Multichannel STM-1 Service Module
Installation and Configuration on Cisco
3900 Series Integrated Services Routers

Product Number: SM-1-STM1-SM-C(=), SM-1-STM1-MM-C(=)

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-23027-01
Preface 3

Objectives 1-4
Organization 1-4
Related Documentation 1-5
Obtaining Documentation, Obtaining Support, and Security Guidelines 1-5

CHAPTER 1
Overview 1-1
Service Module Overview 1-1
SDH Overview 1-4
SM-1-STM1 Multiplexing Hierarchy 1-5
Features 1-5
SM-1-STM1 Optical Fiber Specifications 1-6
LEDs and Ports 1-7
Cables, Connectors, and Pinouts 1-8
Network Management 1-9
Service Module Slot Locations on the Cisco 3900 Series Integrated Services Routers 1-10
Cisco 3900 Series Routers Slot Numbering 1-10
Identifying Interface Addresses 1-10

CHAPTER 2
Preparing for Installation 2-1
Required Tools and Equipment 2-1
Minimum Software and Hardware Requirements 2-1
Checking Hardware and Software Compatibility 2-2
Safety Guidelines 2-2
Warning Definition 2-2
Electrical Equipment Guidelines 2-8
Preventing Electrostatic Discharge Damage 2-8
Laser and LED Safety 2-8
FCC Class A Compliance 2-10

CHAPTER 3
Removing and Installing Service Modules 3-1
Handling Service Modules 3-1
Contents

Online Insertion and Removal 3-2
Warnings and Cautions 3-2
  Equipment Installation Warning 3-2
Service Module Removal and Installation 3-3
Connecting a SM-1-STM1 Cable 3-3

CHAPTER 4
Configuring the SM-1-STM1 4-1
Configuring the Interface 4-1
  Shutting Down an Interface 4-2
  Performing a Basic Interface Configuration 4-3
  Configuring the AU-3s and TUG-3s of a SM-1-STM1 4-4
  Configuring an E1 Unframed Channel 4-5
Checking the Configuration 4-5
  Using show Commands to Verify the New Interface Status 4-5
    Using the show controllers Commands 4-6
    Using the show protocols Command 4-6
    Using the show running-config Command 4-7
    Using the show startup-config Command 4-7
    Using the show version or show hardware Commands 4-9
    Using the show diag Command 4-10
    Using the show interfaces Command 4-11
  Using the ping Command to Verify Network Connectivity 4-12
  Using loopback Commands 4-12

INDEX
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 4
- Organization, page 4
- Related Documentation, page 5
- Obtaining Documentation, Obtaining Support, and Security Guidelines, page 5
Objectives

This document describes how to install and configure the multichannel STM-1 service module (SM-1-STM1-SM-C and SM-1-STM1-MM-C), hereafter referred to as the SM-1-STM1, which is used in the Cisco Integrated Services Routers Generation 2 (ISR G2), which include Cisco 3925, Cisco 3945, Cisco 3925E and Cisco 3945E routers.

Organization

This document contains the following chapters:

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1</td>
<td>Overview</td>
<td>Describes the SM-1-STM1 and its LED displays, cables, and receptacles.</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>Preparing for Installation</td>
<td>Describes safety considerations, tools required, and procedures you should perform before the actual installation.</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>Removing and Installing Service Modules</td>
<td>Describes the procedures for installing and removing SM-1-STM1 service modules in the supported platform.</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>Configuring the SM-1-STM1</td>
<td>Provides instructions for configuring the SM-1-STM1 on the supported platform.</td>
</tr>
</tbody>
</table>
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 3925 and Cisco 3945 integrated services routers:
  - To quickly access documents for the Cisco 3900 series ISRs, refer to the following URL: http://www.cisco.com/en/US/products/ps10536/prod_installation_guides_list.html
- For international agency compliance, safety, and statutory information, refer to the following document:
  - Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers

Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and recommended aliases and general Cisco documents, see the monthly What’s New in Cisco Product Documentation, which also lists all new and revised technical documentation at:

Overview

This chapter describes the SM-1-STM1 service modules (SM) and contains the following sections:

- Service Module Overview, page 1-1
- SDH Overview, page 1-4
- SM-1-STM1 Multiplexing Hierarchy, page 1-5
- Features, page 1-5
- SM-1-STM1 Optical Fiber Specifications, page 1-6
- LEDs and Ports, page 1-7
- Cables, Connectors, and Pinouts, page 1-8
- Network Management, page 1-9
- Service Module Slot Locations on the Cisco 3900 Series Integrated Services Routers, page 1-10
- Identifying Interface Addresses, page 1-10

Service Module Overview

The SM-1-STM1-SM-C, shown in Figure 1-1, is a single-mode, high-speed, single-port multichannel STM-1 service module. SM-1-STM1-MM-C, shown in Figure 1-2, is a multi-mode, high-speed, single-port multichannel STM-1 service module. You can configure the SM-1-STM1 as a multichannel E1 STM-1 port, which can be configured into 63 individual E1 links. Each E1 link can carry a single channel at full or fractional rates, or it can be broken down into multiple DS0 rates.

