-config	Displays the configuration stored in NVRAM	Router# show startup-config

If an interface is shut down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections:

- [Using the show version or show hardware Commands, page 4-11](#)
- [Using the show diag Command, page 4-12](#)
- [Using the show interfaces Command, page 4-13](#)

Choose the subsection appropriate for your system. Proceed to the “[Using the ping Command to Verify Network Connectivity](#)” section on page 4-15 when you have finished using the **show** commands.

Using the show version or show hardware Commands

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images by using the **show version** (or **show hardware**) command.



Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Cisco 7304 Routers

Following is an example of the **show version** command from a Cisco 7304 router with the 6T3 line card:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.1(1.23.139), CISCO DEVELOPMENT VERSION
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Thu 20-Dec-01 03:25 by cva
Image text-base:0x40008970, data-base:0x41796000

ROM: System Bootstrap, Version 12.1(20011026:021245) [hih-rommon_1_1 101], DEVELOPMENT
SOFTWARE
Currently running ROMMON from ROM 1
BOOTLDR: 7300 Software (C7300-BOOT-M), Version 12.1(1.23.87), CISCO DEVELOPMENT VERSION

nag-wsl uptime is 10 minutes
System returned to ROM by reload
System image file is "disk0:c7300-js-mz.121-10.EX"

cisco 7300 (NSE100) processor (revision A) with 114688K/16384K bytes of memory.
Processor board ID
R7000 CPU at 350Mhz, Implementation 39, Rev 3.2, 256KB L2, 1024KB L3 Cache
4 slot midplane, Version 65.48

Last reset from software reset or reload
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc0 running 'system:pxf/ucodel' v1.4 is active
PXF processor tmcl running 'system:pxf/ucodel' v1.4 is active
1 FastEthernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)
6 Serial network interface(s)
509K bytes of non-volatile configuration memory.

16064K bytes of ATA compact flash in bootdisk (Sector size 512 bytes).
31360K bytes of ATA compact flash in disk0 (Sector size 512 bytes).
Configuration register is 0x0
```

Using the show diag Command

Display the types of line cards installed in your system (and specific information about each) using the **show diag slot** command.



Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Cisco 7304 Routers

Following is an example of the **show diag slot** command that shows the 6T3 line card in slot 5 of a Cisco 7304 router:

```
Router# show diag 5
```

```
Slot 5:
```

```
T3 Line Card, 6 ports
Line Card state:Active
Insertion time:00:02:10 ago
Bandwidth points:30
EEPROM contents at hardware discovery:
Hardware Revision      :2.1
Unknown Field (type 0046):00 00
PCB Serial Number     :CAB0541KUZ4
Part Number           :73-5938-02
Board Revision        :A0
Fab Version           :02
RMA Test History      :00
RMA Number            :0-0-0-0
RMA History           :00
Deviation Number      :0-0
Product Number        :7300-6T3
Top Assy. Part Number :68-0000-00
Manufacturing Test Data :00 00 00 00 00 00 00 00
Field Diagnostics Data :00 00 00 00 00 00 00 00
Calibration Data      :Minimum:0 dBmV, Maximum:0 dBmV
    Calibration values :
EEPROM format version 4
EEPROM contents (hex):
    0x00:04 FF 40 02 E8 41 02 01 46 00 00 C1 8B 43 41 42
    0x10:30 35 34 31 4B 55 5A 34 82 49 17 32 02 42 41 30
    0x20:02 02 03 00 81 00 00 00 00 04 00 80 00 00 00 00
    0x30:CB 94 37 33 30 30 2D 36 54 33 20 20 20 20 20 20
    0x40:20 20 20 20 20 20 87 44 00 00 00 C4 08 00 00 00
    0x50:00 00 00 00 00 C5 08 00 00 00 00 00 00 00 00 C8
    0x60:09 00 00 00 00 00 00 00 00 00 C7 7C F6 44 3F 30
    0x70:00 00 00 00 00 00 00 00 00 00 00 00 07 08 64 32
    0x80:28 37 26 09 C4 64 32 28 32 DD 0C E4 64 32 28 43
    0x90:24 2E E0 AA 82 64 F4 24 00 00 00 00 00 00 00 00
    0xA0:00 00 00 00 00 00 F4 C8 FF FF FF FF FF FF FF FF
    0xB0:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0xC0:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0xD0:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0xE0:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0xF0:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

This linecard has not crashed since its insertion

Using the show interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify. The example that follows specifies serial interfaces.