The following restrictions exist:

- The maximum number of channels is limited to 226 per SM-1-STM1.
- This Cisco IOS software (Cisco IOS version 15.1(2)T) does not support more than two SM-1-STM1 SMs in the 3900 series ISRs.
- For OIR support, the STM-1 controller needs to be in a shutdown state before hot-swapping the module.
- Loopback support on the SONET controller is used for diagnostics only with no functional impact to the loopback feature. The following behavior is noted: Link is flapped on the peer interface when the SONET controller is set to loopback [local | network]. Using the `shutdown/no shutdown` command will overcome the link flap. Refer to “Shutting Down an Interface” section on page 4-2 for details on using the `shutdown/no shutdown` command.
The maximum number of FIFO buffers is 2048. The FIFO buffers are shared among the interfaces; how they are shared is determined by speed. If all the FIFO buffers have been assigned to existing interfaces, a new interface cannot be created, and the “%Insufficient FIFOs to create channel group” error message is seen. FIFO allocation information is provided in Table 1-1, and examples of supported and unsupported configurations are provided in Table 1-2 and Table 1-3.

**Table 1-1 FIFO Allocation**

<table>
<thead>
<tr>
<th>Number of Timeslots</th>
<th>Number of FIFO Buffers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Full E1</td>
<td>32</td>
</tr>
</tbody>
</table>
Following are three examples of supported and unsupported configurations.

**Table 1-2  Supported Configurations**

<table>
<thead>
<tr>
<th>Supported Configurations</th>
<th>Total FIFO Buffers</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 E1s –&gt; x 32 FIFOs =</td>
<td>2016</td>
</tr>
<tr>
<td>226 DSOs –&gt; 226 x 3 FIFOs =</td>
<td>678</td>
</tr>
<tr>
<td>62 E1s + 21 DSOs –&gt; (62 x 32) + (21 x 3) =</td>
<td>2047</td>
</tr>
</tbody>
</table>

**Table 1-3  Unsupported Configurations**

<table>
<thead>
<tr>
<th>Unsupported Configurations</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>228 DS0s –&gt;</td>
<td>226 interface limit is exceeded</td>
</tr>
<tr>
<td>62 E1s with 31 DSOs –&gt; (62 x 32) + (31 x 3) =</td>
<td>2077 FIFOs (exceeds 2048 FIFO limit)</td>
</tr>
</tbody>
</table>

The SM-1-STM1 supports up to three TUG-3/AU-3 transport slots numbered 1 to 3.

**Figure 1-1  SM-1-STM1-SM-C—Faceplate View**

**Figure 1-2  SM-1-STM1-MM-C—Faceplate View**
SDH Overview

Synchronous Digital Hierarchy (SDH) is the international standard for optical digital transmission at hierarchical rates from 155.520 Mbps (STM-1) to 2.5 Gbps (STM-16) and greater.

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

### Table 1-4 SDH Transmission Rates

<table>
<thead>
<tr>
<th>SDH</th>
<th>Transmission Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM-1</td>
<td>155.520 Mbps</td>
</tr>
<tr>
<td>STM-4</td>
<td>622.080 Mbps</td>
</tr>
<tr>
<td>STM-16</td>
<td>2,488.320 Mbps</td>
</tr>
<tr>
<td>STM-64</td>
<td>9,953.280 Mbps</td>
</tr>
</tbody>
</table>

The SM-1-STM1 currently allows transmission over single-mode and multimode optical fiber only. Transmission rates are integral multiples of 51.840 Mbps, which can be used to carry E3 bit-synchronous signals.

---

**Warning**

No user-serviceable parts inside. Do not open. Statement 1073

---

**Warning**

Installation of the equipment must comply with local and national electrical codes. Statement 1074
SM-1-STM1 Multiplexing Hierarchy

Figure 1-4 illustrates the SDH multiplexing structure supported on the SM-1-STM1. The SM-1-STM1 multiplexing structure is a subset of that defined in ITU-T G.707. At the lowest level, containers (Cs) are input into virtual containers (VCs) with stuffing bits to create a uniform VC payload with a common bit-rate, ready for synchronous multiplexing. Then, the VCs are aligned into tributary units (TUs) where pointer processing operations are implemented, allowing the TUs to be multiplexed into TU groups (TUGs). Three TU-12s can be multiplexed into one TUG-2.

The TUGs are then multiplexed into higher level VCs, which in turn are multiplexed into administration units (AUs). The AUs are then multiplexed into an AU group (AUG) and the final payload from the AUG is then multiplexed into the Synchronous Transport Module (STM).

Features

The following is a list of features provided with the SM-1-STM1 service module:

- One channelized STM-1 port
- Channelized E1, fractional E1, and full-rate E1 supported
- Up to 226 usable channels allocated among the 63 E1 ports
- Internal or network clocking selectable on each E1
- 64 kbps DS0 time slots
- Line and payload loopback capabilities—local and network at the E1 and STM-1 level
- Full bit-error-rate testing capabilities on any E1
- Programmable pseudo-random pattern up to 32 bits in length, including $2^{11-1}$, $2^{15-1}$, and QRSS
- 32-bit error count and bit-count registers
- Detect test patterns conform to ITU-T 0.151 and 0.152 standards
- Online insertion and removal (OIR)
- Support for the following serial encapsulation protocols:
  - Frame Relay
SM-1-STM1 Optical Fiber Specifications

The SM-1-STM1 specification for optical fiber transmission defines two types of fiber: single-mode and multimode. Within the single-mode category, two types of transmission are defined: intermediate reach and long reach. Within the multimode category, only short reach is available. (See Table 1-5 for specifications.)

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 at one wavelength and polarization, and multimode fiber allows multiple modes of light to propagate through the fiber for each wavelength and polarization.

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). Modal dispersion limits propagation distance in multimode fiber before attenuation does. Therefore, single-mode fiber is capable of higher bandwidth and greater cable run distances than multimode fiber is. Table 1-5 lists nominal OC-3 optical parameters for single-mode and multimode 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 1-5  OC-3 Optical Parameters

<table>
<thead>
<tr>
<th>Transceiver Type¹</th>
<th>Transmit Power</th>
<th>Maximum Power to Receiver²</th>
<th>Receiver Sensitivity</th>
<th>Loss Budgets</th>
<th>Nominal Distance Between Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-mode³ intermediate reach</td>
<td>–15 dBm min. to –8 dBm max. at 1280–1335 nm</td>
<td>–8 dBm</td>
<td>–28 dBm</td>
<td>0 to 12 dB</td>
<td>Up to 9 mi (15 km)</td>
</tr>
<tr>
<td>Multimode⁴ short reach</td>
<td>–20 dBm min. to –14 dBm max. at 1280–1335 nm</td>
<td>–8 dBm</td>
<td>–23 dBm</td>
<td>0 to 7 dB</td>
<td>Up to 1.2 mi (2 km)</td>
</tr>
</tbody>
</table>

1. This table gives nominal OC-3 optical parameters.
2. This value represents the maximum power to which any receiver can be exposed.
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 Equipment and Systems Relating to the Synchronous Digital Hierarchy

### LEDs and Ports

Figure 1-5 shows the LEDs and Tx and Rx ports for the SM-1-STM1. The green- or yellow-colored LEDs indicate service module status.

#### Table 1-6 SM-1-STM1 LEDs

<table>
<thead>
<tr>
<th>LED Label</th>
<th>Color</th>
<th>State</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLED</td>
<td>Green</td>
<td>On</td>
<td>Service module is enabled for operation.</td>
</tr>
</tbody>
</table>

After system initialization, the ENABLED LED goes on to indicate that the SM has been enabled for operation.

The following conditions must be met before the SM-1-STM1 is enabled:

- The SM-1-STM1 is correctly connected and is receiving power.
- A valid system software image for the SM has been downloaded successfully.
- The system recognizes the SM-1-STM1.

If any of the above conditions are not met, or if the initialization fails for other reasons, the ENABLED LED does not go on.

Table 1-6 lists LED colors and indications.
Cables, Connectors, and Pinouts

Use a single-mode or multimode optical fiber interface cable to connect your router or switch to another router or switch. In general, multimode cables are gray or orange, and single-mode cables are yellow.

**Note**

These cables are not available from Cisco Systems.

For SDH single-mode and multimode optical fiber connections, use one duplex SC-type connector (see Figure 1-6) or two simplex SC-type connectors (see Figure 1-7).

<table>
<thead>
<tr>
<th>Table 1-6</th>
<th>SM-1-STM1 LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>RxCXR</td>
<td>Green On</td>
</tr>
<tr>
<td>Alarm</td>
<td>Yellow On</td>
</tr>
</tbody>
</table>

1. LOS = loss of signal
2. LOF = loss of frame

Attach either one duplex optical fiber cable or two simplex optical fiber cables between the service module and the device to which the service module is connected. Observe the receive (RX) and transmit (TX) cable relationship shown in Figure 1-8.
Figure 1-8 Attaching Simplex or Duplex Optical Fiber Cables

SONET/SDH with simplex or duplex SC connectors

Simplex

Duplex

RX

TX

The following warnings apply when you work with optical fiber cable ports.