**Note**

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Cisco 7304 Routers

Following is an example of the **show interfaces** command for Cisco 7304 routers. In this example, the serial interfaces (0 to 5) are on a 6T3 line card in slot 5; also, the status information for interfaces 1 through 5 is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 5/0
Serial5/0 is up, line protocol is up
  Hardware is Packet over DS3
  Internet address is 50.1.1.2/8
  MTU 9216 bytes, BW 44210 Kbit, DLY 200 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Scramble enabled
  Last input 15:00:13, output 15:00:13, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
    5 packets input, 520 bytes, 0 no buffer
    Received 0 broadcasts, 101 runts, 0 giants, 0 throttles
      0 parity
    0 input errors, 0 CRC, 0 frame, 0 overrun, , 42 abort
    5 packets output, 520 bytes, 0 underruns
    0 output errors, 0 applique, 4 interface resets
    0 output buffer failures, 0 output buffers swapped out
    4 carrier transitions
[Additional display text omitted from this example]
```

DS3 Alarm and Event Detection

This section assumes that you are familiar with DS3 alarms and line states. The 6T3 line card does not have an LED for alarm and event detection. However, you can enter the **show controllers serial slot/port EXEC** command to verify whether the alarm and event detection messages are active or inactive. Most alarm and event detection messages are short-lived, because if problems occur, the line card clears the error condition, but records the event to verify line card operation status.

The output from the **show controllers serial slot/port EXEC** command sends messages about the following types of alarms and events:

- AIS (Alarm Indication Signal)
- LOF (Loss of Frame)
- LOS (Loss of Signal)
- OOF (Out of Frame)
- RAI (Remote Alarm Indication)

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The output also indicates whether the alarm or event originates from the local end connector or the remote end connector, as shown in the following example:

```
Router# show controllers serial 5/0
Interface Serial5/0 (DS3 port 0)
Line state is up
  rxLOS inactive, rxLOF inactive, rxAIS inactive
  txAIS inactive, txRAI inactive, txRAI inactive
Current configurable parameter settings:
  Loopback is none, Framing is c-bit
  Clock source is internal, Cable length is 50
  DSU mode is cisco, DSU bandwidth limit is 44210
  Payload scrambling is disabled, CRC is 16
  Transmitter delay is 0, Encapsulation is HDLC
  Idle character is flags, Invert data is disabled
  Remote fullrate has no request outstanding
  Remote accept is enabled, MTU is 9216
MIB information:
  Data in current interval (127 seconds elapsed):
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations
    0 P-bit Err Secs, 0 P-bit Sev Err Secs
    0 Sev Err Framing Secs, 8 Unavailable Secs
    0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  No alarms detected.
    0 AIS, 1 LOF, 2 RAI, 118 FEBE
  Last FEAC code received:AIS
Interface 5/0 counters:
  Total input packets = 0, bytes = 0, drops = 0
  Total output packets = 0, bytes = 0, drops = 0
  PXF i/f number = 0x1E
  PXF Hdr lo = 0x300001E, PXF Hdr hi = 0x30000000
```

Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. This section provides a brief description of this command. Refer to the publications listed in the “[Related Documentation](#)” section on page viii for detailed command descriptions and examples.

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), and repeat the **ping** command.

Proceed to the next section, “[Using loopback Commands](#),” to finish checking network connectivity.

Using loopback Commands

With the loopback test, you can detect and isolate equipment malfunctions by testing the connection between the 6T3 line card interface and a remote device such as a modem or a CSU/DSU. The **loopback** command places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device or compact serial cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or compact serial cable in the path of the loopback test.

[Table 4-8](#) provides examples of the **loopback {dte | local | network {line | payload} | remote}** command. The examples given are for interface 0 of a 6T3 line card in slot 2 of a Cisco 7304 router:

Table 4-8 Using loopback Commands

Command	Function	Example
loopback local	Sets the interface into local loopback mode. Local loopback loops the router output data back toward the router at the framer.	Router(config)# interface serial 2/0 Router(config-if)# loopback local
loopback network line	Sets the interface into network line loopback mode. Network line loopback loops the data back toward the network (before the framer).	Router(config)# interface serial 2/0 Router(config-if)# loopback network line

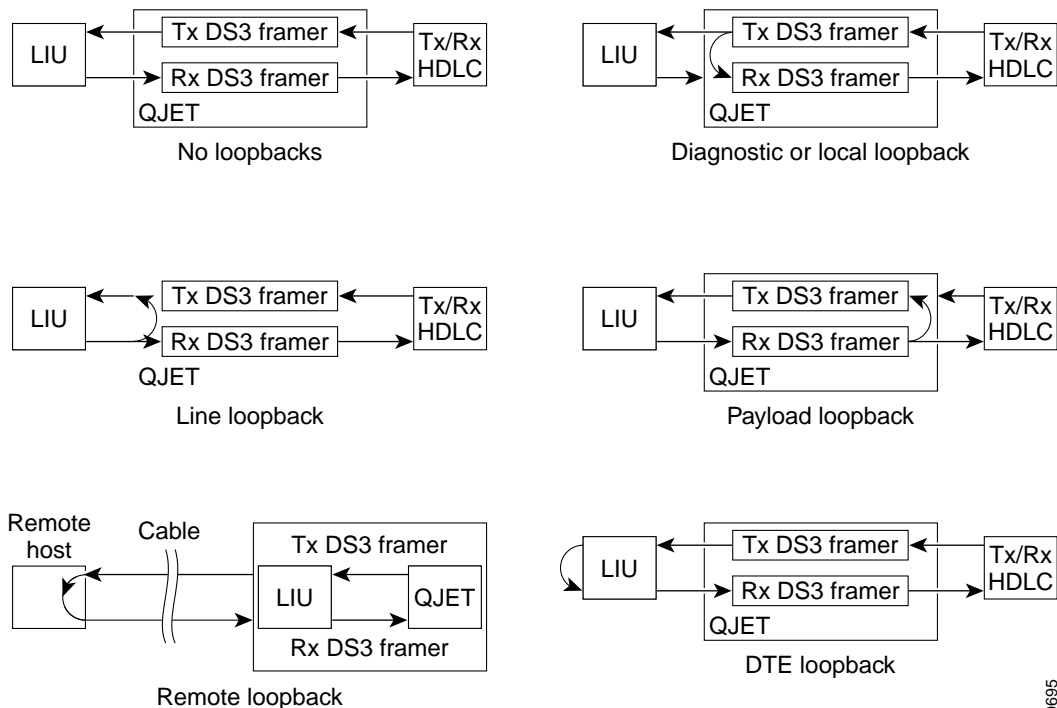
Table 4-8 Using loopback Commands (continued)

Command	Function	Example
loopback network payload	Sets the interface into network payload loopback mode. Network payload loopback loops just the payload data back toward the network at the T3 framer.	Router(config)# interface serial 2/0 Router(config-if)# loopback network payload
loopback remote¹	Sets the interface into remote loopback mode. Remote loopback loops the data back toward the network (before the framer at the remote T3 device).	Router(config)# interface serial 2/0 Router(config-if)# loopback remote
loopback dte	Sets the interface into loopback data terminal equipment (DTE). Loopback DTE loops the router output data back toward the router (after the LIU).	Router(config)# interface serial 2/0 Router(config-if)# loopback dte

1. Remote loopback mode works with C-bit framing only. The other loopback modes listed above work with C-bit and M23 framing. Refer to the "Specifying T3 Framing" section on page 4-9 for information on configuring C-bit framing.

Figure 4-1 shows the data flow for three loopback configuration paths, including no loopback.

Figure 4-1 DS3 Loopback Paths



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Bit Error Rate Testing

The ratio of received bits on an interface that contain errors is called the bit error rate (BER). A bit error rate test (BERT) is used to check the BER. T3 bit error rate testing is used on the Cisco 7304 router to check communication between local and remote DS3 ports. If traffic is not being transmitted or received on a DS3 port, or if the quality of the line simply needs to be tested, T3 bit error rate testing can be used to test the port.

For information on performing bit error rate testing, refer to [T3 Bit Error Rate Testing on the Cisco 7304 Router](#).

CLI-Controlled OIR

Line cards can be removed from the Cisco 7304 router without disrupting data flow by using the **hw-module slot slot # stop/start** command in EXEC mode. The **hw-module slot slot # stop** command will stop traffic, shut down all line card interfaces, and deactivate the line card. The **hw-module slot slot # start** command resets the line card, puts the line card back online and turns off the OIR LED.



Note

Upon insertion of a line card, the system will automatically activate the card. The **hw-module slot slot # start** command is only necessary when reactivating an installed line card that has been deactivated with the **hw-module slot slot # stop** command.

To remove and install an active line card in slot 2 proceed as follows:

```
Router# hw-module slot 2 stop
```

When the OIR LED turns green, the line card in slot 2 has been deactivated and can be physically removed and replaced with a new line card (see the “[Line Card Removal and Installation](#)” section on [page 3-3](#).)

When the new line card is inserted in slot 2 it is automatically reset, put online, and the OIR LED is turned off.

Line Card Crash Recovery

The 6T3 line card automatically recovers from the following catastrophic errors:

- Fatal serial link errors
- Line card local processor firmware crash
- Loss of keepalive packets from line card local processor
- Hardware errors reported by line card devices
- Too many line card error interrupts (more than 60 interrupts within 10 processor ticks)

If the 6T3 line card encounters more than five fatal errors within one hour, recovery will not be attempted and the line card will be deactivated. To reactivate the line card use the **hw-module slot slot # start** command, or physically remove and replace the line card.

The 6T3 line card crash history may be viewed by using the **show diag slot** command. The crash history is saved as long as the line card is physically present in the chassis. Physically removing the 6T3 line card from the chassis or performing a CLI-controlled OIR will clear the crash history.

The following messages are associated with line card recovery:

Error Message 00:00:06:% LC-3-RECOVERY: Line card (slot <x>) recovery in progress

Error Message 00:00:06:% LC-3-EXCESSERRORS: Noof errors seen on the line card (slot <x>) exceed the threshold

When the 6T3 line card encounters any of the non-recoverable errors listed below, the line card is deactivated and must be restarted by performing a CLI-controlled OIR or physically removing and installing the line card.

- Line card hardware failures
- Line card local processor boot code/firmware initialization failure (failure to boot or boot code exceptions, firmware download failure)
- Environmental critical conditions (voltage and temperature)
- Insufficient system memory to allocate critical line card driver data structures during line card initialization

The following examples show non recoverable fatal error messages:

Error Message 00:00:06% SERIAL-0-DLL_OUTOFLOCK: T3 HW DLLS failed to lock in line card at slot <x>

Error Message 00:00:06% SERIAL-0-860_BOOT_NOTOK: T3 Line card local processor at slot <x> failed to boot

Error Message 00:00:06% SERIAL-3-FW_CHECKSUM_FAILED: T3 line card in slot <x>, firmware integrity check failed (section <x>, expected checksum: <x>, calculated checksum: <x>)

Error Message 00:00:06% ENVM-0-SHUTDOWN: Environmental Monitor initiated shutdown due to <voltage/temperature/power supply> in slot <x>

Error Message 00:00:06% SERIAL-1-ALLOCFAIL: T3 (slot <x>) line card plugin structure allocation failure

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