**Warning**

Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Statement 1056

---

**Warning**

Class 1 Laser Product. Statement 1008

---

**Warning**

Class 1 LED Product. Statement 1027

---

**Network Management**

To locate MIBs and system messages associated with the SM-1-STM1 service module, see the following sites:

- The Error Message Decoder website allows you to determine the explanation and recommended action for an existing Cisco syslog message. You must be a registered Cisco.com user to access this document. To visit the Error Message Decoder website, go to this URL:
  
  http://www.cisco.com/cgi-bin/Support/Errordecoder/home.pl

- You can find information about MIBs and OIDs at the Cisco IOS MIB Locator and SNMP Object Identifier website. The MIB Locator finds MIBs in Cisco IOS software releases. The SNMP Object Navigator translates OID’s into SNMP names. To visit the Cisco IOS MIB Locator and SNMP Object Identifier website, go to this URL:
  
  http://tools.cisco.com/ITDIT/MIBS/servlet/index
Service Module Slot Locations on the Cisco 3900 Series Integrated Services Routers

This section discusses service module slot locations on the supported platforms. The illustrations that follow summarize slot location conventions on each platform.

Cisco 3900 Series Routers Slot Numbering

See *Overview of Cisco Network Modules and Service Modules for Cisco Access Routers* general information and single- and double-wide slot numbering.

Figure 1-9  Cisco 3900 Series Router with Service Module Installed

Cisco 3945 series routers have four slots for service modules. You can place the service modules in any of the four slots.

Identifying Interface Addresses

This section describes how to identify interface addresses for the SM-1-STM1. Interface addresses specify the actual physical location of each interface on the router.

Interfaces on a SM-1-STM1 installed in a router maintain the same address regardless of whether other service modules are installed or removed. However, when you move a service module to a different slot, the first number in the interface address changes to reflect the new service module slot number.

---

Note

Interface ports on the Cisco 3945 series routers are numbered from bottom right to top left starting with 1.

*Table 1-7* summarizes the interface address formats for the supported platforms.
### Table 1-7 Identifying Interface Addresses

<table>
<thead>
<tr>
<th>Platform</th>
<th>Interface Address Format</th>
<th>Numbers</th>
<th>Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco 3945 series ISRs</td>
<td>SM/slot-number</td>
<td>Service module slot—1 through 4 Interface port—0</td>
<td>1/0</td>
</tr>
<tr>
<td>Cisco 3925 series ISRs</td>
<td>SM/slot-number</td>
<td>Service module slot—1 through 2 Interface port—0</td>
<td>1/0</td>
</tr>
</tbody>
</table>
Chapter 1      Overview

Identifying Interface Addresses
Preparation for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the SM-1-STM1. This chapter contains the following sections:

- Required Tools and Equipment, page 2-1
- Minimum Software and Hardware Requirements, page 2-1
- Checking Hardware and Software Compatibility, page 2-2
- Safety Guidelines, page 2-2
- Laser and LED Safety, page 2-8
- FCC Class A Compliance, page 2-10

Required Tools and Equipment

You need the following tools and parts to install a SM-1-STM1. If you need additional equipment, contact a service representative for ordering information.

- SM-1-STM1SMI or SM-1-STM1MM
- One SC-type duplex or two SC-type simplex, multimode or single-mode optical fiber cables to connect the interface with the network. (Single-mode and multimode optical fiber cables for the SM-1-STM1 are not available from Cisco Systems but are available from commercial cable vendors. For information about optical fiber cables, see the “Cables, Connectors, and Pinouts” section on page 1-8.)
- Number 2 Phillips or a 3/16-inch flat-blade 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

Minimum Software and Hardware Requirements

This section indicates the recommended minimum Cisco IOS software release required to use the SM-1-STM1 in supported platforms.
Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum IOS requirements for individual hardware modules or components.

Access to this tool is limited to users with Cisco.com login accounts.

To access Software Advisor, go to:

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Safety Guidelines

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

Warning Definition

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, may cause bodily harm. A warning symbol precedes each warning statement.
**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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

**SAVE THESE INSTRUCTIONS**
Safety Guidelines

Chapter 2      Preparing for Installation

Safety Guidelines

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. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Avvertenza

Advarsel

IMPORTANTE SIKKERHETSINSTRUKSJONER

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Advarsel

INSTRUCOES IMPORTANTES DE SEGURANCA

Este simbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

Aviso

¡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. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

¡Advertencia!

Varning!

VIKTIGA SÄKERHETSANVISNINGAR


SPARA DESSA ANVISNINGAR
Chapter 2      Preparing for Installation

Safety Guidelines

**FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmezteto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhöz mellékel biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

**ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!**

**ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть, есть имеется место ситуция, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каких опасностями может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведённым в конце каждого предупреждения, чтобы найти его переведённый вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

**СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ**

**警告 重要的安全性说明**

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

**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載されています。装置の取り扱い作業を行うときは、電気回路の安全性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

**주의 중요 안전 지침**

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.
Chapter 2  Preparing for Installation

Safety Guidelines

Aviso  INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES

Advarsel  VIGTIGE SIKKERHEDSANVISNINGER


GEM DISSE ANVISNINGER

Upozorenje  VAŽNE SIGURNOSNE NAPOMENE

Ovaj simbol upozorenja predstavlja opasnost. Naizdete se u situaciji koja može prouzročiti tjelesne ozljede. Prijede rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne skipovice, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění  DŮLEŽITÉ BEZPEČNOSTNÍ POKyny

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznámte se s standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TÝTO POKyny
Производительность

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Акції по експлутаційній смугі змінюють кінцевого. Вірситет зе витягає акумулятор. Виробники зе відстежують експлуатацію. При ергентиє о топології експлуатації, зе експлутація зе витягає кінцевого. Не дай вам зустріти заряджену експлуатацію.

ΟΛΑ ΤΙΣ ΟΔΗΓΙΕΣ

 Грекотеті Сіміеті Хіщеніті

ΣΤΟΜΑΤΗΡΙΟ ΚΑΙ εκπαιδευτικό. Αυτά θα πρέπει να έχει την προστασία και την δίαιτα που επιτρέπει. Αν και καλά, άλλοι εκπαιδευτικοί σε λεπτομέρειες στην προστασία της υγείας εκπαιδευτικού. Αν και διευρύνεται, περιλαμβάνεται στην εκπαιδευτική θεωρία η ασφάλεια.

Οπόμενα

ΒΑЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Символ за предупредување значи опасност. Се наоѓа во ситуација што може да предизвици телески повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните поставки за справување на несреќи случаи. Искористете го бројот на извадата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Остърежение

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Упомінення

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzaste sa v situácii s nebezpečenstvom úrazu. Pred pracou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD
Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures 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.

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. Service modules and processor modules comprise 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.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed circuit 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 only protects components from ESD voltages on the body; 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).

Laser and LED Safety

The single-mode transmitter in the module uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in Figure 2-1.
Warning
Class 1 laser product. Statement 1008.

Warning
Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051.

The multimode aperture contains a Class 1 LED warning label, as shown in Figure 2-2.

Warning
Class 1 LED product. Statement 1027.

Warning
Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Statement 1056.
FCC Class A Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and radiates radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users are required to correct the interference at their own expense.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the equipment to one side of the television or radio.
- Move the equipment farther away from the television or radio.
- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Caution

This product has been designed to meet FCC Class A compliance requirements. Modifications to this product that are not authorized by Cisco Systems, Inc. could void the various approvals and negate your authority to operate the product.
This chapter describes how to remove the SM-1-STM1 service module. This chapter contains the following sections:

- Handling Service Modules, page 3-1
- Online Insertion and Removal, page 3-2
- Warnings and Cautions, page 3-2
- Service Module Removal and Installation, page 3-3
- Connecting a SM-1-STM1 Cable, page 3-3

### Handling Service Modules

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

---

**Note**

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

---

**Caution**

Always handle the service module by the carrier edges and handle; never touch the SM components or connector pins. (See Figure 3-1.)

---

**Figure 3-1  Handling a Service Module**

---
Online Insertion and Removal

Note
As you disengage the service module from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the service module. To properly perform OIR, follow the steps in the following URL:


OIR allows you to install and replace service modules while the system is operating; you do not need to notify the software or reset the system power, although you should not run traffic through the service module you are removing while it is being removed. OIR is a method that is seamless to end users on the network, maintains all routing information, and ensures session preservation.

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 caution when installing or removing modules:

Caution
Be sure the service module is firmly seated in the router.

Equipment Installation Warning

Warning
Only trained and qualified personnel should be allowed to install, replace, or service this equipment.
Statement 1030

Warning
Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

Warning
Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals. Statement 43
Service Module Removal and Installation

This section describes how to remove and install service modules.

Figure 3-2  Removing the SM-1-STM1 from the Cisco 3945 ISR

Step 1  Un screw the the service module captive screws.
Step 2  Pull the service module out of the service module slot.
Step 3  Insert the service module into the service module slot until it is fully seated.
Step 4  Tighten the captive screws on the service module.

Connecting a SM-1-STM1 Cable

To continue your SM-1-STM1 service module installation, you must connect the interface cables. The instructions that follow apply to all supported platforms.

Note  Optical fiber cables are not available from Cisco Systems; they are available from outside commercial cable vendors. (For more information on the cables you should use with this service module, see the “SM-1-STM1 Optical Fiber Specifications” section on page 1-6 and the “Cables, Connectors, and Pinouts” section on page 1-8.)

To connect cables to the SM-1-STM1, attach either one duplex optical fiber cable or two simplex optical fiber cables between the SM-1-STM1 interface port and your network. (See Figure 3-3.)

Note  Ensure that you observe the proper relationship of receive (RX) cable to RX SC-type receptacle and transmit (TX) cable to TX SC-type receptacle on the SM-1-STM1.
Warning: Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Statement 1056

Warning: Class 1 Laser Product. Statement 1008.

Warning: Class 1 LED Product. Statement 1027.
Configuring the SM-1-STM1

To continue your SM-1-STM1 service module installation, you must configure the STM-1 interface.

This chapter contains the following sections:
- Configuring the Interface, page 4-1
- Checking the Configuration, page 4-5

Configuring the Interface

After you verify that the new SM-1-STM1 is installed correctly (the ENABLED LED is lit), use the privileged-level configure command to configure the new interface. Have the following information available:
- 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

If you installed a new SM-1-STM1, or to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a SM-1-STM1 that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configurations.

For a summary of the configuration options available and instructions for configuring interfaces on a SM-1-STM1, refer to the appropriate configuration publications listed in the “Related Documentation” section on page 5.

This section contains the following subsections:
- Shutting Down an Interface, page 4-2
- Performing a Basic Interface Configuration, page 4-3
- Configuring the AU-3s and TUG-3s of a SM-1-STM1, page 4-4
- Configuring an E1 Unframed Channel, page 4-5
- Using show Commands to Verify the New Interface Status, page 4-5
- Using the ping Command to Verify Network Connectivity, page 4-12
- Using loopback Commands, page 4-12
Shutting Down an Interface

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

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `interface serial slot/port`
4. `shutdown`
5. `copy running-config startup-config`
6. `show interfaces serial slot/port`
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 interface serial slot/port</td>
<td>Enters interface configuration mode, and specifies an interface for configuration.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# interface serial 3/0</td>
<td></td>
</tr>
<tr>
<td>Step 4 shutdown</td>
<td>Shuts down the selected interface.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# shutdown</td>
<td></td>
</tr>
<tr>
<td>Step 5 copy running-config startup-config</td>
<td>Copies the new configuration to NVRAM.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# copy running-config startup-config</td>
<td></td>
</tr>
<tr>
<td>Step 6 show interfaces serial slot/port</td>
<td>Confirms the interfaces have been shut down.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# show interfaces serial 3/0</td>
<td></td>
</tr>
</tbody>
</table>

Note: 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 SM. Use the no shutdown command to enable the interface.

Performing a Basic Interface Configuration

Following are instructions for a basic configuration, which include enabling an interface and configuring the SONET controller. 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 SONET interfaces, refer to the appropriate software documentation.

In the following procedure, press the Enter 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>
SUMMARY STEPS

1. enable
2. configure terminal
3. controller sonet slot/port
4. clock source {internal | line}
5. end
6. copy running-config startup-config

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router# enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 controller sonet slot/port</td>
<td>Configures the SONET controller.</td>
</tr>
<tr>
<td>Example: Router(config)# controller sonet 3/0</td>
<td>Follow this command by entering the interface address of the controller you plan to configure.</td>
</tr>
<tr>
<td>Step 4 clock source {internal</td>
<td>line}</td>
</tr>
<tr>
<td>Example: Router(config-controller)# clock source internal</td>
<td></td>
</tr>
<tr>
<td>Step 5 end</td>
<td>Returns you to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router(config-controller)# end</td>
<td></td>
</tr>
<tr>
<td>Step 6 copy running-config startup-config</td>
<td>Copies the new configuration to NVRAM.</td>
</tr>
<tr>
<td>Example: Router# copy running-config startup-config</td>
<td></td>
</tr>
</tbody>
</table>

Configuring the AU-3s and TUG-3s of a SM-1-STM1

You can configure each of the administrative unit groups (AUGs) and tributary unit groups (TUGs) of a SM-1-STM1 to carry a set of E1 links that are mapped into TU-12s (see Figure 4-1).
Configuring an E1 Unframed Channel

To create an unframed or clear channel logical channel group on an E1 line, use the \texttt{tug-2 tug-2# e1 e1\# unframed} command, as shown in the example below:

\begin{verbatim}
Router(config)# controller sonet 3/0
Router(config-controller)# au-4 1 tug-3 2
Router(config-controller-tug3)# tug-2 4 e1 1 unframed
\end{verbatim}

\textbf{Note} The channel group is always 0 for unframed E1 lines.

Checking the Configuration

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

- Using \texttt{show} Commands to Verify the New Interface Status, page 4-5
- Using the \texttt{ping} Command to Verify Network Connectivity, page 4-12
- Using \texttt{loopback} Commands, page 4-12

Using \texttt{show} Commands to Verify the New Interface Status

This section demonstrates how you can use the \texttt{show} commands to verify that new interfaces are configured and operating correctly and that the module appears in them correctly. Sample displays of the output of selected \texttt{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 5.

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 \texttt{show controllers} Commands, page 4-6
- Using the \texttt{show protocols} Command, page 4-6
- Using the \texttt{show running-config} Command, page 4-7
Using the show controllers Commands

Display all the current interface processors and their interfaces using the `show controllers` command.

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.

The following is an example of the `show controllers` command:

```
Router# show controllers sonet 1/0
SONET 1/0 is up.
Hardware is single mode intermediate reach SM
FREEDM version: 2, reset 0
Applique type is Channelized Sonet/SDH
Clock Source is Internal, AUG mapping is AU4.
Medium info:
  Type: SDH, Line Coding: NRZ, Line Type: Short SM

Regenerator Section Status:
  No alarms detected.

Multiplex Section Status:
  No alarms detected.
  No BER failure/degrade detected
  BER_SF threshold power : 3
  BER_SD threshold power : 6

Higher Order Path Status:
  Path# 1 has no defects

Lower Order Path Status:
  VC-12 1/1/1/1 has no defects
```

Using the show protocols Command

Display protocols configured for the entire system and for specific interfaces using the `show protocols` command.

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.

The following is an example of the `show protocols` command:

```
Router# show protocols
line protocol is up
```
Using the show running-config Command

Display the running configuration file using the `show running-config` 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.

The following is an example of the `show running-config` command:

```
Router# show running-config
controller SONET 1/0
framing sdh
  !
  au-4 1 tug-3 1
  tug-2 1 e1 1 channel-group 1 timeslots 1-3
interface Serial1/0/1/1/1/1:1
ip address 1.1.1.1 255.255.255.0
```

Using the show startup-config Command

Display the configuration stored in the NVRAM using the `show startup-config` 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.

The following is an example of the `show startup-config` command:

```
Router# show startup-config
Building configuration...

Current configuration : 27478 bytes
!
! Last configuration change at 13:23:45 IST Mon Jun 21 2010
!
version 15.1
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname 3945_PGI1
!
boot-start-marker
boot-end-marker
!
!
enable password lab
!
no aaa new-model
clock timezone IST 5 0
!
no ipv6 cef
ip source-route
```
ip cef
!
!
!
!
multilink bundle-name authenticated
!
!
enewwise domain cisco security shared-secret 0 cisco
!
crypto pki token default removal timeout 0
!
!
license udi pid C3900-SPE150/K9 an FOC13522K4K
!
!
controller SHDSL 0/0/0
termination co
dsl-group pairs 0
!
controller SONET 1/0
framing sdh
clock source internal
!
au-4 1 tug-3 1
tug-2 1 e1 1 channel-group 1 timeslots 1-31
!
au-4 1 tug-3 2
tug-2 2 e1 1 unframed
!
au-4 1 tug-3 3
tug-2 1 e1 3 channel-group 30 timeslots 1
tug-2 3 e1 2 channel-group 17 timeslots 17
!
interface GigabitEthernet0/0
ip address 209.165.200.225 255.255.255.224
duplex auto
speed auto
!
interface GigabitEthernet0/1
mtu 1600
no ip address
shutdown
duplex auto
speed auto
!
interface GigabitEthernet0/2
mtu 1600
no ip address
shutdown
duplex auto
speed auto
!
interface Ethernet0/0/0
no ip address
tx-ring-limit 1
tx-queue-limit 1
!
interface Serial0/3/0
ip address 209.165.200.254 255.255.255.224
!
! ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/0
ip route 2209.165.201.1 255.255.255.224 209.165.201.30
!
!
snmp-server community public RW
!
control-plane
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 login
 transport input all
!
!
exception data-corruption buffer truncate
 scheduler allocate 20000 1000
end

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, 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.

Example Output of the show version Command

Following is an example of the show version command from a Cisco 3945 ISR router with a SM-1-STM1 installed:

Router# show version

Cisco IOS Software, C3900 Software (C3900-UNIVERSALK9-M), 15.1(20100617:043914)
Copyright (c) 1986-2010 by Cisco Systems, Inc.
Compiled Thu 17-Jun-10 11:54 by anybody

ROM: System Bootstrap, Version 15.0(1r)M1, RELEASE SOFTWARE (fc1)

3945_PGIRI uptime is 5 hours, 5 minutes
System returned to ROM by reload at 08:16:36 IST Mon Jun 21 2010
System image file is "flash:c3900-universalk9-mz.SSA.last"
Last reload type: Normal Reload
Last reload reason: Reload Command
This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to export@cisco.com.

Cisco CISCO3945-CHASSIS (revision 1.0) with C3900-SPE150/K9 with 980992K/67584K bytes of memory.
Processor board ID FHK1402F1YL
1 DSL controller
1 Ethernet interface
3 Gigabit Ethernet interfaces
231 Serial interfaces
2 Channelized STM-1 ports
DRAM configuration is 72 bits wide with parity enabled.
255K bytes of non-volatile configuration memory.
126448K bytes of USB Flash ushflash0 (Read/Write)
254464K bytes of ATA System CompactFlash 0 (Read/Write)

License Info:
License UDI:
Device# PID SN
*0 C3900-SPE150/K9 FOC13522K4K

Technology Package License Information for Module:'c3900'

<table>
<thead>
<tr>
<th>Technology</th>
<th>Technology-package</th>
<th>Technology-package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Type</td>
<td>Next reboot</td>
<td></td>
</tr>
<tr>
<td>ipbase</td>
<td>ipbasek9</td>
<td>Permanent</td>
</tr>
<tr>
<td>security</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>uc</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>data</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Configuration register is 0x0

Using the show diag Command

Display the types of service modules installed in your system (and specific information about each) using the show diag slot command, where slot is the service module slot in a Cisco 3925 router or Cisco 3945 router.
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.

### Using the show interfaces Command

Display status information (including the physical slot and interface address) for the interfaces you specify using the `show interfaces` command.

For complete descriptions of interface subcommands and the configuration options available for the supported interfaces, refer to the publications listed in the “Related Documentation” section on page 5.

**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.

### Example Output of the show interfaces Command

Following is an example of the `show interfaces` command from a Cisco 3945 ISR with a SM-1-STM1 installed:

```
Router> show interface serial

Router#sh int Serial1/0.1/1/1/1
Serial1/0.1/1/1/1 is up, line protocol is up
  Hardware is Channelized STM-1 controller
  Internet address is 1.1.1.2/24
  MTU 1500 bytes, BW 192 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 65/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:00, output never, 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: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/1/16 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 144 kilobits/sec
  5 minute input rate 49000 bits/sec, 23 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
  5507 packets input, 1785932 bytes, 0 no buffer
  Received 30 broadcasts (0 IP multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  35 packets output, 2995 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 unknown protocol drops
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions no alarm present
  Timeslot(s) Used: 1-3, subrate: 192Kb/s, transmit delay is 0 flags
  non-inverted data

Router#
```
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 5 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, “Using loopback Commands” section on page 4-12, 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 SM-1-STM1 interface and a remote device such as a multiplexer interface. The loopback subcommand places an interface in loopback mode, which enables test packets that are generated from the ping command to loop through a remote device. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device in the path of the loopback test.

The SM-1-STM1 supports two loopback modes at the sonet controller level: local and network. Use the loopback {local | network} command to set the loopback mode, as shown below:

```
Router(config)# controller sonet 3/0
Router(config-controller)# loopback network
```

When the loopback local command is used, all data transmitted to the network is internally looped back to the receiver. In this loopback mode, the serial interfaces should go into up/up looped state.

When the loopback network command is used, all data received from the connected device is transmitted back unchanged. In this loopback mode, T1 serial interfaces are not working.

The SM-1-STM1 also supports loopback on E1 lines mapped to a TUG-3 or AU-3. To specify a loopback on an E1 line that has been mapped to a TUG-3, use the tug-2 e1 loopback command in configuration controller tug3 mode.

To specify a loopback on an E1 line that has been mapped to an AU-3, use the tug-2 e1 loopback command in configuration controller au3 mode.

The complete tug-2 e1 loopback command syntax is:
```
tug-2 tug-2 number e1 e1-number loopback {local | network [line | payload]}
```
To disable the loopback, use the **no** form of this command:

```
[no] tug-2 tug-2 number e1 e1-number loopback {local | network {line | payload}}
```
## Numerics

4E
- service module LEDs 1-7

## E

- electrical equipment guidelines 2-8
- electrostatic discharge damage
  - See ESD prevention
- ESD prevention 2-8

## I

- installation
  - VIP prerequisites 2-1
- interface processor
  - installation prerequisites 2-1
  - tools and parts required for installation 2-1

## L

- LEDs
  - 4E service module 1-7

## P

- parts required for VIP installation and maintenance 2-1
- prerequisites
  - VIP installation 2-1

## R

- RJ-45
  - 4E
    - cable attachment 3-3

## S

- safety guidelines 2-2
- service module
  - 4E
    - LEDs 1-7

## T

- tools required for VIP installation and maintenance 2-1